TRC

DEMOLITION AND RENOVATION

COST OF COMPLYING WITH

EPA ASBESTOS REGULATIONS

FINAL REPORT

THE RESEARCH CORPORATION
OF NEW ENGLAND

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Acceptance of this report does not signify that the contents necessarily reflect the official views or policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

This final report is presented in two parts. Part I estimates the volume of demolition projects potentially subject to EPA Asbestos regulations. Part I also estimates the cost of compliance for the demolition and renovation industry. Part II provides a list of every demolition contractor who may be subject to EPA Asbestos regulations.

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1.0 INTRODUCTION

The link between various forms of cancer in human beings and asbestos was established in the 1940's. Barry I. Castleman, in testimony before the House Subcommittee on elementary, secondary and vocational education, said, "Dr. Wilhelm Heuper, (a cancer research scientist), implored industry to substitute carcinogens used in the work place and specifically named asbestos as a carcinogen in 1943." Further, "In 1952, an international panel of scientists declared that a lung cancer risk had been *demonstrated* in, among other things, the handling of asbestos." Selikoff, Hammond and Heimann pointed out that "until 1969, disease associated with asbestos exposure was considered entirely an occupational hazard. This hazard was recognized to be primarily scarring of the lung - Asbestosis, consequently, is caused by the inhalation of large amounts of asbestos." Since these studies, there has been a sharp increase in scientific studies showing a strong, positive relationship between exposure to asbestos and a variety of illnesses. As these studies gain publicity, the public, industry, state and federal government, and independent regulatory agencies are focusing their attention on controlling exposure to asbestos. Asbestos is found in such diverse products as fire retardant material, brake linings, paper mache and thermal insulating material. One of the potentially largest sources of asbestos emissions is the demolition and renovation of buildings. The building trades have been utilizing asbestos for many decades. The uses include floor tiles, fire proofing, insulation, aesthetically pleasing interiors, spackling compounds, road pavings and ship building.

1.1 Regulatory Authority

The danger from asbestos has caused many regulatory agencies to promulgate regulations restricting asbestos uses and emissions. The Consumer Product Safety Commission, Occupational Safety and Health Administration (OSHA), the Mining Enforcement and Safety Administration (MESA), the Food and Drug Administration (FDA) and the Environmental Protection Agency (EPA) have oversight responsibilities.

Both OSHA and the EPA have promulgated regulations that effect asbestos emissions from demolition and renovation projects. OSHA regulations concern the exposure of the worker and conditions at the work site. The EPA has responsibility for asbestos emissions into the ambient air and the effect on the general public. The enabling legislation, which gave the EPA regulatory authority over asbestos emissions, was the Clean Air Act of 1970. Subsequently, on April 6, 1973, EPA promulgated regulations for the control of asbestos emissions from demolition projects. These regulations had definitive changes made on May 3, 1974, October 14, 1975, and March 2, 1977, and June, 1978.

For a complete discussion of the various regulations that concern asbestos, see Appendix D. The emission limit for demolition or renovation projects is "no visible emissions." This is also a work practice standard. Currently, there is not a numeric emission standard for asbestos from demolition or renovation projects.

1.2 Purpose of the Current Contract

Currently, there exists a shortage of hard data in regard to the number of demolition and renovation projects actually completed in a year, the number of contractors engaged in demolition and renovation work, the amount of asbestos released into the ambient air from demolition and renovation projects and the industries cost of complying with the asbestos regulations. Data that does exist is fragmented and out-of-date.

The shortage of hard data can be explained by three factors. The first factor is the uniqueness of the demolition and renovation industry.

Variables that are unique to the demolition and renovation industry that hinder the collection of hard data are the size of contracting firms, the local nature of the business and the short duration of a demolition or renovation project. The second factor that hinders the collection of data is in identifying and quantifying asbestos emissions. Problems such as designing an air sampling strategy and the time consuming and expensive method of using electron microscopy to identify a specific type of asbestos fiber, lead to problems in developing data.

A third factor that hinders collecting hard data is the EPA reporting requirement. Federal reporting requirements have changed the units for reporting the amount of asbestos present during demolition or renovation projects.

Under EPA Contract, Cost Estimating for Asbestos Control from Demolition and Renovation (Contract 68-01-4145, Technical Service Area 1, Task 57), the EPA and The Research Corporation of New England (TRC) are trying to develop baseline data for the demolition and renovation industries. Under the contract, TRC agreed to undertake four tasks:

- Estimate the gross volume of projects actually or potentially considered subject to the existing asbestos regulations.
- Provide a list of every demolition and renovation contractor subject to EPA reporting requirements.
- Estimate the cost of compliance for the demolition and renovation industry.
- Estimate the quantity of asbestos by weight released into the ambient air from demolition sites.

The Research Corporation of New England is pleased to have been called upon to assist EPA in this task.

2.0 ESTIMATE THE GROSS VOLUME OF DEMOLITION AND RENOVATION PROJECTS

2.1 Variables that Affect the Number of Projects

The number of demolition/renovation projects that are either started or completed during a year can vary depending on how various terms such as "demolition", "renovation", and "structure" are defined. The number of projects in a given year can depend on the availability of federal funds, for example, Urban Renewal grants given through the Department of Housing and Urban Development. The number of projects are also dependent upon local political considerations, e.g. the recent publicity on asbestos in public schools.

Although the term renovation is narrowly defined in Section 61.21 of the Clean Air Act, the renovation industry uses a much broader definition. The term renovation ranges from structural changes to minor aesthetic changes. Depending on which definition of renovation one chooses, the number of renovation projects can vary from a relatively small number of projects in the case of structural renovation to voluminous listings for those involving aesthetic changes. The term structure usually refers to a building, pipe or boiler; however some specifications of demolition projects include the demolition of bridges or ships. Estimating the gross volume of demolition projects is easier if the definitions under the NESHAPS regulations are followed. Under the NESHAPS regulations, a demolisher must report to EPA ten days before the commencement of the demolition project if asbestos is present and the structure being demolished is a commercial, industrial, or residential (more than four family units) building.

2.2 Methodology for Development of Counts

In developing the number of demolition jobs, TRC utilized five sources; information from various EPA Regional offices; visits to EPA Region V's office and the city offices of Boston, Massachusetts and Chicago, Illinois; EPA publications; phone calls to EPA Regional, State, and local govern-

ment offices; and a publication entitled the "Demo Memo" published by the Wrecking and Salvage Journal, Inc., Braintree, Massachusetts.

In background information on National Emissions Standards for Hazardous Air Pollutants - proposed amendments to Standards for Asbestos and Mercury (p. 112), EPA estimated that there are less than 3,000 demolition projects per year. To verify this figure, TRC contacted the EPA Regional NESHAPS officers. For a list of the NESHAPS coordinators, see Appendix A. Most regional offices referred us to the appropriate state agency which has accepted delegation of the NESHAPS provisions. For a list of those states that have accepted delegation, see Appendix C. TRC then made use of the 1978 Directory of Governmental Air Pollution Control Agencies in contacting more than 48 such organizations. Included in these organizations were many (local) country divisions of health, departments of environmental quality, etc. In turn, most of these agencies referred us to individual contractors, town and city halls or back to the state or EPA regional offices. Appendix B is a list of all individuals contacted.

2.3 Number of Projects

Based on the above method, an estimated 2,618 projects are completed in a year. The organizations at the town and city level provided the most detailed information.

The availability of information at the local level tends to reflect the local nature of the construction industry. Most local governing bodies have regulations that require a demolition contractor to obtain a permit before the commencement of the project. The local permit is primarily to ensure that utilities are notified and water mains are capped. TRC spoke to a Mr. Harry McDuff of the Chicago City Building Department.

Mr. McDuff reported that the following number of demolitions were performed in the city of Chicago between 1975 - 1978:

1975 - 2065 demolitions
1976 - 2443 demolitions
1977 - 2274 demolitions
1978 - 2149 demolitions

These numbers compared with EPA's estimate of less than 3,000 serve to show the large influence of small demolition jobs. Mr. McDuff estimates that between 70-80% of the Chicago demolitions were for small one or two story residential buildings containing no asbestos.

Another method employed to verify the EPA figure was to obtain one year's (52) issues of the "Demo Memo." The Demo Memo lists upcoming demolition bids, bids already awarded, with the name, city and amount of all the low bidders. In the 1978 issues of the "Demo Memo," there were contracts awarded for the demolition of 2,596 buildings. The percent distribution by EPA region is given in Table 1. Table 1 also compares the percent of demolition contracts with the percentage of demolition contractors. The disproportionately large number of contracts awarded in Region I may be due to the location of the publisher of the Demo Memo, namely, Braintree, Massachusetts. Table 2 lists the number of contracts by state within EPA region. The table also lists the associated state rank for the number of contracts and contractors. The contractor information given in Tables 1 and 2 is explored in more detail in Section 3.0 of this report. A perusal of Table 1 will show that Massachusetts has the highest number of contracts awarded of any state. This finding would tend to corroborate the finding that the locale of the publisher of the Demo Memo has an influence on which bids are covered. There are six states with more than one hundred projects reported in 1978. These are Massachusetts, Wisconsin, Pennsylvania, Connecticut, Michigan, and Ohio.

2.4 Types of Buildings Demolished

The NESHAPS regulations state that notice of intent to demolish or renovate must be given for industrial, commercial, or residential buildings. Further, the residential buildings must contain more than four family dwellings. In order to establish the distribution of the types of buildings demolished or renovated, TRC reviewed EPA Region V, IX, and X NESHAPS demolition and renovation notices. In Region V, there were 79 structures demolished or renovated in 1978. Of this total, 29 were commercial buildings, 22 were residential, while 28 were industrial. Table 3 is a sample list of the types of buildings demolished or renovated by Region V, IX and X states.

TABLE 1

DISTRIBUTION OF CONTRACTS BY EPA REGION*

REGION	NUMBER OF CONTRACTS	PERCENTAGE OF ALL CONTRACTS	PERCENTAGE OF ALL CONTRACTORS
I	674	26.0%	6.2 %
II	150	5.8	13.8
III	577	22.2	10.8
IV	119	4.6	10.9
V	731	28.2	22.8
VI	121	4.7	7.9
VII	141	5.4	5.7
VIII	16	0.6	4.6
IX	22	0.9	13.2
X	45	1.7	4.0
TOTALS	2,596	100.1%	100.2 %

*Information tabulated from the "Demo Memo"

TABLE 2
NUMBER OF DEMOLITION CONTRACTS BY STATE WITHIN REGION WITH ASSOCIATED STATE RANK*

	Total Contracts	State Rank* of Contracts	State Rank* of Contractors
REGION I - Total Contracts 674 (26.0%)			
Connecticut	144	5	19
Maine	16	16	37
Massachusetts	457	1	11
New Hampshire	8	33	42
Rhode Island	39	15	34
Vermont	10	30	50
REGION II - Total Contracts 150 (5.8%)			
New Jersey	78	7	5
New York	72	8	2
REGION III - Total Contracts 577 (22.2%)			
Delaware	47	13	46
District of Columbia	72	8	40
Maryland	10	30	18
Pennsylvania	445	2	4
Virginia	3	38	17
West Virginia	0	47	30
REGION IV - Total Contracts 119 (4.6%)			
Alabama	15	25	36
Florida	16	24	7
Georgia	56	12	23
Kentucky	12	27	26
Mississippi	3	38	48
North Carolina	13	26	16
South Carolina	3	38	34
Tennessee	1	44	31
REGION V - Total Contracts 731 (28.2%)			
Illinois	12	27	3
Indiana	58	11	10
Michigan	209	4	9
Minnesota	9	32	28
Ohio	125	6	8
Wisconsin	318	3	11
REGION VI - Total Contracts 121 (4.7%)			
Arkansas	27	20	37
Louisiana	36	16	24
New Mexico	0	-	42
Oklahoma	28	19	21
Texas	30	17	6

TABLE 2

(continued)

	Total Contracts	State Rank* of Contracts	State Rank* of Contractors
REGION VII - Total Contracts 141 (5.4%)			
Iowa	29	18	13
Kansas	0	47	29
Missouri	44	14	19
Nebraska	68	10	33
REGION VIII - Total Contracts 16 (0.6%)			
Colorado	0	47	14
Montana	4	37	47
North Dakota	2	42	42
South Dakota	6	35	48
Utah	1	44	27
Wyoming	3	38	42
REGION IX - Total Contracts 22 (0.9%)			
Arizona	2	42	24
California	19	22	1
Hawaii	0	47	39
Nevada	1	44	31
REGION X - Total Contracts 45 (1.7%)			
Alaska	12	27	50
Idaho	7	34	40
Oregon	6	35	22
Washington	20	21	15
TOTAL CONTRACTS 2,596 (100.1%)			

Data Source: Demo Memo

*State ranks are relative ranks based on the number of contractors and contracts reported. Ranks are in descending order.

TABLE 3

TYPES AND COMPOSITION OF BUILDINGS DEMOLISHED IN EPA REGIONS V, IX AND X

REGION #	SINGLE-STORY	MULTI-STORY	SCHOOLS	MULTI-STORY COMMERCIAL	AMOUNT OF Ab. REMOVED
REGION V					
IL	1 brick				UN*
IL				2 brick	UN
IL				2 brick	UN
IL	1 brick				UN
IL	1 concrete				UN
IL		4 brick		1 brick	UN
IL		2 brick		1 brick	UN
IL		5 brick		1 brick	UN
IL		8 brick			UN
IL		37 brick			UN
IL		2 brick		1 brick	UN
IL	1 brick				UN
IL		2 brick		1 brick	UN
IL				4 brick	UN
IL				1 steel corrugated transite siding	1500 cu. ft.
IL		6 frame			UN
IL	1 brick				UN
IL				4 brick	UN
IL		6 brick		1 brick	UN
IL		4 brick		2 brick	UN
IL				1 UN	UN
IL				1 frame	UN
IL		2 brick		1 brick	UN
IL		2 brick		1 brick	UN
IL				9 brick	UN
IL				2 brick	UN
IL				1 brick	UN
IL				1 brick	UN
IL		10 brick			UN
IL				4 brick	UN
IL				40 brick	UN
IL				1 UN	260 ft pipe &/or 160 sq ft surface
IL				1 brick	UN
IL	1 brick				UN
IL				1 brick	UN
IL				1 brick	UN
IL		1 brick			UN
IN				1 UN	245 ft pipe

TABLE 3 (continued)

REGION #	SINGLE-STORY	MULTI-STORY	SCHOOLS	MULTI-STORY COMMERCIAL	AMOUNT OF Ab. REMOVED
MI				1 UN	290 lbs.
MI				1 UN	1500 ft pipe.
MI	1 brick				UN
MI				1 UN	1000 linear ft, 2 inch pipe.
MI				1 UN	700 linear ft insulation.
MI				1 UN	800 linear ft, 2 inch pipe.
MI				1 UN	1800 linear ft, pipe.
MI				1 UN	UN (pipes & lines @ 9 yrs old).
MI				1 UN	100 linear ft, pipe.
MI				1 UN	1500 linear ft, pipe.
MI				1 UN	260 linear ft, friable.
MI				1 UN	260+ ft.
MI		1 masonry			260+ ft.
MI				1 UN	3800 sq ft, 1 tank.
MI				11 UN	50-80 linear ft, 1-2" thick.
MI				1 UN	46 linear ft from 7 bends 10" diameter.
MI				1 UN	30 linear ft.
MI				1 UN	300 ft, 3" and 2" pipe
MI				1 UN	60 linear ft, 4" thick Ab. from 12" dia. pipe.
MI				1 UN	30 linear ft, 4" thick Ab.
MI				1 UN	200 linear ft, 1½" pipe dia., 140 ft boiler.
MI				1 UN	200 linear ft, 1" dia pipe.
MI		1 UN			260+ ft.
MI		1 UN			260+ ft.
MI		1 UN			>260 ft.
MI		1 masonry			>260 ft.
MI		1 masonry			>260 ft.
MI		1 masonry			<260 ft.
MI		1 masonry			<260 ft.

TABLE 3 (continued)

REGION #	SINGLE-STORY	MULTI-STORY	SCHOOLS	MULTI-STORY COMMERCIAL	AMOUNT OF Ab. REMOVED
MI		1 masonry			UN
MI				1 UN	250 ft pipe.
MI		1 UN			260 lin. ft.
MI		1 UN			200 lin. ft.
MI		1 UN			260 lin. ft.
MI				1 UN	600 lin. ft.
MI				1 UN	975 sq. ft.
MI				1 UN	260+ lin. ft.
MI				1 UN	260+ lin. ft.
MI				1 UN	UN
MI				1 UN	4200 ft.
MI				1 UN	400 ft.
OH				1 UN	25,000 lin. ft. pipe insulation.
OH				1 UN	UN
OH				1 UN	20,000 sq. ft.
OH				1 UN	UN
MN				1 cement	UN
WI		1 brick			UN
WI				1 UN	UN
REGION IX					
CAL				1 brick	UN
CAL				1 UN	UN
CAL				1 UN	UN
CAL				1 UN	UN
CAL				1 concrete	500 lin. ft., 5 and 6" piping
CAL				1 UN	100 lin. ft.
CAL				3 UN	1500 lin. ft.
CAL				1 concrete	1830 lin. ft.
CAL		1 brick			UN
REGION X					
OR		1 brick			UN
OR		1 brick			UN
OR		1 brick			UN
OR		1 brick			UN
OR		1 UN			UN
OR		1 UN			UN
OR		1 UN			UN

*UN = unknown

3.0 PROVIDE A LIST OF EVERY DEMOLITION AND RENOVATION CONTRACTOR SUBJECT TO THE EPA REPORTING REQUIREMENTS

Under separate cover is a list which contains approximately 300 individual U.S. firms who engage in demolition work. In this section, we will review the methodology for the collection of firm names and some geographic distribution of the firms.

3.1 Methodology for the Collection of Demolition and Renovation Firms

In establishing a list of every contractor subject to EPA reporting requirements, it was determined that the largest number of contractors would be included if TRC reviewed organization membership lists. Three major trade organizations were contacted for information about their membership lists. The organizations were:

- The National Association of Demolition Contractors
  4415 West Harrison St.
  Hillside, Illinois 312-449-5959
- The Asbestos Information Association
  Arlington, Virginia 703-971-1150
- The Wrecking and Salvage Journal, Inc.
  14 Wood Road
  Braintree, Massachusetts 617-848-6150

Both the National Association of Demolition Contractors and the Asbestos Information Association obtain mailing lists from the New York based mailing list firm of Zeller and Letica, 15 East 26th Street, New York, New York 10010 (212-MU5-7512). The Wrecking and Salvage Journal maintains its own mailing list of subscribers.

The mailing list from The Wrecking and Salvage Journal, Inc. contained approximately 3,000 individual addresses. Better than ten percent of the mailing labels were advertising agencies,

large industrial concerns, libraries, and antique dealers. Because of the large percent of non-industry firms on this list, TRC obtained a mailing list from Zeller and Letica. This list contained 2,502 names. Firms that are included in this list must earn at least fifty-one percent of their gross incomes from the demolition of buildings. After reviewing the Zeller and Letica list, there were 221 firms that were questionable. After checking with the firms in question, 205 were dropped from the list, leaving 2297 firms that engage in demolition projects. The fifty-one percent criteria is also required for membership in the National Association of Demolition Contractors. Those listed by Zeller and Letica were used to derive approximate statistics. Puerto Rico and Guam do not appear on the following list. A similar list for renovation contractors could contain up to forty percent of firms not associated with asbestos removal.

3.2 Distribution of Contractors

Table 4 is the breakdown of the number of demolition contractors by EPA Regions. Table 4 shows that Regions II, V and IX contain the largest number of contractors (316, 524 and 304 respectively). These three Regions account for 49.8% of all contractors in the United States.

TABLE 4

NUMBER OF DEMOLITION CONTRACTORS BY EPA REGION*

REGION	NUMBER OF CONTRACTORS	PERCENTAGE OF ALL CONTRACTORS
I	148	6.5%
II	316	13.8
III	249	10.8
IV	251	10.9
V	524	22.8
VI	181	7.9
VII	130	5.7
VIII	106	4.6
IX	304	13.2
X	92	4.0
TOTALS	2301	100.2%

*Data Source: Zeller and Letica

Within the three Regions (II, V, and IX), we find the most contractors in the states with large population centers, and/or heavy industrial development. Table 5 is the number of contractors by state within the three Regions.

TABLE 5

NUMBER OF CONTRACTORS BY STATE
IN REGION II, V AND IX*

REGION / STATE	TOTAL CONTRACTORS	PERCENT OF CONTRACTORS
II	316	100.0
New Jersey	107	33.9
New York	209	66.1
Puerto Rico	N/A	
Virgin Islands	N/A	
V	524	100.0**
Illinois	185	35.3
Indiana	75	14.3
Michigan	83	15.8
Minnesota	24	4.6
Ohio	87	16.6
Wisconsin	70	13.3
IX	304	100.0
Arizona	27	8.9
California	245	80.6
Hawaii	12	3.9
Nevada	20	6.6

N/A = Not available

*Data Source: Zeller and Letica

**Percent may not sum to 100 due to rounding

A perusal of Table 5 will show that the more industrial states in Regions II, V and IX have the most contractors.

Table 6 is the number of contractors by state within Region. This table contains the relative rank of each state in regard to the number of demolition contractors. A review of the ten states with the most contractors shows that these states have an abundance of heavy industry. The ten states are: California, New York, Illinois, Pennsylvania, New Jersey, Texas, Florida, Ohio, Michigan, and Indiana. These states account for 57.1% (1,312 contractors) of all contractors in the United States.

TABLE 6
NUMBER OF DEMOLITION CONTRACTORS BY STATE WITHIN REGION WITH ASSOCIATED STATE RANK

	Total Contractors	State Rank
REGION I - Total Contractors 148 (6.5%)		
Connecticut	36	19
Maine	13	37
Massachusetts	70	11
New Hampshire	10	42
Rhode Island	17	34
Vermont	2	50
REGION II - Total Contractors 316 (13.8%)		
New Jersey	107	5
New York	209	2
REGION III - Total Contractors 249 (10.8%)		
Delaware	8	46
District of Columbia	11	40
Maryland	38	18
Pennsylvania	130	4
Virginia	41	17
West Virginia	21	30
REGION IV - Total Contractors 251 (10.9%)		
Alabama	16	36
Florida	95	7
Georgia	28	23
Kentucky	26	26
Mississippi	4	48
North Carolina	45	16
South Carolina	17	34
Tennessee	20	31
REGION V - Total Contractors 524 (22.8%)		
Illinois	185	3
Indiana	75	10
Michigan	83	9
Minnesota	24	28
Ohio	87	8
Wisconsin	70	11
REGION VI - Total Contractors 181 (7.9%)		
Arkansas	13	37
Louisiana	27	24
New Mexico	10	42
Oklahoma	35	21
Texas	96	6

TABLE 6 (continued)

	Total Contractors	State Rank *
REGION VII - Total Contractors 130 (5.7%)		
Iowa	54	13
Kansas	22	29
Missouri	36	19
Nebraska	18	33
REGION VIII - Total Contractors 106 (4.6%)		
Colorado	50	14
Montana	7	47
North Dakota	10	42
South Dakota	4	48
Utah	25	27
Wyoming	10	42
REGION IX - Total Contractors 304 (13.2%)		
Arizona	27	24
California	245	1
Hawaii	12	39
Nevada	20	31
REGION X - Total Contractors 92 (4.0%)		
Alaska	2	50
Idaho	11	40
Oregon	31	22
Washington	48	15
TOTAL CONTRACTORS 2301 (100.2%)		

*Relative rank order of each state in regard to the number of demolition contractors. States are ranked in descending order.

4.0 ESTIMATE THE COST OF COMPLIANCE

There are many costs involved with the demolition or renovation of a building. There are capital costs for equipment which have to be amortized over the life of the equipment, labor costs, dumping costs for the trucked away waste, and efficiency costs of demolition method. These costs have to be balanced against goods recovery and salvage benefits. The demolition and renovation industry is such that many firms are also in associated businesses such as excavating, construction and hauling. The same firm may be awarded the demolition as well as clean-up contract. Separating out the costs of complying with the EPA regulations from compliance with other agencies' regulations for demolition projects is very difficult. Most of the work on complying with Federal Regulating has been on the macro scale. In an opening statement at a hearing before the subcommittee on Economic Growth and stabilization of the congressional Joint Economic Committee on April 11, 1978, Senator Lloyd Bentsen said, "The Commerce Department has found that pollution abatement control expenditures have increased an average of 17 percent every year over the past five years." Also, Secretary of Commerce Juanita Kreps estimate that National Pollution abatement and control expenditures have shown a cumulative cost of $135 billion over the period of 1972 to 1976. In a report prepared for the Joint Economic Committee, Murray Weidenbaum of the Center for the Study of American Business at Washington University St. Louis, Missiouri, estimates that "the cost imposed on the private sector is 20 times the money spent to operate the regulatory agencies." Weidenbaum proceeded to utilize the multiplier of 20 to derive the gross cost of complying with all federal regulations. Weidenbaum estimated that in fiscal 1979, the federal government regulatory administrative costs were $4.8 billion while the cost of compliance with all federal regulations was $97.9 billion.

There is no evidence to confirm or derive a straight linear relationship between the cost of complying with asbestos regulations

for the demolition and renovation industry and the cost of complying with all federal regulations. For our analysis we will assume a growth rate of 17%.

4.1 Factors of Costs

The total cost of the demolition and renovation industries to comply with EPA's asbestos regulations can be seen as a function of several component costs. The factors of costs can be seen in equation 4.1.

Equation 4.1

$$TC^{*} = \text{capital}_{(c)} + \text{labor}_{(c)} + \text{materials}_{(c)} + \text{transportation}_{(c)} + \text{final deposition}_{(c)}$$

Capital costs include equipment such as trucks and cranes. Materials costs include protective clothing and breathing apparatus for workmen if removal is by encapsulation the material used for binding and encapsulation must be enclosed in containers for final deposition. Transportation costs include the contracting of a firm to haul away the debris. The final deposition costs include identifying an approved land fill and making arrangements to utilize the land fill. The largest single factor in determining the cost of demolishing or renovating a building is labor. Labor costs include three separate components. Training costs such as the handling of asbestos, medical costs for annual medical check-ups, and additional manpower costs. (Often the removal of asbestos involves a great deal of working by hand. This usually involves having to put additional people on one job.)

4.2 Costs of Complying for the Demolition Industry

Separating out the costs of complying with EPA regulations from compliance with other agencies regulations for demolition projects is very difficult. There are four parts of the EPA regulations that may increase the bid on a demolition project. The first extra cost is sending EPA ten days notification. Costs associated with notification should be minimal. The contractor has local reporting

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*TC = total cost

requirements to obtain a local demolition permit. This permit has to be obtained irrespective of the presence of asbestos. The second cost is that incurred by wetting the asbestos. Again this cost which also should be minimal since water from a firehose fulfills EPA's requirements. The third cost is the additional labor costs involved with the stripping, handling, and bagging the asbestos. When wet, asbestos becomes very slippery and difficult to handle. The increase in labor cost may be the most significant cost factor in placing a bid. Most contractors would have to strip any insulation material from boilers, etc. before selling them for scrap. The salvage value of the boilers reduces the impact of the extra labor costs on the industry. The last cost involved is that of final disposition of the asbestos material.

All of the above costs are incorporated when a bid is made to demolish a building. In scanning the "Demo Memo", many times, a company's bid would be twice or three times the bid of a competitor. An example is the bids that appeared in the December 1, 1978 issue. The bids were for the demolition and removal of a vocational school in Everett, Massachusetts. The following is a list of the lowest bids, contractors and addresses of the contractors placing bids on this project:

NAME	AMOUNT
J. Berardi, Allston, MA.	$22,222.00
Franklin Creane Service, Randolph, MA.	$36,000.00
James G. Grant Co., Readville, MA.	$42,740.00
Francessco Excavation, S. Weymouth, MA.	$48,400.00
Mystic Wrecking Co., Chelsea, MA.	$48,675.00
New Boston Wrecking Co., Newton Ctr, MA.	$64,388.00
J. J. Duane, Quincy, MA.	$66,996.00
Napoli Wrecking Co., Dorchester, MA.	$73,731.00

Table 7 is the average dollar bid value for buildings being demolished. The data was taken from the Demo Memo. This table serves to illustrate the large variance of costs associated with

TABLE 7

AVERAGE DOLLAR BID PER BUILDING

	Single Story	Multi Story	Schools	Commercial
REGION I				
Connecticut		67,580.00 (86)		40,257.00 (3)
Maine		11,441.00 (10)		
Massachusetts	18,061.00 (244)	324,793.00 (212)	106,175.00 (5)	678.94 (5)
New Hampshire				
Rhode Island		22,220.00 (31)		35,700.00 (1)
Vermont		10,294.00 (9)		
REGION II				
New Jersey		22,594.00 (38)		162,025.00 (2)
New York		123,490.00 (15)	244,493.00 (2)	78,343.00 (25)
Puerto Rico*				
Virgin Islands*				
REGION III				
Delaware		9,097.00 (37)		10,000.00 (1)
District of Columbia		20,172.00 (70)		2,746,948.00 (1)
Maryland		25,443.00 (3)		
Pennsylvania	16,964.00 (50)	12,757.00 (214)	47,179.00 (4)	20,122.00 (68)

*No figures were available for these states.

Numbers in parenthesis are the number of buildings included in the average.

TABLE 7 (continued)

	Single Story	Multi Story	Schools	Commercial
REGION III (cont.)				
Virginia		139,912.00 (3)		
REGION IV				
Alabama		11,413.00 (24)		
Florida	2,144.00 (2)	46,349.00 (13)		
Georgia	1,578.00 (21)	16,862.00 (9)		
Kentucky	4,454.00 (5)	145,372.00 (3)	22,350.00 (1)	
Mississippi				29,090.00 (1)
North Carolina		3,458.00 (13)		
South Carolina		71,565.00 (3)		
Tennessee		143,085.00 (2)		
REGION V				
Illinois		53,840.00 (10)		
Indiana		37,172.00 (23)	105,163.00 (1)	
Michigan	3,268.00 (33)	11,068.00 (64)	48,830.00 (1)	
Minnesota		391,815.00 (1)	20,900.00 (1)	435,618.00 (1)
Ohio	21,091.00 (27)			
Wisconsin	17,072.00 (161)	34,264.00 (19)	835,502.00 (2)	216,560.00 (2)

TABLE 7 (continued)

	Single Story	Multi Story	Schools	Commercial
REGION VI				
Arkansas		9,109.00 (10)		
Louisiana		17,505.00 (24)		
Oklahoma		12,637.00 (9)		
Texas	45,478.00 (7)	6,705.00 (20)		
REGION VII				
Iowa	32,021.00 (7)			
Missouri		33,889.00 (37)		
Nebraska	6,399.00 (88)			
REGION VIII				
Montana		74,822.00 (6)		
North Dakota				81,514.00 (1)
Utah		1,266,488.00 (1)		
Wyoming		18,190.00 (2)		
REGION IX				
Arizona		65,790.00 (1)		
California	857.00 (2)	39,095.00 (18)		
Hawaii*				
Nevada				102,489.00 (1)

* No figures were available for this state.

TABLE 7 (continued)

	Single Story	Multi Story	Schools	Commercial
REGION X				
Alaska	372.00 (9)			
Oregon		1,701.00 (6)		
Washington		2,172,663.00 (12)	104,973.00 (2)	116,074.00 (1)

a demolition. Orginally we planned to contact federal government agencies to analyze cost factors in Demolition Proposals, and individual contractors to determine the individual cost considerations. After contacting demolition contractors in the Springfield, Massachusetts and Hartford, Connecticut area, we were unable to determine any reasonable set of values associated with the various costs involved in a demolition project. The contractors said that they could not segregate the costs associated with asbestos. Contractors seem to bid the job based on difficulty of the work, the perceived advantages of doing a particular job, and the length of time the job will take.

An EPA document entitled "Backgroud Information on National Emission Standards for Hazardous Air Pollutants - Proposed Amendments to Standards for Asbestos and Mercury" dated October 1974 fixed the cost of compliance for the demolition industry at $5.2 million. If there are 3,000 projects annually subject to the asbestos regulations, the average project compliance costs are $1,733 (1974 dollars). In an industry where bids vary by a factor of three and often reach one million dollars or more, $1,733 to comply with the asbestos regulations is not large. If we assume that the cost of compliance has grown at the 17% rate of all government regulations, we find the compliance cost to (of) the demolition industry currently being $3,796.

YEAR	COST OF COMPLYING
1974	1733
1975	2027
1976	2371
1977	2774
1978	3245
1979	3796
1980	4441
1981	5196
1982	6079
1983	7112

YEAR	COST OF COMPLYING
1984	8321

The above figures assume an annual compound growth rate of 17%.

4.3 Cost of Complying for the Renovation Industry

The largest compliance costs to the renovation industry is complying with the OSHA Asbestos Regulations. One method of complying with the EPA Regulations is by wetting and then stripping the asbestos. Often the renovation work is being performed in a building that is being occupied or closed for only a short duration. Under these conditions, a method of encapsulation of the asbestos has to be found.

After contacting numerous renovation contractors, it was found the average costs of removing asbestos during renovation is approximately $1/sq. ft. The bags used to transport the asbestos costs approximately fifty cents apiece. The workers, performing the asbestos removal, wear disposable clothing that costs two dollars. The largest costs are in the training of employees who must work in an enclosed area with asbestos. Another cost associated with employees is that of medical care. Most employees receive regular medical check-ups and annual chest X-rays at company expense.

In a book titled "Engineering Aspects of Asbestos Dust Control", Rajhans and Bragg review the costs associated with controlling asbestos dust. Their analysis is more appropriate for controlling dust from industries that produce asbestos containing products. However, renovations are performed in an enclosed environment and same of the cost factors are similar. They derived equation 4.2 for the operating cost of a dust control system.

Equation 4.2

$$C = 1.173 \times 10^{-4} \frac{SPHK}{E}$$

where C is the annual electrical cost in U.S. $
S is the design capacity of the system in cfm (actual)
P is the pressure drop in inches of water
H is the estimated yearly hours of operation
K is the cost of electricity in dollars/kWh
E is the fan efficiency expressed as a percentage

4.4 Regulation and Inflation

In his report to the Joint Economic Committee, Weidenbaum addresses the question of regulations impacting non-inflation, he said,

> "Of the many ways in which government can affect the rate of inflation, perhaps the least understood method is to require actions in the private sector which increase the cost of production and hence the prices of products and services sold to the public. Attention needs to be focused on these regulatory policy instruments because their use is becoming more widespread and neither the public nor government decisionmakers realize their full inflationary effects.
>
> At first blush, government imposition of socially desirable requirements on business through the regulatory process appears to be an inexpensive way of achieving national objectives. This practice apparently costs the government little and represents no significant direct burden on the taxpayer. But the public does not escape paying the cost.
>
> These higher prices, however, represent the "hidden tax" of regulation which is shifted from the taxpayer to the consumer."

The major contribution to inflation of complying with the asbestos regulations concerns the cost of labor. Bid prices rise to meet the wage demand of the additional labor required to manually strip the asbestos.

5.0 ESTIMATE THE QUANTITY OF ASBESTOS BY WEIGHT RELEASED INTO THE AIR

5.1 Mineralogy of Asbestos and Uses in Building Material

Asbestos is a generic term applied to a group of highly fibrous silicate minerals. Six common asbestos varieties belong either to the serpentine group as to the amphibole group of minerals. The amphibole varieties include:

> amosite (a variety of granosite), anthophyllite, crocidolite (a variety of riebechite), tremolite and actinolite. The single serpentine variety of asbestos is chrysotile. There are additional mineral varieties which possess many of the properties of the asbestos group but they are not considered to be asbestos. Appendix E contains a description of the problems delineating which mineral species are in the asbestos group.

The four economically important varieties of asbestos include amosite, anthophyllite, crocidolite and chrysotile. As noted in "Engineering Aspects of Asbestos Dust Control", chrysotile accounts for more than 90% of all asbestos uses. The vast majority of the chrysotile used in the United States is produced in Canada and most of the amphibole asbestos is imported from South Africa. Building materials contain predominantly the chrysotile variety of asbestos, with the relatively small amounts of the amphibole varieties. As noted in the article published by Ross and also Gilson, this distribution is important in that health studies suggest that of the four economically important forms of asbestos, crocidolite has been responsible for the greatest health risk, followed by amosite, then chrysotile and lastly, anthophyllite. Appendix E contains additional information pertaining to the grades of chrysotile mined and uses of asbestos in building material.

The EPA document entitled "Asbestos Containing Materials in School Buildings: A Guidance Document" notes that in 1950, more than half of all multi-story buildings constructed in the U.S. used some form of sprayed mineral fiber fireproofing. In 1968, fireproofing alone accounted for 40,000 tons of sprayed material.

5.2 Quantity of Asbestos Released by Demolitions

In the open literature, most authors agree that demolition is potentially a major source of asbestos emissions, however there are very few quantitative figures available. The amount of asbestos emitted will depend on the type and age of a structure (industrial/commercial structures versus residential structures), as well as the demolition method used. For example, the "explosive" technique may release asbestos imbedded in wallboards and floor/ceiling tiles (not usually classified as friable) in addition to asbestos used in insulating material.

The potential problems involved in quantitatively measuring asbestos emissions from a demolition project can be seen in the lack of any numeric estimates. However, for the manufacturing or processing of products containing asbestos fibers, there are numerous estimates of emissions. An example of such estimates is a study conducted by Stanford Research Institute International for the National Cancer Institute entitled "Asbestos: An Information Resource," dated May 1978, which concluded that there were 534,554 metric tons of asbestos disposed or emitted in 1974. Of the 534,544 metric tons, 532,307 (99.60%) metric tons were disposed to the land, while 2,093 (0.39%) and 154 (0.03%) metric tons were emitted to the air and water respectively. The 534.554 metric tons was a summation of emissions from the consumption, production and manufacturing goods that contain asbestos.

Since asbestos has been in common use in building materials since 1950, most buildings should be inspected for asbestos prior to any demolition activity. Typically, a swatch of building material is removed and analyzed using light microscope detection or x-ray diffraction techniques. The problems using these methods for identifying asbestos are discussed in Section 5.5. Also, characterizing the mineralogy, quantity and textural characteristics of the source material provides little information of the particulate "cloud" which results from demolition activity. Variables such as the friability of the building material and grain size of the asbestos component, meterology at the time of demolition

and mitigating measures used to minimize fugitive emissions make the task of quantifying emissions from demolition projects formidable.

Under Subpart B of the National Emission Standard for Asbestos, Paragraph (d) of Section 61.22, clearly states that the written notice containing the (i) name of owner or operator, (ii) address of owner or operator and (iii) description of the building, structure, facility or installation to be demolished or renovated including the amount of friable asbestos materials present be sent to EPA.

Paragraph (d) (iii) was revised at 43 FR 26374 on June 19, 1978. From the files containing notification for Region V, IX and X, it would indicate that contractors are either not aware that they must report an estimated amount of asbestos or chose not to include this information in their report.

5.3 Quantity of Asbestos Released by Renovation

Various control measures have been adopted to limit fugitive emissions of asbestos material in renovation projects. When asbestos is removed from a structure, wetting of the material significantly lowers the amount of dust emitted compared to dry methods which can result in airborne asbestos levels in excess of 100 fibers/cm^3. For containing exposed friable asbestos, techniques which either use a sealant or barrier result in similar levels of airborne asbestos which are generally lower than for removing the asbestos. Appendix E contains data taken from "Sprayed Asbestos Containing Materials in Buildings: A Guidance Document" which compare the methods of controlling asbestos during renovation. In addition, most renovation projects include an air filtering device which, in theory, should allow a quantitative measure of emissions. This filtering system can be checked by one of the various analytical techniques available.

Paragraph (d) of Subsection 61.22 of Subpart B states:

> "the requirements of this paragraph shall apply to any owner or operator...who intends to renovate any institutional, commercial or industrial building, structure facility, installation or portion thereof where more than 80 meters (ca. 260 feet) of pipe covered or coated with friable asbestos materials are stripped or removed, or more than 15 square meters (ca. 160 sq. ft.) of friable asbestos materials used to cover or coat any..."

Most of the reports that were reviewed simply stated that there are more than 260 feet of asbestos.

Table 8 is a list of the type of buildings, the description of the demolished or renovated structure, and the amount of asbestos removed. Of the eighty-five (85) demolition reports sent to Region V, only 43 (50%) of the notices list any information pertaining to the amount of asbestos.

5.4 Asbestos in the Ambient Air Resulting From Construction Activities

Significant levels of airborne asbestos have been measured in a number of urban areas (reference Appendix E). However, there are many other sources of asbestos in addition to those from construction activities which contribute to ambient air concentrations. The day-to-day wear of auto brake linings, the manufacturing of asbestos-containing products and the mining of asbestos all contribute to asbestos accumulations in the atmosphere. In urban areas where most demolitions occur, the demolition of a building contributes more significantly to the asbestos in the atmosphere than in rural areas. Although demolition projects are completed in a short time and are a one-time occurrence, the cumulative effects of the asbestos on those exposed is accelerated.

5.5 Problems in Measuring Asbestos

Currently, the EPA, Research Triangle Park, North Carolina, is developing standard methodologies to measure asbestos in the atmosphere. However, there are significant problems in both the sampling and analysis to overcome.

As noted in "Engineering Aspects of Dust Control", samples collected may be the total dust or the respirable dust fraction. Pre-samplers are required to segregate grain sized in the latter case. There are various types of pre-samplers (cyclones, impactors, etc.) that have been standardized for granular dust and some that have been modified and standardized for fibrous dust under certain conditions. However, measurement procedures that have been developed have yet to be fully disseminated, evaluated, and standardized.

It is pointed out in "Asbestos: An Information Resource" that, at present, the major method of monitoring in use is membrane filtration. The procedure most commonly used is a single step filtration in which all suspended particulate material in the medium is entrapped with the suspended asbestos. Also, dual-filter methods utilizing coarse and fine filters have been used but inherent problems in loading and asbestos being entrained on both filters makes this technique less reliable.

Inherent problems in sampling include: (1) inaccuracies caused by a lack of reproducibility between samples collected in both, (2) differences between sampling techniques manner and location, and (3) selecting representative sites from which quantitative emissions from a demolition project may be determined.

Harwood and Yamate in their article entitled "The Detection and Quantification of Asbestos Present in the Environment" have compiled and reviewed the various techniques for detecting and quantifying asbestos. These techniques are presented in Appendix E. However, it should be noted that inaccuracies in values obtained using normal analytical techniques can result from several circumstances: (1) statistical variation in the number of fibers found in a given grid square within a sample, (2) variability in the volume of each fiber, (3) problems with interference and light dispersion particularly with chrysotile, (4) variability in the amount of material lost during processing and (5) low-level contamination of the sample at various points during its preparation and analysis. Another problem is that of economics.

In "Asbestos: An Information Resource," SRI reports:

> "the minimum initial capital investment required for new equipment will be in the range of $100,000-$250,000, and an annual operating budget of nearly $100,000 will be required. This will cover the expense of purchasing and installing a scanning/transmission electron microscope and the salaries, fringe benefits and overhead expenses for a microscopist and two or three technicians."

These costs are well beyond the normal budget of most asbestos enforcement agencies.

6.0 PROBLEMS WITH THE REPORTING REQUIREMENTS

6.1 Nature of Industries

Demolition and renovation contracts are performed by firms that range in size from a few people who rent equipment to 20 to 30 firms which are national in scope and have hundreds of employees, with the largest U.S. contractor being the Cleveland Wrecking Company. Most demolition contractors cannot compete on the national scale and confine their operations to their local area. The local nature of the industry makes the gathering of national (or industry-wide) date difficult. Looking at the demolition notices from the EPA Region V, IX and X offices, one would surmise that contractors either are unaware of EPA's reporting requirements or they have chosen not to fulfill these requirements. Notices are often submitted to EPA after the projected completion date of the project or do not contain all the required information or consists simply of a letter that says a building will be torn down without giving the building location or any further information. Table 8 is an example of the reported quantity of asbestos removed from demolition jobs in Regions V, IX, and X. This table serves to highlight the incomplete nature of the data reported.

Many times notices are sent to EPA when asbestos is not present. An example of this is the 39 sites inspected in Region V on October 20, 1978. Thirty-three contained no asbestos. On November 15, 1978, there were 34 inspected sites with 25 containing no asbestos, and on January 22, 1979, there were 96 inspections with 84 sites containing no asbestos. Of these 96 sites, there were four that did not notify EPA. In all four cases, there were either small amounts of asbestos or the asbestos was being properly handled. Of the 169 inspections in Region V carried out between October 20, 1978 and January 22, 1979, 98% of the inspections contained no asbestos. To enhance industry's understanding of the reporting requirements, an educational campaign should be designed and distributed to the industry.

For EPA to have adequate data upon which to base an enforcement strategy, EPA must ensure that demolition and renovation contractors give ample notification.

6.2 Tracking Demolition Contractors

EPA Headquarters needs to track the compliance of the individual contractors because of the local nature of the industry. A data base that currently exists and can be used for tracking purposes is the Compliance Data System which is maintained by the Division of Stationary Source Enforcement. Individual contractors can be entered as a source. Every demolition or renovation project in which the contractor participates can be described as an emission point. Once a valid data base has been established, an enforcement inspector can scan a retrieval for those sources with a history of being out-of-compliance. This will assist the inspector in planning which sites to visit. This type of data base can also assist EPA in developing an enforcement strategy for the demolition and renovation industry.

EPA Regional offices can receive special printouts on which contractors in their jurisdiction are consistently out-of-compliance, which contractors specialize in the demolition of industrial, commercial or residential buildings, etc. This type of information can assist the Regional offices in carrying out their surveillance responsibilities.

6.3 Developing an Education Program

In order to ensure that the demolition and renovation contractors are aware of their reporting obligations and the penalties associated with failure to meet the EPA regulations, EPA should develop an educational program aimed at the industry. Industrial seminars could be held at EPA Regional offices. EPA Headquarters currently holds seminars at Regional offices for federal and local enforcement personnel, which concentrate on the regulations, how to perform a safe inspection and how to develop a non-compliance case. The industry seminars could be run in a similar manner to the enforcement seminars. One critical point that should be stressed during the education program is where OSHA regulations level off and EPA responsibility begins. Contractors do not fully understand why there are two sets of regulations because they are not aware of the concept of OSHA being responsible for the workers and EPA being responsible for the general public.

TABLE 8

Examples of Quantity of Asbestos Removed by Demolitions or Renovations in Buildings for Select EPA Regions (1978)

STATES	TYPE OF STRUCTURE			
	Single Story	Multi Story	Schools	Multi-Story Commercial
ILLINOIS				
Average Pounds of Ab.	UN* (6)	UN (76)	NA	UN (81)
Average Linear Footage	NA	NA	NA	260 linear ft. (1)
Average Sq. Footage	NA	NA	NA	160 sq. ft. (1)
Average Cubic Footage	NA	NA	NA	1500 cu. ft. (1)
INDIANA				
Average Pounds of Ab.	UN NA	UN NA	UN NA	UN (1)
Average Linear Footage	NA	NA	NA	2451 ft. (1)
Average Sq. Footage	NA	NA	NA	NA
Average Cubic Footage	NA	NA	NA	NA
MISSOURI				
Average Pounds of Ab.	UN (1)	UN NA	UN NA	UN NA
Average Linear Footage	NA	260 ft. (3)	NA	174261. ft. (29)
Average Sq. Footage	NA	520 sq. ft. (2)	NA	4775 sq. ft. (2)
Average Cubic Footage	NA	NA	NA	NA

* KEY:

UN = Unknown
NA = Not Available
Numbers in parentheses represent the number of buildings included in the average.

TABLE 8

	Single Story	Multi Story	Schools	Multi-Story Commercial
OHIO				
Average Pounds of Ab.	NA	NA	NA	UN (2)
Average Linear Footage	NA	NA	NA	25,000 lin. ft. (1)
Average Sq. Footage	NA	NA	NA	20,000 sq. ft. (1)
Average Cubic Footage	NA	NA	NA	NA
MINNESOTA				
Average Pounds of Ab.	NA	NA	NA	UN (1)
Average Linear Footage	NA	NA	NA	NA
Average Sq. Footage	NA	NA	NA	NA
Average Cubic Footage	NA	NA	NA	NA
WISCONSIN				
Average Pounds of Ab.	NA	UN (1)	NA	UN (1)
Average Linear Footage	NA	NA	NA	NA
Average Sq. Footage	NA	NA	NA	NA
Average Cubic Footage	NA	NA	NA	NA
CALIFORNIA				
Average Pounds of Ab.	NA	NA	NA	UN (4)
Average Linear Footage	NA	NA	NA	3930 lin. ft. (4)
Average Sq. Footage	NA	NA	NA	NA

TABLE 8

	Single Story	Multi Story	Schools	Multi-Story Commercial
CALIFORNIA (cont.)				
Average Cubic Footage	NA	NA	NA	NA
OREGON				
Average Pounds of Ab.	NA	UN (7)	NA	NA
Average Linear Footage	NA	NA	NA	NA
Average Sq. Footage	NA	NA	NA	NA
Average Cubic Footage	NA	NA	NA	NA

7.0 CONCLUSIONS

7.1 Conclusions

From this investigation various inferences can be drawn regarding the nature of the demolition and renovation industries and the costs incurred by these industries in complying with the asbestos regulations outlined in the NESHAPS provisions of the Clean Air Act of 1977 as amended.

- There are 2,502 demolition contractors in the United States
- In 1978, there were 2,596 demolition projects started
- The majority of contracts and contractors are located in urban centers where people are more exposed to asbestos emissions than people in rural areas
- The average increase to the industry resulting from the asbestos regulations is $1,733 (in 1974 dollars)
- The average demolition bid is $43,878
- Most government agencies are not aware of the number or dollar amount of the demolition projects they support
- Demolition and renovation projects are local in nature, which makes the collection of national or industry-wide data difficult
- There are no industry standards for charges when asbestos is present in a demolition project
- Industry feels that EPA should set a numeric emission standard
- Often, notification is given to EPA after the demolition project has been initiated or completed

7.2 Recommendations

Based on this investigation, TRC makes the following recommendations:

- Compliance of demolition contractors should be tracked in an EPA data base, such as the Compliance Data System. A contractor could be entered into the data base as a source and every demolition project he completes could be entered as a point. This would allow an inspector to have a printout of which contractors have a history of non-compliance. This can assist the inspector in planning a more efficient inspection strategy.

- Contractors consistently do not report complete information as required to EPA. EPA should institute an educational program to inform the industry of their reporting obligations. EPA Headquarters currently has an educational program designed to help educate state and local enforcement personnel. A similar Regional program should be arranged and industry personnel invited. This program could emphasize the federal and local regulations and what a contractor can expect during an inspection.

- For complete data on the number of demolition and renovation projects, EPA should combine an information package and a questionnaire to distribute to those contractors listed in the Appendice to this report. The questionnaire could address the question of the amount of asbestos handled in one year, the number of projects, the number of employees of a given firm and the final distribution of the asbestos. The information package could contain the pertinent asbestos regulations.

- EPA should develop a numeric emission standard for asbestos, as well as a quick, efficient method of measuring and classifying asbestos. The emission standard and measuring technologies are already being addressed by EPA at Research Triangle Park, North Carolina.

- EPA should try to develop a directory of federal government agencies that lists the types and amounts of demolition projects supported by these agencies.

- EPA should consider other alternatives to the control of asbestos emissions than by direct regulation.

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APPENDIX A

LIST OF EPA REGIONAL NESHAPS COORDINATORS

NESHAPS COORDINATORS

REGION	CITY	NAME	PHONE
I	Boston, MA	Steve Fradkoff	617-223-5186
II	New York, NY	Marcus Kantz	212-264-9538
III	Philadelphia,PA	Jean Thompson	215-597-9884
IV	Atlanta, GA	Carl Sova	404-881-4552
V	Chicago, IL	Eric Cohen	312-353-2212
VI	Dallas, TX	Martin Brittain	214-767-2755
VII	Kansas City,MO	Pete Culver	816-374-2576
VIII	Denver, CO	Clifford Blackwell	303-837-2361
IX	San Francisco, CA	Chuck Sealy	415-556-0970
X	Seattle, WA	Ken Lepic	206-442-1125

APPENDIX B

LIST OF INDIVIDUALS CONTACTED DURING THIS CONTRACT

LIST OF INDIVIDUALS CONTACTED

REGION I EPA-Boston Steve Fradkoff (617)223-4448
stepped-up school removals

CONNECTICUT - ∿250 jobs per year involve removal of asbestos

State Agency - Stanley J. Pac, Commissioner 566-4030
- Mrs. Bernard Swan, President, Board of Health, New Haven 787-8189, said authority delegated to towns; referred to Jon Kabish 566-5626
- Leo Alex, State Labor Dept., Meriden, 566-5160

Contractors - Cappozziello Bros. Building Wrecking Co., Inc. Bridgeport, 335-2293
- D&M Demolition Inc, Rocky Hill, 563-4921
- Dunn Bros. Inc., South Windsor, 528-9201
- The Leibert Corp. Hartford, 247-6656
- Mitchell Trucking Inc., South Windsor, 528-4431
- Stamford Wrecking Co., Stamford, 324-9537
- Waterbury House Wrecking Co., Inc., 757-8444

MAINE - annually wreck 2 residential, 5 commercial, 3 industrial

State Agency - David Tudor, (207)289-2437 State Director, Bureau of Air Quality Control

Contractors - Lawrence S. Datil, 622-0535
- Aceto & Co., 797-6761
- Benjamin Building Wrecking Co., 767-2985
- Bourque Inc., 282-3318
- D. Renzo & Sons, 854-5562
- Gary's Trucking, 883-5997
- Merill, Inc., 799-1541
- Viola, 722-2392

MASSACHUSETTS - annually wreck 8 residential, 13 commercial, 6 industrial

State Agency - Steve Joyce, District Director (800)332-0366 (Berkshire Air Pollution Control District)

Contractors - (Following are area code 617)
- Ace Wrecking & Dismantling, 472-4716
- Central Building Wrecking, 387-3700
- John Duane Building Wrecking, 773-6030
- James Grant Co., 361-2716
- John Crant & Sons Co., 848-8070
- Hawks Mt., Co., 729-1577
- Kouns & Clifford Wrecking, 442-7030
- Mystic Building Wrecking Co., 884-3101
- Napoli Wrecking Co., 282-5190
- North American Site Developers, 254-3140
- Sinclair Trucking, 438-0016
- Southbridge Salvage Inc. 764-8887
- Wrecking Corp. of American (212)937-2288 (N.Y.)
- Robert S. Young & Co., 479-1826

LIST OF INDIVIDUALS CONTACTED

MASSACHUSETTS (continued)

Contractors
- (Following are area code 413)
- American Recycling Corp. 781-2345
- Associated Building Wreckers Inc. 732-3179
- Armet Charlie Trucking, 525-6325
- Haber Sand & Gravel Co., 532-9240
- LaFlamme Trucking, 532-3525
- Nawrocki Construction, 592-6577
- F&D Truck Co., Inc., 754-9572
- Lorion Building Wrecking 791-8401

NEW HAMPSHIRE - NONE

RHODE ISLAND - annually wreck 2 residential, 2 commercial

State Agency - Austin Daley 401-277-2808, Co-ordinator, Dept. of Environmental Management

Contractors
- AHR Construction Co. 401-336-7310
- Pasquazzi Bros., Inc. 942-2250

VERMONT - NO INFORMATION

State Agency - Mr. Cedric Sanbourne 802-828-3395, Air Pollution Control Engineer

REGION II

EPA Region - Marcus Kantz 212-264-9538, Engineer
- ∿ 25,000 demolition jobs annually in NY and NJ
- ∿ 8,000 in New York City
- ∿ 2,000 involve asbestos removal

REGION III

DELAWARE - majority of projects are industrial

State Agency - Robert French, Air Resource Section, Manager 302-678-4403

Contractors
- DuPont, John Resor, 302-629-9121
- Allied Chemical, David Murphy, 798-0621
- Asbestos Workers, Ray Ryan, 328-4203

MARYLAND - ∿50 demolition jobs annually

State Agency - Carl York 301-383-2776, Chief, Div. of Compliance, Air Quality Program

LIST OF INDIVIDUALS CONTACTED

REGION III (continued)

PENNSYLVANIA - last year - 24 inspections, one enforcement action, most jobs are industrial

State Agency - Doug Lesher, 717-787-9702

VIRGINIA

State Agency - Ray Belcher, 804-786-4867
- Mike Overstreet, 804-786-2378, one industrial (Regional Director, Southwest VA, Abingdon)
- Ray Minx, 804-786-2378, 2 demolitions, 1 commercial (Regional Director, Northeastern, VA, Fredericksburg)
- Henry Moss, 804-786-2378, 4 demolitions (Regional Director, State Capitol, Richmond)
- Robert Beasly, 804-786-2378, 3 indus., 2 comm., 1 pending (Asst.Regional Director, State Capitol, Richmond)
- Luke McDonald, 804-786-2378, one commercial (Asst. Director, Hampton Roads, Virginia Beach)

REGION IV (Thomas)

ALABAMA - two ongoing projects

State Agency - 205-834-6570

GEORGIA - 11 commercial, 5 residential, 6 industrial

State Agency - Dave Yardumian, 404-656-4867
- Marvin Bradford, 404-656-7410

KENTUCKY - 1978: 6 res., 3 comm., 6 indus.; 1979: 1 comm.

State Agency - Carl Horneman, 502-564-3560, Environmental Specialist III

NORTH CAROLINA - NO INFORMATION

State Agency - Paul Wilns, 919-733-5188, Environmental Engineer III
Head of Air Branch

MISSISSIPPI - NO INFORMATION

State Agency - 601-354-2550

SOUTH CAROLINA - 3 industrial, 2 commercial

State Agency - Otto Pearson, 803-758-5406, P.E.Engineer & Dir.of Facilities Evaluation Div., Bureau of Air Quality Control
- Kim Cauthen, 803-758-5406 Environmental Engineer

TENNESSEE

State Agency - 615-741-3931

LIST OF INDIVIDUALS CONTACTED

REGION V Eric Cohen, EPA Region NESHAPS Co-ordinator

ILLINOIS - have applied for authority over regulations

State Agency - Miles Zamco 217-782-7326, Manager, Field Operation Section
- Berkley Moore, 217-782-7326 , Energy Specialist,Fiv.of Air Pollution Control

INDIANA - NO INFORMATION

State Agency - John Pruessner, 317-633-0600

MICHIGAN - 15 indus., 3 comm., 2 resid.

State Agency - Del Rector, 517-373-7573 (322-1330)
Chief, Air Quality Division

MINNESOTA - NO INFORMATION

State Agency - Gary Palford, 613-296-7373 (7301)

OHIO - 50 projects for 1978; no residential for Cincinnati, Butler, Clermont, Hamilton, and Warren Counties

- James Orleman, Chief, Air Pollution Control
513-352-4880; M. F. Smith, same phone
(not listed under State Agency, Cinc. includes Butler, Clermont, Hamilton and Warren Counties)

WISCONSIN - 3 projects
State Agency - Doug Evans, 608-266-0151 - Asst. to the Director, Bureau of Air Management

REGION VI

ARKANSAS - NO INFORMATION

State Agency - 501-371-1136

LOUISIANA - NO INFORMATION

State Agency - 504-568-5122

NEW MEXICO - NO INFORMATION

State Agency - 505-827-5271

OKLAHOMA - NO INFORMATION

State Agency - 405-271-5220

TEXAS - since 11/15/78 - 31 industrial projects

State Agency - Mr. Mike Peters, 512-451-5711

REGION VII

IOWA - 3 res., 1 comm., 3 indus.

State Agency - Bud Karachiwala, 515-281-8092

KANSAS - NO INFORMATION

State Agency - John Erwin, 913-862-9360

MISSOURI - NO INFORMATION

State Agency - Bill Moore, 314-751-3241

NEBRASKA

State Agency - Gene Robinson, 402-471-2186 - Chief, Air Pollution Div.
- Gary Walsh, 402-474-1541 - 6 commercial, Supervisor, Lincoln-Lancaster County Air Pollution Control Agency
- Bob Timmerman, 402-444-5378 - 3 comm., 1 indus. Chief, Air Quality Control Inspector, Omaha City

REGION VIII

COLORADO - NO INFORMATION

EPA Region - Charles Baldwin, 303-837-2361, Attorney Advisor
- Cliff Blackwell, 303-837-5914, Attorney Advisor

MONTANA - NO INFORMATION

State Agency - Michael Roach, 406-449-3454 , Chief, Air Quality Bureau

NORTH DAKOTA - NO INFORMATION

State Agency - Mr. Drawford, 701-224-2371
Dept of BID - Bruce Batch, 701-224-2811

SOUTH DAKOTA - NO INFORMATION

State Agency - 605-224-3329 (773-3329)

UTAH - NO INFORMATION

State Agency - 801-533-6108

WYOMING - NO REGULATIONS

State Agency - Robert Sundin 307-777-7391

REGION IX

EPA-San Francisco - Chuck Sealey, 415-556-0970

ARIZONA - NO INFORMATION

State Agency - Carl Billings, 602-255-1144

CALIFORNIA- 210-220 contractors, 15-20 report routinely, 2 submit ten reports per month; 44 APCD's in CA., 15-16 report.

NEVADA - NO INFORMATION

State Agency - 702-885-4670

REGION X

EPA-Seattle - Mark Hooper, 206-442-1263, (206-344-7330, Puget Sound number includes King, Kitsap, Pierce & Snohomish Counties) referred to Puget Sound Authority - 38 commercial

IDAHO - NO INFORMATION, NO REGULATIONS

State Agency - 208-384-2903

OREGON - 9 commercial, 1 industrial, 503-229-5395

State Agency - Michael Ziolko

WASHINGTON

Control Officer, Fred Gray, 509-456-4727 - 14 commercial, Spokane County Air Pollution Control Authority

Control Officer, Air Pollution Control Authority, J. Philip Cooke, Benton, Franklin, Walla-Walla Counties, one commercial, one industrial (509-946-4489)

APPENDIX C

LIST OF AGENCIES THAT HAVE ACCEPTED DELEGATION OF RESPONSIBILITIES FOR DEMOLITION/RENOVATION

Information obtained from:
Asbestos Federal and State Regulations by Asbestos Information Association, Arlington, Va. as of April, 1979

STATE	STATUS OSH PLAN	STATE OSH OFFICE	STATUS NESHAPS 61.22(d) DELEGATION	STATE AIR POLLUTION CONTROL AGENCY
ALABAMA	Submitted Under review	Director Alabama State Dept. of Labor 600 Administration Bldg. 64 N. Union Street Montgomery, Ala. 36104 (205) 269-6211	YES	Alabama Air Pollution Control Commission 645 S. McDonough St. Montgomery, Ala. 36104 (205) 269-7841
ALASKA	Certified	Commissioner Alaska Dept. of Labor P.O. Box 1149 Juneau, Alaska 99801 (907) 465-2700	NO	Dept. of Environmental Conservation 419 Sixth St. Juneau, Alaska 99801 (907) 586-6721
ARIZONA	Approved Certification pending	Director Occupational Safety & Health Division Industrial Commission of Arizona P.O. Box 19070 Phoenix, Ariz. 85005 (602) 271-5795	YES	Bureau of Air Pollution Control 1740 West Adams Street Phoenix, Ariz. 85007 (602) 271-5306
ARKANSAS	Submitted Under review	Director Dept. of Labor Capitol Hill Building Little Rock, Ark. 72201 (501) 371-1401	NO	

STATE	STATUS OSH PLAN	STATE OSH OFFICE	STATUS NESHAPS 61.22(d) DELEGATION	STATE AIR POLLUTION CONTROL AGENCY
CALIFORNIA	Certified	Director Dept. of Industrial Relations 455 Golden Gate Avenue San Francisco, California 94102 (916) 445-1935	See note	
COLORADO	Approved	Executive Director Dept. of Labor & Employment 251 East Ninth Ave. Denver, Colorado 80203 (303) 892-9911	YES	Air Pollution Control Division Dept. of Health 4201 East 11th Avenue Denver, Colo. 80220
CONNECTICUT	Withdrawn	Commissioner Connecticut Dept. of Labor 200 Folly Brook Blvd. Wethersfield, Conn. 06109 (203) 566-5123	YES	Dept. of Environmental Protection 165 Capitol Ave. Hartford, Conn. 06106 (203) 566-4030
DELAWARE	Submitted Under review	Director Dept. of Labor 801 West Street Wilmington, Del. 16899 (302) 571-2710	NO	Division of Environmental Control Tatnall Building Capitol Complex Dover, Del. 19901 (302) 678-4761

STATE	STATUS OSH PLAN	STATE OSH OFFICE	STATUS NESHAPS 61.22(d) DELEGATION	STATE AIR POLLUTION CONTROL AGENCY
FLORIDA	Submitted Under review	Director Division of Labor Ashley Bldg., Room 201 1321 Executive Center Dr., East Tallahassee, Fla. 32301 (904) 599-8211	NO	Dept. of Pollution Control 2562 Executive Center Circle Tallahassee, Fla. 32301 (904) 488-4807
GEORGIA	Withdrawn	Commissioner Department of Labor 288 State Labor Bldg. Atlanta, GA 30334	YES	Environmental Protection Div. Dept. of Natural Resources 47 Trinity Ave., SW Atlanta, GA 30334 (404) 656-4713
HAWAII	Approved Certification pending	Director Labor & Industrial Relations 825 Mililarii Street Honolulu, Hawaii 96813 (808) 548-3150	NO	State Dept. of Health 1250 Punchbowl St. Honolulu, Hi. 96813 (808) 548-6455
IDAHO	Submitted Under review	Dept. of Labor Industrial Administration Bldg. 317 Main Street Boise, Idaho 83702 (208) 384-2327	NO	Dept. of Health & Welfare Statehouse Boise, Idaho 83720 (208) 384-2390

STATE	STATUS OSH PLAN	STATE OSH OFFICE	STATUS NESHAPS 61.22(d) DELEGATION	STATE AIR POLLUTION CONTROL AGENCY
ILLINOIS	Withdrawn plan	Dept. of Labor 910 S. Michigan Ave. Chicago, Ill. 60605 (312) 793-2800 OR Illinois Industrial Comm. 160 N. LaSalle St. Chicago, Ill. 60601 (312) 793-3333	NO	Division of Air Pollution Control 2200 Churchill Road Springfield, Ill. 62704 (217) 782-7326
INDIANA	Approved Certification pending	Indiana Division of Labor 1013 State Office Bldg. Indianapolis, Ind. 46204 (317) 633-4473	YES	Indiana State Board of Health 1330 W. Michigan St. Indianapolis, Ind. 46206 (317) 633-4273
IOWA	Certified	Bureau of Labor East 7th and Court Ave. Des Moines, Iowa 50319 (515) 281-3606	NO	Iowa Dept. of Environmental Quality 3920 Delaware Ave. P.O. Box 3326 Des Moines, Iowa 50316 (515) 265-8134
KANSAS	None submitted	Kansas Bureau of Labor 401 Topeka Avenue Topeka, Kansas 66603 (913) 296-7474	NO	

STATE	STATUS OSH PLAN	STATE OSH OFFICE	STATUS NESHAPS 61.22 (d) DELEGATION	STATE AIR POLLUTION CONTROL AGENCY
KENTUCKY	Approved Certification pending	Kentucky Dept. of Labor Capitol Plaza Towers, 12th Floor Frankfort, Ky. 40601 (502) 564-3070	YES	Kentucky Dept. for Natural Resources & Environmental Protection Capitol Plaza Tower Frankfort, Ky. 40601 (502) 564-3382
LOUISIANA	None submitted	Dept. of Labor P.O. Box 44063 Baton Rouge, La. 70804 (504) 389-5314	NO	Louisiana Health & Human Resources Administration P.O. Box 60630 325 Loyola Ave. New Orleans, La. 70160 (504) 527-5115
MAINE	Withdrawn	Commissioner of Manpower Affairs 20 Union Street Augusta, Maine 04330 (207) 289-3814	YES	Dept. of Environmental Protection Bureau of Air Quality Control State House Augusta, Maine 04330 (207) 289-2437
MARYLAND	Approved Certification pending	Dept. of Licensing & Regulation Div. of Labor & Industry 203 E. Baltimore St. Baltimore, Md. 21202 (301) 383-2251	NO	Bureau of Air Quality Control 610 N. Howard St. Baltimore, Md. 21201 (301) 383-2779

STATE	STATUS OSH PLAN	STATE OSH OFFICE	STATUS NESHAPS 61.22(d) DELEGATION	STATE AIR POLLUTION CONTROL AGENCY
MASSACHUSETTS	Submitted Under review	Commissioner Dept. of Labor & Industries 100 Cambridge St. Boston, Mass. 02202 (617) 727-3454	YES	Bureau of Air Quality Control 600 Washington St. Boston, Mass. 02111 (617) 727-2658
MICHIGAN	Approved Certification pending	Michigan Dept. of Labor 309 N. Washington P.O. Box 30015 Lansing, Michigan 48909 (517) 373-9600	YES	Division of Air Pollution Control Steven T. Mason Bldg. Lansing, Michigan 48926 (517) 373-7573
MINNESOTA	Certified	Dept. of Labor & Industry 444 Lafayette Road St. Paul, Minn. 55101 (612) 296-2342	NO	Minnesota Pollution Control Agency 1935 W. County Rd., B-2 Roseville, Minn. 55113 (612) 296-7317
MISSISSIPPI	Withdrawn	State Board of Health P.O. Box 1700 Jackson, Miss. 39205 (601) 354-6635	NO	Mississippi Air & Water Pollution Control Commission Robert E. Lee Bldg. Jackson, Miss. 39205 (601) 554-6783

STATE	STATUS OSH PLAN	STATE OSH OFFICE	STATUS NESHAPS 61.22(d) DELEGATION	STATE AIR POLLUTION CONTROL AGENCY
MISSOURI	Submitted Under Review	Division of Labor Standards P.O. Box 449 Jefferson City, Mo. 65101 (314) 751-3403	NO	Missouri Dept. of Natural Resources P.O. Box 176 Jefferson City, MO 65101 (314) 751-3252
MONTANA	Withdrawn	Bureau of Safety & Health Dept. of Labor & Industry 815 Front Street Helena, Montana 59601 (406) 449-2047	YES	Montana State Dept. of Health & Environmental Sciences Cogswell Bldg. Helena, MT 59601 (406) 449-3454
NEBRASKA	None submitted	Dept. of Labor State Capitol Lincoln, Neb. 68509 (402) 477-5211	NO	Div. of Air Pollution Control P.O. Box 94653 State House Station Lincoln, NEB. 68509 (402) 471-2186
NEVADA	Approved Certification pending	Dept. of Occupational Safety & Health Nevada Industrial Commission 515 E. Musser St. Carson City, Nev. 89714 (702) 885-5240	See note	Dept. of Human Resources Nye Bldg. 201 S. Fall St. Carson City, NEV. 89701 (702) 885-4701

STATE	STATUS OSH PLAN	STATE OSH OFFICE	STATUS NESHAPS 61.22 (d)DELEGATION	STATE AIR POLLUTION CONTROL AGENCY
NEW HAMPSHIRE	Withdrawn	Dept. of Labor 1 Pillsbury St. Concord , N. H. 03301 (603) 271-3171	YES	New Hampshire Air Pollution Control Agency State Lab. Bldg. Hazen Drive Concord, N. H. 03301 (603) 271-2281
NEW JERSEY	Withdrawn	Dept. of Labor & Industry P.O. Box V Trenton, N. J. 08625 (609) 292-2323	YES	Dept. of Environmental Protection P.O. Box 2807 Trenton, N. H. 08625 (609) 292-5450
NEW MEXICO	Approved Certification pending	Environmental Improvement Agency P.O. Box 2348 Santa Fe, N. M. 87501 (505) 827-5273	NO	Environment Improvement Agency Air Quality Division PERA Bldg., Old Santa Fe Trail & Paseo de Peralta Santa Fe, N. M. 87502 (505) 827-2813
NEW YORK	Withdrawn	N .Y. State Industrial Comm. Dept. of Labor State Campus, Bldg. #12 Albany, N. Y. 12240 (518) 457-3427	YES	Dept. of Environmental Conservation 50 Wolf Road Albany, N. Y. 12201 (518) 457-7231

STATE	STATUS OSH PLAN	STATE OSH OFFICE	STATUS NESHAPS 61.22(d) DELEGATION	STATE AIR POLLUTION CONTROL AGENCY
NORTH CAROLINA	Certified	North Carolina Dept. of Labor P.O. Box 27407 11 West Edenton Street Raleigh, N. C. 27611 (919) 733-7166	YES	Dept. of Natural & Economic Resources P.O. Box 27687 Raleigh, N. C. 27611 (919) 829- 4740
NORTH DAKOTA	Withdrawn	North Dakota Workmen's Compensation Board State Capitol Bismarck, N. D. 58501 (701) 224-2700	YES	Dept. of Health State Capitol Bismarck, N. C. 58501 (701) 224-2372
OHIO	None submitted	Div. of Occupational Safety & Health Dept. of Industrial Relations 2323 W. Fifth Ave. Columbus, OH 43204 (614) 466-4124	NO	Environmental Protection Agency 361 East Broad St. Columbus, OH 43216 (614) 469-8565
OKLAHOMA	Submitted Under review	Dept. of Labor State Capitol Room 5 Oklahoma City, OK 73105 (405) 521-2461	NO	Air Quality Service Dept. of Health Northeast 10th & Stonewall Oklahoma City, OK 73105 (405) 271-5220

STATE	STATUS OSH PLAN	STATE OSH OFFICE	STATUS NESHAPS 61.22(d) DELEGATION	STATE AIR POLLUTION CONTROL AGENCY
OREGON	Approved Certification pending	Worker's Compensation Dept. Labor & Industries Bldg. Salem, OR 97310 (503) 378-3302	YES	Dept. of Environmental Quality 1234 S. W. Morrison St Portland, OR 97205 (503) 229-5696
PENNSYLVANIA	Withdrawn	Dept. of Labor & Industry 1700 Labor & Industry Bldg. Harrisburg, PA 17120 (717) 787-3157	YES	Bureau of Air Quality & Noise Control 200 N. Third St. Harrisburg, PA 17120 (717) 787-9702
RHODE ISLAND	Submitted Under review	Div. of Occupational Safety Dept. of Labor 235 Promenade St. Providence, R. I. 02903 (401) 277-2500	YES	Div. of Air Pollution Control 204 Health Bldg. Davis Street Providence, R. I 02908 (401) 277-2808
SOUTH CAROLINA	Certified	S. C. Dept. of Labor 3600 Forest Drive P.O. Box 11329 Columbia, S. C. 11329 (803) 758-2851	YES	Dept. of Health & Environmental Control J. Marion Sims Bldg. 2600 Bull St. Columbia, S. C. 29201 (803) 758-5496

STATE	STATUS OSH PLAN	STATE OSH OFFICE	STATUS NESHAPS 61.22(d) DELEGATION	STATE AIR POLLUTION CONTROL AGENCY
SOUTH DAKOTA	None submitted	Secretary of Health Sate Dept. of Health Office Bldg. #2 Pierre, S. C. 57501 (605) 227-3361	NO	Dept. of Environmental Protection Air Quality Program Office Bldg. #2 Pierre, S. C. 57501 (605) 224-3351
TENNESSEE	Approved Certification pending	Tennessee Dept. of Public Health 344 Cordell Hull Bldg. Nashville, Tenn. 37319 (615) 741-3111	See note	Div. of Air Pollution Control Dept. of Public Health 301 Seventh Ave., Rm. 256 Capitol Hill Bldg. Nashville, TN 37219 (615) 741-3931
TEXAS	Submitted Under review	Div. of Occupational Safety & Sate Safety Engineer Texas Dept. of Health Resources 1100 W. 49th St. Austin, TX 78756 (512) 397-5721	NO	Texas Air Control Board 8520 Shoal Creek Blvd. Austin, TX 78758 (512) 451-5711
UTAH	Certified	Utah Industrial Commission 350 East 5th South Salt Lake City, Utah 84111 (801) 533-4000	NO	Div. of Health 44 Medical Drive Salt Lake City, Utah 84113 (801) 328-6108

STATE	STATUS OSH PLAN	STATE OSH OFFICE	STATUS NESHAPS 61.22(d) DELEGATION	STATE AIR POLLUTION CONTROL AGENCY
VERMONT	Certified	Dept. of Labor & Industry Montpelier, VT 05602 (802) 533-6411	YES	Agency of Environmental Conservation Air Pollution Control P.O. Box 489 Montpelier, VT 05602 (802) 828-3395
VIRGINIA	Approved Certification pending	Dept. of Labor & Industry P.O. Box 1814 Ninth St Office Bldg. Richmond, VA 23214 (804) 786-2376	YES	State Air Pollution Control Board Room 1106 Ninth St. Office Bldg. Richmond. VA 23219 (804) 770-2378
WASHINGTON	Approved Certification pending	Dept. of Labor & Industries General Administration Bldg, Room 344 Olympia, WA 98504 (206) 753-6307	YES	
WEST VIRGINIA	Submitted Under review	W. Virginia Dept. of Health State Capitol Charleston, W. VA 25305 (304) 348-2971	NO	W. VA Air Pollution Control Commission 1558 Washington St., East Charleston, W. VA 25311 (304) 348-3286

STATE	STATUS OSH PLAN	STATE OSH OFFICE	STATUS NESHAPS 61.22(d) DELEGATION	STATE AIR POLLUTION CONTROL AGENCY
WISCONSIN	Withdrawn	Dept. of Industry, Labor & Human Relations 201 E. Washington Ave. P.O. Box 2209 Madison, WI 53701 (608) 266-7552	YES	Wisconsin Dept. of Natural Resources P.O. Box 450 Madison, WI 53701 (608) 266-7718
WYOMING	Approved Certification pending	Occupational Health & Safety Dept. 200 E Eighth Avenue P.O. Box 2186 Cheyenne, WY 82002 (307) 777-7786	NO	Air Quality Division Dept. of Environmental Quality State Office Bldg. Cheyenne, WY 82002 (307) 777-7391

EXPLANATORY NOTE:

Many states are divided into air quality control districts for enforcement of NESHAPS and report directly to the federal EPA. Some state districts, counties and cities have developed and enforce their own regulation.

CALIFORNIA	-	All districts have adopted NESHAPS asbestos provisions. Del Nora, Humboldt, Kern, Mendocino, N. Sonora, Trinity and San Diego districts have plans. Other districts fall under state provisions as regards waste disposal.
NEVADA	-	Washoe district
TENNESSEE	-	Nashville and Knoxville districts
ILLINOIS	-	Chicago. Cook County is developing plan.
MASSACHUSETTS	-	Boston
NEW YORK	-	New York City
PENNSYLVANIA	-	Philadelphia
OHIO	-	Dayton Area.

APPENDIX D

SUMMARY OF FEDERAL REGULATION OF ASBESTOS

Prepared by David Brandwein, Esquire

FEDERAL REGULATION OF ASBESTOS

Several agencies within the federal government have been involved with regulating various aspects of exposure to asbestos. Their concern with asbestos health issues has depended on the scope of their regulatory jurisdiction and has covered exposure to asbestos fibers in the workplace (OSHA), the general environment, air, water, and ground (EPA), mining operations (MESA), drugs (FDA), and consumer products (CPSC).

This section will briefly describe the extent of regulatory jurisdiction of each of these agencies, how they have historically regulated exposure to asbestos, and what the status of that regulation is today. Particular attention is paid to OSHA's regulation of asbestos in the demolition and renovation workplace and to EPA's application of the NESHAPS for asbestos to the demolition and renovation industry.

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)

OSHA was established by the Occupational Safety and Health Act of 1970. The purpose of the Act is to assure every working person safe and healthful working conditions. Accordingly, OSHA is concerned with worker exposure to toxic substances in the workplace. Under section 6 of the Act, OSHA may publish a rule designating an occupational health standard in order to achieve this purpose.

A standard for occupational exposure to asbestos was included in the initial promulgation of OSHA standards published on May 29, 1971. The standard derived from the 1969 regulation issued under the Walsh-Healey Public Contracts Act, established an exposure limit of 12 fibers (greater than 5 microns in length) per milliliter or 2 million particles per cubic foot of air. A petition for an emergency standard to control concentrations of asbestos dust was submitted to the Secretary of Labor by the Industrial Union Department of the AFL-CIO on November 4, 1971. As a result of that petition, an emergency temporary standard of 5 fibers per milliliter of air for occupational exposure to asbestos dust was published by OSHA on December 7, 1971. This was followed on January 12, 1972, by OSHA's publication in the Federal Register of a "notice of proposed rulemaking" for

a permanent standard of 5 fibers per milliliter of air for occupational exposure to asbestos dust.

On January 24, 1972, OSHA established an Advisory Committee on Asbestos Dust and charged its members to make recommendations with regard to the proposed standard. A criteria document on asbestos, which contained recommendations for a permanent asbestos standard, was submitted by the National Institute for Occupational Safety and Health (NIOSH) and OSHA on February 1, 1972. NIOSH recommended a 2 fiber per cc permissible level of exposure, to become effective two years after promulgation of a permanent standard. On February 25, 1972, OSHA's Advisory Committee on Asbestos Dust, by narrow margin, endorsed the NIOSH recommendations. OSHA held public hearings during the period March 14-17, 1972, to receive oral data, views, and arguments from interested parties concerning the proposed asbestos standard. A "permanent" standard for occupational exposure to asbestos dust was published in the Federal Register on June 7, 1972. The regulation, applicable "in every employment and place of employment" to every employee exposed to asbestos dust, except those workers otherwise covered by the Federal Coal Mine Health and Safety, and the Federal Metal and Nonmetallic Mine Safety Acts as administered by the Mining Enforcement and Safety Administration, became effective July 7, 1972. The regulation established a permissible occupational exposure level or standard of five fibers (longer than five micrometers) per cc of air, which was to be lowered to 2 f/cc as of July 1, 1976.

Less than two months after promulgation of the standard, the Industrial Union Department (IUD) of the AFL-CIO, along with other unions, filed suit (July 28, 1972) in the U.S. Court of Appeals challenging the regulation. Among other allegations, it was charged that OSHA's decision to delay implementation of the two fiber exposure limit for four years (Until July 1, 1976) violated "highest degree of health protection" under section 6(b)(5) of the OSH Act.

On April 15, 1974, a three-judge panel in the U.S. Court of Appeals for the District of Columbia ruled in the case, in effect, denying the IUD petition but ordered OSHA to:

- o Review the 1976 implementation date for the two-fiber exposure level requirement, suggesting that OSHA might require the two-fiber level in those sectors of the industry where it was already feasible to achieve; and

- o Provide a longer period for the retention of personal and environmental monitoring records. (The standard as promulgated, provided for a three-year retention period.)

OSHA republished all its occupational safety and health standards on June 27, 1974, with changes made through June 3, 1974. There were no substantive changes to the asbestos regulation. On May 28, 1975, OSHA announced that the asbestos standard was recodified from 1910.93a (Subpart G) to 1910.1001 (Subpart Z). The purpose of this action was to simplify the reference system for toxic substance standards.

On October 9, 1975, OSHA proposed in the Federal Register to lower the permissible occupational exposure to asbestos to 500,000 fibers per cubic meter or 0.5 fibers per cc greater than five micrometers in length, with a length-to-diameter ratio of at least three to one and a maximum diameter of five micrometers. The proposed revision to the standard would apply to all employments covered by the Act except the construction industry. OSHA stated its intent to publish a separate revision to the standard applicable to the construction industry. In addition, OSHA stated that the record developed under the 1972 regulation was inadequate to resolve the court-s remand in the IUD case and a new rulemaking proceeding should be initiated.

As of August 1, 1979, OSHA had not finalized the 1975 proposal to lower the standard to 0.5 fibers per cc and had no timetable to do so. No separate standard for the construction industry is being developed at this time. Accordingly, the standard today remains at two fibers per cc.

NIOSH, on December 15, 1976, recommended to OSHA that the asbestos standard "be set at the lowest level detectable by available analytical techniques." NIOSH defined this level as 0.1 fibers per cc.

Pursuant to the court remand regarding a longer period for the retention of personal and environmental records, OSHA issued an amendment to the standard on March 19, 1976, requiring that such records be maintained for "at least 20 years."

APPLICABILITY TO THE DEMOLITION AND RENOVATION INDUSTRY

The OSHA asbestos regulation is contained in 29 CFR 1910.1001. This regulation, as do all occupational health regulations, applies to exposure of workers to the toxic substance in the workplace. As such, the standard applies to any employee engaged in the demolition or renovation industry. The standard:

- Establishes an eight-hour time-weighted average permissible exposure level to airborne asbestos of two fibers (longer than five micrometers) per cc of air.
- As a ceiling concentration, states that no employee shall be exposed at any time to asbestos concentrations in excess of 10 fibers longer than five microns, per cc of air.

The standard specifically mentions the demolition industry:

- Employees engaged in the removal, or demolition of pipes, structures, or equipment covered or insulated with asbestos, and in the removal or demolition of asbestos insulation or coverings shall be provided with respiratory equipment and with special clothing.

The requirements for respirators and special clothing are detailed in the regulation, as are requirements which apply to all industries for particular tools, monitoring, caution signs, record keeping and medical examinations. Of special interest, perhaps, to the demolition industry is the provision concerning waste disposal:

- Asbestos waste, scrap, debris, bags, containers, equipment, and asbestos-contaminated clothing, consigned for disposal, which may produce in any reasonably foreseeable use, handling, storage, processing, disposal, or transportation airborne concentrations of asbestos fibers in excess of the exposure limits shall be collected and disposed of in sealed impermeable bags, or other closed, impermeable containers.

ENVIRONMENTAL PROTECTION AGENCY (EPA)

AIR

Section 112 of the Clean Air Act of 1970 gives authority to the Administrator, Environmental Protection Agency (EPA) to set emissions standards for hazardous air pollutants. On March 31, 1971, EPA published its first list of hazardous air pollutants (asbestos, beryllium, and mercury). On December 7, 1971, EPA proposed a standard for control of asbestos fiber emissions. Following rulemaking procedures, the standard was issued on April 6, 1973, as part of the National Emissions Standards for Hazardous Air Pollutants (NESHAPS).

The NESHAPS for asbestos appears at 40 CFR 61.20. The asbestos regulation contains a specific subsection applying to demolition and renovation activities, Section 61.22(d).

The 1973 standard required the use of certain procedures such as wetting and removal of load-supporting structural members before wrecking was commenced and a prohibition "to prevent emissions of particulate asbestos material to outside air," and required 20 days notice to EPA before commencing demolition. The regulation applied only to structures insulated or fireproofed with friable asbestos material.

The standard was significantly amended on October 14, 1975. Renovation was specifically added to Section 61.22(d), and guidance was given on what demolition and renovation activities were covered by the NESHAPS, including an exemption from certain requirements operations below a certain amount of friable asbestos. Wetting requirements could be suspended if the temperature was below freezing. Local exhaust ventilation and collection systems for renovation operations were offered as an alternative to wetting. Finally, waste disposal techniques were mandated for <u>all</u> asbestos operations, based on a "no visible emission" standard. The standards apply to both active and inactive waste disposal sites.

On March 2, 1977, the regulation was amended to define the term "structural member." The definition expanded the scope of the regulation to include

the demolition or renovation of non-load-bearing supporting structural members, such as non-supporting walls and ceilings, as well as from load-supporting structural members.

On the same day, EPA proposed to further amend the NESHAPS regulation. This proposal was finalized on June 19, 1978. This most recent amendment extend coverage of the demolition and renovation provisions to all friable asbestos material (not just fireproofing and insulation). The amended regulation also now specifically defines "renovation."

The 1977 Amendments to the Clean Air Act and *Adamo Wrecking Co. v U.S.*

Following the initial promulgation of the NESHAPS for asbestos in 1973, a number of wrecking companies began challenging EPA effort to enforce the regulations on the grounds that regulation was a work practice standard and not a (numerical) emission standard under section 112 of the Clean Air Act of 1970. These arguments ultimately let to at U.S. Supreme Court Decision, *Adamo Wrecking Co. v U.S.*, No. 76-911, 11 ERC 1081 (January 10, 1978).

That case arose in the narrow contact of a criminal enforcement proceeding and was decided on an interpretation of section 112 prior to its amendment in 1977. The court held that the pre-1977 version of section 112 did not authorize a portion of the national emission standard for asbestos (prescribing certain work practices for demolition and renovation activities) because it consisted of requirements other than numerical limitations on emissions.

In EPA's opinion, the 1977 amendments to section 112 now clearly authorize the Administrator to promulgate work practice or other non-numerical standards in order to control emissions of hazardous air pollutants. In addition, citizens and States, under section 304, to enforce work practice and other non-numerical standards promulgated under section 112.

Under section 112(e) of the Clean Air Act, as amended in 1977, the Administrator may promulgate a "design, equipment, work practice, or operational standard, or combination thereof" for control of a hazardous air pollutant

if it is infeasible to prescribe an emission standard under section 112(b) for the pollutant. Such infeasibility occurs, for example, when "a hazardous pollutant or pollutants cannot be emitted through a conveyance designed and constructed to emit or capture such a pollutant" or when "the application of measurement methodology to a particular class of sources is not practicable due to technological or economic limitations."

TOXICS

Under section 6 of the Toxic Substances Control Act (TSCA), EPA can publish a rule prohibiting or limiting the manufacture, processing, distribution, use, or disposal of a chemical substance that presents or will present an unreasonable risk of injury to health or the environment. In April 1979, EPA decided to begin an indepth investigation of asbestos exposure sources directed toward the development of regulations under section 6 of TSCA. An advance notice of proposed rulemaking is planned for the summer of 1979.

Although EPA has addressed asbestos levels in ambient air through its NESHAPS for asbestos, concern over existing problems with indoor air contamination has continued, especially with identification of asbestos in schools. In December 1978, the Environmental Defense Fund (EDF) petitioned EPA to regulate asbestos-sprayed materials under section 6 of TSCA by requiring manufacturers and processors of asbestos to pay for abatement actions. The Administrator denied the petition on March 21, 1979.

The Administrator found that immediate regulation was unnecessary and that non-regulatory control measures should be evaluated first. EPA has not ruled out eventual regulation of existing asbestos-sprayed material; however, in the meantime it has developed a national asbestos control program for schools. In May 1979, each state and school district received a Guidance Package which provided officials with information needed to identify asbestos-sprayed materials, to evaluate the hazards, and to take appropriate abatement action. EPA and HEW personnel have made themselves available to assist the states.

HAZARDOUS WASTE

EPA initially was considering listing asbestos and asbestos wastes as hazardous wastes under the Resource Conservation and Recovery Act (RCRA). However, in its proposed hazardous waste rules of December 18, 1978, EPA did not list asbestos as a hazardous waste because it felt that existing rules (i.e. the NESHAPS covering asbestos-containing waste material under the Clean Air Act and the occupational health standard covering disposal of asbestos waste under OSHA) adequately covered the disposal problem.

FOOD AND DRUG ADMINISTRATION (FDA)

The Food and Drug Administration, within the Department of Health, Education, and Welfare, is charged under the Federal Food, Drug and Cosmetic Act with protecting the public from unsafe and impure foods, drugs, cosmetics and other hazards associated with these products.

On September 28, 1973, FDA proposed to restrict the use of:

- Asbestos filters used in the manufacture of parenteral (injectable) drugs and parenteral drug ingredients; and
- Asbestos-containing talc used as a food, or food and drug ingredient, or in food and drug packaging materials.

FDA promulgated a final regulation governing the use of "asbestos-containing or other fiber releasing filters" in the manufacture of parenteral drugs on March 14, 1975. FDA deferred any regulatory action on asbestos containing talc used in foods, drugs, or packaging materials until completion of further analytical and biomedical research.

CONSUMER PRODUCT SAFETY COMMISSION (CPSC)

The CPSC has two basic functions:

- The gathering and dissemination of information relating to product hazards and the injuries caused by them; and

- The creation and enforcement of safety standards designed to eliminate or reduce product hazards.

On July 29, 1977, the CPSC proposed that it is in the public interest to regulate consumerpatching compounds and artificial emberizing materials (embers and ash) containing respirable free-form asbestos under the Consumer Product Safety Act (CPSA). These products are used in artificial fireplace logs or are sprinkled on logs to simulate burning and glowing ashes. In addition, the Commission stated its intent to ban as hazardous products consumer patching compounds and artificial emberizing materials (embers and ash) containing free-form asbestos. On December 15, 1977, the CPSC issued its final rule banning the following products containing respirable free-form asbestos under the CPSA: "(1) consumer patching compounds used to join or repair interior walls and ceilings; and (2) artificial emberizing materials (embers and ash) used in fireplaces to simulate live embers and ash."

Based on a completed study to determine the extent to which asbestos is used in consumer products, the Commission is evaluating the need for further regulatory action. In the spring of 1979, the CPSC asked for a voluntary recall of hand-held hair dryers that contained asbestos.

Prior to establishment of the CPSC, the Food and Drug Administration (FDA) then regulating the Federal Hazardous Substances Act (FHSA), issued a proposal in the Federal Register banning "general-use garments containing asbestos (other than garments having a bona fide application for personal protection against thermal injury and so constructed that the asbestos fibers will not become airborne under reasonable foreseeable conditions of use)." The FHSA is now regulated by the CPSC.

CONCLUSION

The asbestos regulations of concern to the demolition and renovation industry are those adopted (1) by OSHA for the occupational exposure to employees engaged in that industry and (2) by EPA for the exposure to the public and the environment at large through the NESHAPS provisions of the Clean Air Act.

Although it would simplify enforcement by federal and state authorities and minimize the economic impact on the industry if one could say that the two regulations overlapped and therefore satisfying the requirements of one of the programs resulted in compliance with the other, that is not the case. The OSHA occupational health standard is a numerical exposure limit (two fibers per cc/8 hour average); the EPA NESHAPS is a work practice standard. It may be possible to meet the OSHA standard through practices other than those required by EPA, conversely, using the EPA-mandated procedures may not achieve the OSHA workplace exposure levels.

One area for possible coordination of requirements is waste disposal. The PSHA regulation requires collection and disposal of asbestos waste in sealed impermeable containers. The EPA regulation prohibits visible emissions during any activity dealing with disposal of asbestos-containing waste material and the use of waste disposal sites operated in accordance with mandated procedures. The Asbestos Work Group of the Inter-agency Regulatory Liaison Group (IRLG), of which EPA and OSHA are members, may want to consider reviewing these requirements to determine whether coordination is appropriate and achievable.

APPENDIX E

MAJOR CHARACTERISTICS OF ASBESTOS

Prepared by:

D. Carnes, Geologist

MINERALOGY OF ASBESTOS

Dr. Malcom Ross's article entitled "The Asbestos Minerals: Definitions, Descriptions, Modes of Formation, Physical and Chemical Properties, and Health Risk to the Mining Community" elaborates on the problems delineating mineral species in the asbestos group. Dr. Ross states that many other minerals in addition to those identified in Chapter 5 sometimes possess habits described as aciculas, asbestiform, elongate, fibrous, bladed, lamellar, filliform, prismatic, or columnas. For example, minerals of the zeolite group having acicular habit, fibrous calcite and quartz, acicular wollastonite, prismatic pyroxenes, elongate chrystallites of attapulgite, and filiform sepiolite. Since these minerals are not exploited for commercially valuable properties of asbestos, they are not called "asbestos" by geoscientists. Dr. Ross also points out that,

> "At present, the most widely used definition of 'asbestos' by various groups concerned with environmental health problems, including the U.S. Environmental Protection Agency (EPA) and the U.S. Mining Enforcement and Safety Administration (MESA), is from the notice of proposed rule-making for 'Occupational Exposure to Asbestos' published in the Federal Register (Oct. 9, 1975, p. 47652-47660) by the U.S. Occupational Safety and Health Administration (OSHA). In this notice, the naturally occurring minerals: chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite, are classified as 'asbestos' if the individual crystallites or crystal fragments have the following dimensions: length - greater than 5 micrometers, maximum diameter - less than 5 micrometers, and a length to diameter ratio of 3 or greater. Any product containing any of these minerals in this size range are also defined as asbestos.
>
> The crushing and milling of any rock usually produces some mineral particles that are within the size range specified in the OSHA rules. Thus, these regulations present a formidable problem to those analyzing

for asbestos minerals in the multitude of materials and products in which they may be found in some amount, for not only must the size and shape of the asbestos particle be determined, but also an exact mineral identification must be made.

A wide variety of amphiboles is found in many types of common rocks; many of these amphiboles might be considered asbestos depending upon the professional training of the person involved in their study and the methods used in mineral characterization. Campbell et al have carefully described the differences between the relatively rare fibrous varieties of the amphiboles and the common nonfibrous forms.

If the definition of asbestos from the point of view of a health hazard does include the common nonfibrous forms of amphibole, particularly the hornblende and cummingtonite varieties, then we must recognize that asbestos is present in significant amounts in many types of igneous and metamorphic rocks covering perhaps 30 to 40 percent of the United States. Rocks within the serpentinite belts, rocks within the metamorphic belts higher in grade than the greenschist facies, including amphibolites and many gneissic rocks, and amphibole-bearing igneous rocks such as diabase, basalt, trap rock, and granite would be considered asbestos-bearing, including deposits in the largest open-pit mine in the world at Bingham, Utah. Asbestos regulations would thus pertain to many of our country's mining operations, including much of the construction industry and its quarrying operations for concrete aggregate, dimension stone, road metal, railroad balast, riprap, and the like. The asbestos regulations would also pertain to the ceramic, paint, and cement industries, and to many other areas of endeavor where silicate minerals are used."

Clearly, the criteria for delineating the asbestos minerals is subject to interpretation and may require further refinement in the future.

USES OF ASBESTOS IN BUILDING MATERIAL

The following tables were taken from "Engineering Aspects of Asbestos Dust Control." The different grades of chrysotile and price/ton from Quebec are presented in Table 9. It can be seen from this table that the majority of the materials contain mostly chrysotile with relatively minor amounts of the amphibole varieties of asbestos. Asbestos cement pipe and flooring products account for a significant portion of asbestos distributed for commercial use.

TABLE 9

Grades of Asbestos - Quebec with Prices as of January 1977

Grade No.	Type	Price/Ton (Canadian $)
1	Crude	3,300-4,000
2	Crude	1,800-2,175
3	Spinning fiber	850-1,700
4	Asbestos cement fiber	464-950
5	Paper fiber	315-435
6	Paper and shingle fiber	230-275
7	Shorts	85-200

QUANTITY OF ASBESTOS RELEASED BY RENOVATION

Table 10 was taken from "Asbestos-Containing Materials in School Buildings: A Guidance Document " The methods of resolution to remove asbestos presented fall into two general categories:

1. Asbestos containment through the use of a sealant (encapsulation) vs barrier (enclosure) system.

2. Complete removal of the asbestos material from the structure.

Selection of the appropriate method or combination of methods will depend upon a number of factors including characteristics of the asbestos material, structure use and configuration, uses activity, and cost.

ASBESTOS IN THE AMBIENT AIR RESULTING FROM CONSTRUCTION ACTIVITIES

Table 11 was taken from the "Asbestos: An Information Resource" report. This table lists the average and range of asbestos in the U.S. urban areas.

Table 10: Alternatives for Reduction/Elimination of Contamination from Sprayed Asbestos

Alternatives	Typical Fiber Concentration In Work Area (f/cm^3)[a]	Comments
1. Removal		
a. Dry methods (loose material)	82.2[b] (11)[c]	Much dust and debris made work conditions difficult. Required hose supplied respirators (very restrictive). Fibers move across decontamination barriers.
	>100.0 (-)	Very dusty conditions, contamination control impossible. Building contamination evident.
b. Wet methods		
1) Untreated (loose material)	23.1 (6)	Little dusting. Heavy water runoff.
2) Amended water (loose material)	2.8 (56)	Nearly no water runoff. Acceptable conditions. No visible dusting.
3) Amended water (loose material inadequate H_2O application)	18.4 (12)	Some dusting evident. Dry patches in material noted. Poor contractor performance in wetting material.
4) Amended water (cementitious material)	0.5 (5)	No dusting noted, good penetration of water. Material falling off in sheets and chunks intact.
2. Retention		
a. Ceiling barrier, lath (loose material). Dry	6.4 (9)	Contact and disturbance of material during installation by wood strips with visible emissions.
b. Ceiling, hangers (loose material). Dry	1.1 (12)	Penetration of ceiling by hangers and subsequent disturbance by movement.
c. Sealant, encapsulation (loose material).	0.0 (15)	Force of application varied during spraying adjustments. One air sample that produced a zero count by optical microscopy, had 7×10^3 ng/m^3 by TEM indicating significant small particle release by spray contact disturbance.

[a]Determined by NIOSH Method, phase contrast microscopy.

[b]Mean

[c]Number of observations.

TABLE 11

AIR ASBESTOS CONCENTRATIONS *

Atmospheric Concentrations of Asbestos
in Some U.S. Urban Areas

	Concentration (Nanograms/m^3)	
	Average	Range
Berkely, CA	6.8	2.1-12
Boston, MA	5.0	
Chicago, IL	24	9.5-200
Dayton, OH	6	0.4-11
Frankfort, KY	0.09	0.02-0.15
Houston, TX	5	4-6
Los Angeles (Freeway)	27[a]	
Los Angeles (Control)	43[a]	
New York City, NY	13.2	8.2-41
Manhattan, NY	30[a]	8-65
Brooklyn, NY	19[a]	6-39
Bronx, NY	12[a]	2-25
Queens, NY	9[a]	3-18
Staten Island, NY	8[a]	5-14
Pittsburgh, PA	4	2-8
Philadelphia, PA	70[a]	45-100
Port Allegany, PA	15[a]	10-20
Ridgewood, PA	20[a]	15 (SIC)
San Francisco, CA	25	8.7-68
Washington, D.C.	21	1.6-40

a Identified as chrysotile asbestos by the authors.

* Data from asbestos: A Information Resource, by the Stamford Research Institute International, May, 1978

Table 12 Summary of Analytical Methods for Asbestos

Method	Feature Examined	Comment
Light Microscope		
1. With phase contrast at 400 X	Morphology	Limit of resolution about 0.5um.
2. Dispersion staining	Refractive index and morphology	Skilled operators can distinguish asbestos fibers. Limit of resolution about 0.5um.
X-Ray Diffraction	Crystal structure	No information on fiber size or size distribution.
Infrared Spectroscopy	Characteristic absorption bands	Ambiguity is possible. No information on fiber size or size distribution
Atomic Absorption	Elemental composition	No information on size or size distribution. High sensitivity for trace elements.
Neutron Activation	Elemental composition	No information on size or size distribution. Specialized nuclear equipment needed.
Emission Spectroscopy	Elemental composition	No size or size distribution information. Both gross and trace constituents determined.
Thermal Analysis TGA and DTA	Weight loss on heating due to dehydroxylation	No information on size or size distribution. Specificity to asbestos not yet resolved.
Scanning Electron Microscope with Microprobe	Surface topology of the fiber and elemental analysis	Most SEMs have a theoretical resolution limit of about 10.0-20.0nm. Background can give interference.
Transmission Electron Microscope with Microprobe	Shape outline, electron diffraction, and elemental analysis	Resolution limit down to 0.40 nm. Transfer to grid can lead to statistical errors in counting.

PROBLEMS IN MEASURING ASBESTOS

The analytical techniques in Table 12 were taken from "Engineering Aspects of Asbestos Dust Control." A study of this Table shows that each method provides data on specific features of the dust cloud. The important measurements include: (1) the total fiber concentration, (2) fiber size distribution, and (3) a reliable measurement of the longer respirable fibers that meet the criteria set by regulation of greater than 5 microns long and less than 5 microns in diameter.