J. ENVIRONMENTAL SYSTEMS, Vol. 18(2) 123-131, 1988-89

ASBESTOS REMOVAL AND TREATMENT IMPACTS ON HOUSING AND URBAN NEIGHBORHOODS

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ABSTRACT

Reducing the health hazard caused by the presence of asbestos in buildings is likely to give rise to costly adjustments in the nation's stock of buildings. This article focuses on the residential building stocks, and estimates the effects of several regulatory scenarios on building values, building life and the decision to convert buildings to high-income uses. We find that the value of low-income buildings is seriously eroded by the abatement scenarios analyzed. Conversion of buildings by rehabilitation is discouraged because values inclusive of rehabilitation costs are seriously reduced, and incentives to delay are introduced. Effects on building values in high-income neighborhoods are relatively less severe.

Asbestos has been present in buildings for many years and has been employed in a great variety of productive uses. The United States Environmental Protection Agency (EPA) has estimated that it is present in 55 percent of all residential buildings over ten units in size [1]. In recent years, however, its life-threatening properties have become widely recognized and demands for solutions to the health problem it poses have proliferated. To a growing extent, residential building owners, the focus of this article, must consider the demand for

doi: 10.2190/HM4F-4DAU-PQXT-KMJ5
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protection against asbestos hazards by occupants within the framework of their investment decisions in their property.

In this article we draw together the essential features of the building owner's decision-making problem and present quantitative simulations of the effects of asbestos on the economic value of buildings and their expected length of service. The intent is to develop a foundation of policy analysis based on the individual decision making of building owners faced with the asbestos problem.

ASBESTOS-INDUCED RISK AND BUILDING-OWNER RESPONSES

To the owner of a residential building, public-health concern over asbestos gives rise to new forms of financial risk. Exposure to asbestos in buildings entails an unknown probability of life-threatening illness to occupants and creates a risk that the owner will be sued because of illness that may have been caused by exposure many years earlier. Owners also face other less severe risks. Occupants may protect themselves against the asbestos hazard by vacating buildings, or refusing to move into buildings that contain asbestos.

Removal of asbestos is the most effective way of reducing the risks of asbestos contamination. Immediate removal maximizes risk reduction, although it is often the most expensive response. The owner has several ways of defending himself against risk short of immediate removal, however. One way is airtight enclosure of the asbestos; another is to spray the material to prevent asbestos fiber release into the air.

The use of such techniques allows partial or complete postponement of removal until the building is demolished or rehabilitated. Under present Federal laws, owners of large residential buildings must remove the asbestos prior to demolition.

MODEL BUILDINGS AND NEIGHBORHOOD CONDITIONS

In order to assess the financial impacts of these responses on residential building investments, the parameters of a representative building must first be established. Because of the almost endless variety of buildings, it is very difficult to define an average building. We use the approach of EPA [1], in which three types of model buildings are defined—residential, commercial, and Federal buildings. Our analysis focuses on residential buildings with ten or more units. The model residential building is derived from the EPA national asbestos survey [2]. The EPA defined the physical characteristics (including the amount of asbestos) of a typical fourteen-unit apartment building. In order to simulate the impacts of asbestos abatement strategies, typical revenue and cost profiles of the building had to be developed.

Since residential investment decisions are a function of both individual building and neighborhood characteristics, modeling the owner's response to the asbestos problem also requires the designation of model neighborhood conditions. The neighborhood types defined in this article are intended to capture a wide cross-section of possibilities. The first is a blighted or low-income neighborhood that has an uncertain future. The blighted neighborhood consists of old buildings that have low revenues and site values. Building values in the neighborhood are expected to remain static as costs rise relative to revenues. Initial operating costs are relatively low because owners put as little money into the building as possible, but physical deterioration of the building requires ever increasing amounts of effort just to keep it in operation. In this case the central question is whether the asbestos abatement costs will cause premature retirement of buildings in marginal neighborhoods or whether buildings will be sufficiently profitable to remain in service.

The second model neighborhood, the rehabilitating neighborhood, is similar to the low-income one in terms of type and condition of buildings, but has much better economic prospects because of actual and potential neighborhood amenities. In this neighborhood an extreme asbestos problem could prevent buildings from achieving their economic potential by discouraging rehabilitation investment. Less extreme asbestos problems will affect the profitability of such buildings and may affect the timing of rehabilitation or major remodeling.

The third model neighborhood is a high-income neighborhood. It consists of buildings in high-amenity areas. These buildings are in good condition with lower upkeep costs. They have high revenues, site values and current rates of return.

Table 1 summarizes the building parameter values for the three neighborhoods. The physical characteristics of the building are assumed to be constant across the neighborhoods. Information on typical revenues, operating costs and abatement costs were derived from a variety of sources. These sources and the derivation of the parameters are present in the footnotes to Table 1.

Three abatement strategies can be defined, based upon the timing of removal action: 1) immediate removal of all asbestos, 2) gradual removal over a number of years, and 3) removal at demolition, or conversion of the building. Each of these three strategies is evaluated as a response to the asbestos problem in each of the three model neighborhoods.

The strategies are assumed to be evaluated by the building owner in terms of their potential for risk reduction balanced against the prospective cost. Immediate removal virtually eliminates the risks of owning an asbestos-containing building. Thus, even if other scenarios are less costly, the owner's view of the risks may lead to this choice. Removal at demolition is often the least costly management plan. Such a strategy does, however, expose the owner to maximum risk. Gradual removal balances risks and costs.

In order to simulate the economic effects of the asbestos problem, we need to establish a basis for comparison of alternative management plan options. Nine

Table 1. Model Residential Buildings in Different Neighborhoods[a]

	Initial Neighborhood Status				
		Rehabilitating			High
	Low Income	Before		After	Income
Operating Costs ($/yr)	18,000	18,000		25,000	25,000
Annual Percent Change in Cost	5	5		1	1
Revenue ($/yr)	34,500	34,500		77,000	77,000
Site Value ($)	12,000	94,000		94,000	94,000
Conversion Cost ($)			414,000		
Demolition Cost ($/sq. ft.)	2.1		–		2.1

[a] Notes to Table 1.

Operating costs are drawn from Smith et al. [3], adjusted to correspond to the EPA model residential building in different neighborhoods. Annual increases in operating costs are assumed to be similar to depreciation costs, which are drawn from Topel and Rosen [4] and adapted to the model residential buildings. Building revenues are computed by assuming rents that are representative for apartments in low and high-incomes in an urban area like Chicago. Site value estimates are based on decisions with representatives from the real estate industry in Chicago. Conversion costs are taken from Means Building Construction Cost Data [5] and adapted to the model residential buildings on the basis of discussion in Mills and Hamilton [6, p. 122]. Mills and Hamilton are the source of demolition cost data. Asbestos O and M costs are reported by EPA [1] and adjusted to be consistent with the rental receipts in the model buildings. Asbestos cost removal values are derived from cost ranges published in Dewees [5, 7], and from Fortune magazine [8]. Gradual removal costs are based on the assumption of a removal rate of 6 percent, which corresponds to the average vacancy rate in residential buildings, according to Statistical Abstract of the U.S., 1987, Table 1292 [9]. Removal at demolition costs about one-third less than removal from a building in active use.

management-planning situations emerge from the framework established so far: three management-plan options for buildings in three different kinds of neighborhoods. A base case is added to the framework in terms of a fourth response—no abatement action in each neighborhood. This leads to twelve response-action situations.

RESIDENTIAL VALUATION MODEL

The value of residential property is assumed to be derived from an owner's expectations of the revenues and costs associated with the building and site. In standard valuation models the present value of discounted expected net revenues establishes the basis of the value of the property. Revenues include annual rents and the value of the land when the building is demolished or converted to other uses. Costs include normal operating expenses, demolition costs, asbestos-related maintenance costs and asbestos-removal costs.

The present value of net revenue is affected by both the level of net revenue and the expected lifetime of the building. Given that building costs escalate faster than building revenues, one can establish an optimal lifetime of the building. If the building were operated beyond this time, the present value and therefore the value of the property would decrease.

Given a building with an assumed pattern of revenues and costs, any changes in the timing of the asbestos-related costs based upon the response scenarios defined above will alter the property value. Thus, the residential decision model can be expressed as choosing T and t to maximize present value PV, or

$$\max_{T,\,t} PV(r, c_o, c_a, c_d, sv),$$

where

- T is the lifetime of the building;
- t is the removal date of the asbestos;
- r is the stream of rent receipts;
- c_o is annual operating cost;
- c_a is asbestos removal and operating and maintenance costs;
- c_d is unit cost of demolition;
- sv is salvage value of building, including site value.

The case of the rehabilitating neighborhood requres an extension of the model. In this case, an opportunity cost exists in operating the present building in the form of foregone higher net revenues that could be derived if the present building underwent significant rehabilitation. Rehabilitation itself constitutes a significant investment, but due to the necessity of removing asbestos before the renovation of the building, a second cost of conversion—the asbestos removal cost—is incurred. The owner is still faced with a decision on when to convert the building and when to remove the asbestos, but the decision is constrained because removal must precede conversion. The stream of net revenues in this case consists of the net revenues of the building up to the time of conversion; thereafter the owner receives the higher net revenues associated with the converted building.

The modified model can be expressed as

$$\max_{T,\,t} PV(r_o, c_o, c_c, c_r, r_i, c_i,),$$

where

- T is the time of conversion of the property;
- t is the time of removal of the asbestos;
- r_o is the annual revenue from the old building;
- c_o is annual operating cost of the old building;
- c_c is the conversion or rehabilitation cost;
- c_r is asbestos removal cost;
- r_i is annual revenue from the converted building;
- c_i is annual operating cost of the converted building.

IMPLICATIONS

Simulation results are presented in Tables 2, 3, and 4. The property values and expected building lives for each strategy as well as for the no-asbestos case are presented for each neighborhood.

High-Income Neighborhood

The value of the building without asbestos in the high-income neighborhood is $490,000 (Table 2). As the percentage value reduction column shows, the percentage reduction in value increases dramatically as the time of removal is shortened. In effect, the building owner must be willing to expend 16 percent of the value of the building in order to eliminate the risk of owning an asbestos-containing building.

The building life for the high-income neighborhood and no asbestos case is over fifty years. (The simulation was only carried out to 50 years.) The introduction of asbestos costs in the stream of net revenues does not alter the economic viability of the building over this time period for any of the strategies modeled.

Low-Income Neighborhood

In the low-income (Table 3) the value of the building without asbestos is $71,000. All of the removal strategies cause severe reduction in building value. Removal at demolition, the least costly abatement strategy, causes a 31 percent

Table 2. Abatement Impact on High-Income Neighborhood

	Low O & M Cost[a]			*High O & M Cost*[b]	
	Building Value[c]	*Percent Change*[a]	*Building Life*[d]	*Building Value*	*Building Life*[d]
No Removal	490,000		>50	490,000	>50
Removal at Demolition	476,000	−3	>50	454,000	>50
Gradual Removal[f]	441,000	−10	>50	429,000	>50
Immediate Removal	409,000	−16	>50	409,000	>50

[a] O and M cost = $0.15 per square foot per year; removal cost = $10 per square foot; removal-at-demolition cost - $7 per square foot.

[b] O and M cost = $0.40 per square foot per year; removal cost = $10 per square foot; removal-at-demolition cost = $7 per square foot.

[c] Net present value in dollars, discounted at 0.10.

[d] Years.

[e] Percent reduction in building value from no-removal case to value under abatement strategy.

[f] One unit per year, or 6 percent per year.

reduction in value. Gradual removal results in a 69 percent reduction. Immediate removal, the most stringent strategy, results in a negative net present value.

The reductions in building values are the same in dollar terms in the low-income as in the other neighborhoods. The reason is that the techniques required for safe abatement of asbestos are basically the same for similar buildings regardless of other economic conditions. Since the same dollar costs are applied to a building with a lower value, the reductions in value in percentage terms are much greater in the low-income than in the other neighborhoods.

In the low-income neighborhood, immediate removal results in losses to the owner and gives rise to strong incentives to abandonment. Removal at demolition actually extends building life somewhat—from sixteen to nineteen years. The reason is that postponement of demolition reduces the present value of demolition costs. This result is consistent with a finding obtained by Dewees.

Table 3. Abatement Impact on Low-Income Neighborhood[a]

	Low O & M Cost			*High O & M Cost*	
	Building Value	*Percent Change*	*Building Life*	*Building Value*	*Building Life*
No Removal	71,000		16	71,000	16
Removal at Demolition	49,000	−31	19	31,000	18
Gradual Removal	22,000	−69	16	11,000	16
Immediate Removal	(12,000)	−117	1	(12,000)	1

[a] See notes to Table 2.

Table 4. Abatement Impact in Rehabilitating Neighborhood[a]

	Low O & M Cost			*High O & M Cost*	
	Building Value	*Percent Change*	*Conversion Date*	*Building Value*	*Conversion Date*
No Removal	131,000		1	131,000	1
Removal at Demolition	85,000	−35	7	76,000	5
Gradual Removal	76,000	−42	4	71,000	2
Immediate Removal	49,000	−62	1	49,000	1

[a] See notes to Table 2.

Rehabilitating Neighborhoods

The effects of asbestos abatement strategies on rehabilitating neighborhoods are shown in Table 4. The least stringent strategy is defined here as removal at the time conversion occurs, rather than at demolition. For the representative building, present Federal regulations require removal occur before conversion could take place. The building vaue without asbestos is considerably lower in a rehabilitating neighborhood than in a high income neighborhood, even though the two buildings are identical after rehabilitation. The reason is that the building will require a significant investment before its earning capacity equals that of the building in the high income neighborhood.

The presence of asbestos has impacts on building values in rehabilitating neighborhoods that are comparable to impacts in low-income neighborhoods. Removal of asbestos at conversion substracts 35 percent from building value. Removal at 6 percent per year reduces value by 42 percent; the need to remove asbestos immediately would eliminate over half the building value.

In the absence of asbestos, conversion takes place at the end of one year. Immediate removal, while it causes the greatest reduction in value, does not effect the timing of conversion. After the owner incurs these immediate abatement costs, the factors affecting when the conversion will take place, (i.e., when the present value of net revenue is maximized), remain unchanged for the no-asbestos and immediate-removal cases. If the building owner is able to postpone removal of asbestos, conversion will be delayed in order to reduce the present value of removal costs incurred at conversion. Gradual removal delays conversion until year four, and removal at demolition, which allows maximum deferral of costs, delays conversion until year seven.

High asbestos O and M costs, shown in the right-hand columns of Tables 2 through 4, reduce the values of asbestos containing buildings. The effects are largest in low-income neighborhoods: from one-third to one-half of building value is eliminated if O and M costs are increased to $0.40 from $0.15 per square foot. In high income neighborhoods, by contrast, only about 5 percent of building value is lost because of the increase in O and M costs, and in rehabilitating neighborhoods only 6 percent to 10 percent is lost.

CONCLUSION

The imposition of asbestos abatement requirements on multi-unit residential buildings carries the potential of having a profound impact on the pattern of investment in residential property. For high-income area properties, decreases in property values of 3 percent to 16 percent occur. Since the earning potential of the properties is high and since in these areas the risk of litigation or occupancy effects is greater than in poorer areas, the probability that more aggressive risk-reduction responses will be taken is greater. The cost of such actions can be translated into higher rents to high-income tenants. The impact on low-income neighborhoods are more serious. The sooner the removal actions are mandated, the stronger the incentive to abandon marginal buildings. Financing of a significant asbestos removal investment in a building having low income potential may be quite difficult and result in severe market disruption even in the absence of increased abandonment levels. Banks might tend to avoid these investments. The overall level of rehabilitation might remain the same, but those neighborhoods having a high percentage of asbestos containing buildings could be severely affected.

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