

S

B

373

See also file folder
for SB373 / SB374

Jeanie Henry
9/30/84

Bill No. Sponsor Substitute for Senate Bill 373

Date February 22, 1984

Title "An Act establishing an asbestos health hazard abatement program"

Contact: Richard Arab
465-4856
Robert Landau
465-2700

There is no longer any doubt that exposure to asbestos presents a serious and substantial threat to health. This risk has been found to be especially acute with respect to school children. The U.S. Environmental Protection Agency has required all school districts in the United States to conduct a survey of their buildings to determine whether or not asbestos is present. According to EPA's Alaska office, approximately 50 percent of the 53 school districts in Alaska have complied with EPA's asbestos survey requirements.

The Anchorage school district, for example, has completed a comprehensive survey of their school buildings and found that many of the buildings contain asbestos materials. The Department of Labor's Occupational Safety and Health Section (OSH) has also identified asbestos materials in school buildings in Fairbanks and Juneau. It is evident, therefore, that many school buildings in Alaska contain potentially harmful asbestos materials.

The Department of Labor has been involved in the identification of asbestos health hazards in Alaska schools as part of its responsibilities to employees under the Alaska OSHA Act. The Department's OSH section administers a statewide asbestos standard that sets a "threshold limit" on the amount of asbestos fibers that may be present at an employee workplace and regulates the manner in which asbestos material is removed or encapsulated. The OSH Section has provided specific assistance to the Anchorage, Fairbanks, and Juneau school districts in surveying school buildings for asbestos.

Although the primary focus of the Alaska OSHA program is the protection of employee safety and health, it is clear that asbestos in school buildings is equally a threat to children attending these schools. The problem, therefore, goes beyond the employee safety and health boundaries of the Alaska OSHA program. Nonetheless, it is the Department's opinion that its OSHA program is the State agency best suited to take on the lead responsibilities under the bill. The Department already has the nucleus of a trained staff with the technical knowledge to recognize and analyze asbestos materials and to provide meaningful recommendations for the control and elimination of asbestos as a health hazard in our schools.

The Department, therefore, supports this legislation on the assumption that a realistic level of funding will be provided to adequately meet the two-year time frame and fulfill the substantial duties imposed upon the Department. It is equally important to help school districts defray the significant cost of asbestos removal or encapsulation once the initial surveying has been completed.

The department additionally proposes the following minor amendments to SB 373:

1. Section 18.28.020(1) should be rewritten to read "survey school buildings to inspect and sample material for the presence of asbestos."

POSITION PAPER/Department of Labor

- * 2. Section 18.28.020(3) should be rewritten to read "answer inquiries concerning sampling and ensure quality control of sampling."

These two amendments would more accurately reflect the Department's active role in conducting the asbestos surveys and sampling as opposed to its more limited training function under the original proposed bill.

In addition, Section 18.28.030(d) and (e), should be rewritten to read "a contractor who violates (b) or (c) of this section shall be subject to citations and civil penalties as set forth in AS 18.60.095(b)." The Department believes that the higher level of difficulty and proof required for a criminal conviction may render enforcement of this bill impractical. Moreover, the OSHA program already has a civil citation and penalty system in place which has proved effective in the enforcement of Occupational Safety and Health laws and regulations.

APPROVED:



Jim Robison
Commissioner

STATE OF ALASKA 1984 LEGISLATIVE SESSION
FISCAL NOTE

Revision Date: _____

REQUEST

Bill/Resolution No.: SS SB 373
Title: "An act establishing an asbestos health hazard abatement"
Sponsor: Josephson
Requestor: Josephson
Date of Request: 2-21-84

FISCAL DETAIL

Agency Affected: Labor
Program Category Affected: Public Protection
BRU, Program or Subprogram(s) Affected: Occupational Safety & Health

EXPENDITURES/REVENUES: (Thousands of Dollars)

	FY 84	FY 85	FY 86	FY 87	FY 88	FY 89
OPERATING						
100 PERSONAL SERVICES		158.4	83.1			
200 TRAVEL		32.4	7.6			
300 CONTRACTUAL		80.4	25.9			
400 SUPPLIES		8.5	1.6			
500 EQUIPMENT		16.4	-0-			
600 LAND & STRUCTURES						
700 GRANTS, CLAIMS						
800 MISCELLANEOUS						
TOTAL OPERATING	-0-	296.1	118.2	-0-	-0-	-0-
CAPITAL						
REVENUE						

FUNDING: (Thousands of Dollars)

GENERAL FUND	-0-	296.1	118.2	-0-	-0-	-0-
FEDERAL FUNDS						
OTHER						
TOTAL						

POSITIONS:

FULL-TIME	-0-	2	2	-0-	-0-	-0-
PART-TIME		2				
TEMPORARY						

SOURCE OF FUNDS TO OFFSET FISCAL IMPACT OF BILL:

ANALYSIS: Attach a separate page for analysis

Prepared By: *NR* Robert J. Bacolas

Phone: 465-4870

Division: Labor Standards & Safety

Date: 2-21-84

Approved by Commissioner: *Jim Robison* Jim Robison

Date: 2-21-84

Agency: Department of Labor

LFG:B:6

Distribution (by Agency preparing fiscal note):

Legislative Finance

Legislative Sponsor

Requestor

Office of Management and Budget

Impacted Agency(ies)

12/1/83

FISCAL NOTE

THE LEGISLATURE OF THE STATE OF ALASKA

THIRTEENTH LEGISLATURE

BILL/RESOLUTION NO: SS SB 373

TITLE: "An Act relating to establishing asbestos health hazard abatement"

AGENCY AFFECTED: Department of Labor

Page 2

The appropriation bill, SS SB 374, to this legislation, lapses funds after two years (6/30/86). It is important that the survey of school buildings be completed within one year to allow all school districts time to request the monies needed to abate the asbestos health hazards in their school buildings.

It is assumed that the responsibility for training and certification outlined in AS 18.28.030 of SS SB 373 will mainly be with the employer and that the department will only be responsible for establishing guidelines for review. It is also assumed that the certification program only relates to asbestos removal in schools and public facilities and that this program will not cover contractors involved in asbestos work in private sector buildings or facilities.

According to a survey conducted by the U.S. Environmental Protection Agency, approximately 50 percent of the Alaska school districts have surveyed their buildings for asbestos. The respondents include most of the larger school districts. There are approximately 550 school buildings in Alaska. We know that the Juneau, Anchorage, and Fairbanks school districts have surveyed their buildings. These school districts have approximately 115 buildings, therefore, we are estimating that [550-115] divided by 2, or 220 buildings have yet to be surveyed.

Four positions will be needed, three Industrial Hygienists and one Clerk Typist III. In order to assure that the program can be implemented without delay, we plan to hire an Industrial Hygienist on July 1, 1984. We estimate that it will take two months to set up the schedule for surveying schools and for developing the guidelines for the certification program. An industrial hygienist is required to perform this task as this position requires a person who has an educational background and experience in industrial health evaluation. During the two months it takes to set up the program, we will recruit two other industrial hygienists and bring them on board by September 1, 1984. This will assure us three technical field staff who can recognize asbestos problems and properly sample and survey for this hazard and recommend methods to abate the hazard. One clerk typist will provide the necessary clerical support required to keep track of samples collected and sent for analysis, and to set up a system to inform school districts of the sample results and the department's recommendations for abatement of the asbestos hazard. In the first year of operation the special costs includes:

-One set of sampling pumps for all 3 Industrial Hygienists	\$6,000.00
-Training Films	4,000.00
-Protective clothing and respirators	6,000.00
-Contract to analyze the bulk asbestos samples (5 per build.)	38,500.00
-Rent	14,400.00
-Indirect	14,700.00
-Equipment (one-time item)	16,400.00

1	Postion title Industrial Hygienist I			Range/Step 19A	Barg. Unit GGU	Form 1? Page/Line	GOV.	DISAPP.
2	Type of Position PFT	Staff Months 12	RP Number	PCN Number	BRU Priority	Location Anch.	Election District	LEG.
3	CONTINUATION LEVEL		ADDITION		JUSTIFICATION As lead position of the Asbestos Health Hazard Abatement Program this position will set up the scheduling system for surveying approximately 220 buildings and develop guidelines for the certification program. This position will survey approximately 70 buildings the 1st year and 10 buildings the 2nd year. In the second year this position would be maintained to monitor and evaluate the certification program; provide information and training to contractors, their workers, and other interested parties of the potential health hazards of asbestos.			
4	Type of Expenditure		Amount					
	1	2	3					
	PERSONAL SERVICES							
5	Salary		38,124					
6	Benefits		6,357					
7	Supplemental Benefits		2,337					
8	Fixed Benefits		2,724					
9	TOTAL PERSONAL SERVICES	01		49,552				
10	Travel	02		10,800				
11	Contractual	03		10,175				
12	Commodities	04		2,500				
13	Equipment	05		1,600				
14	Other							
15	TOTAL COST			74,627				
	RECEIPT CODE	FUNDING SOURCE						
16		Federal Receipts	1002					
17		G.F. Match	1003					
18	100	General Funds	1004	74,627				
19		I-A Receipts	1005					
20		Program Receipts	1028					
21		Other						

For M&B Use Only
4A Key Number _____

13 REQUEST FOR NEW POSITION

AGENCY Labor
 PROGRAM Public Protection
 BRU Occupational Safety & Health
 COMPONENT Occupational Safety & Health

FY 85

Page 1 of 4
 Revised Date

LEG:F:20

1	Position Title Industrial Hygienist I		
2	Type of Position SEAS	Staff Months 10	RP Number PCN Number
3	CONTINUATION LEVEL		ADDITION
4	Type of Expenditure		Amount
	1	2	3
	PERSONAL SERVICES		
5	Salary	31,770	
6	Benefits	5,306	
7	Supplemental Benefits	1,948	
8	Fixed Benefits	2,270	
9	TOTAL PERSONAL SERVICES	01	41,294
10	Travel	02	10,800
11	Contractual	03	9,412
12	Commodities	04	2,500
13	Equipment	05	1,600
14	Other		
15	TOTAL COST		65,606

	RECEIPT CODE	FUNDING SOURCE	
16		Federal Receipts	1002
17		G.F. Match	1003
18	100	General Funds	1004
19		I-A Receipts	1005
20		Program Receipts	1028
21		Other	

For M&B Use Only
4A Key Number _____

Range/Step 19A	Barg. Unit GGU	Form 12 Page/Line	GOV. A	IV.	DISAPP.
BRIJ Priority	Location Anch.	Election District	LEG.		

JUSTIFICATION This is a one year position responsible for surveying approximately 70 school buildings to determine if there are any asbestos materials present in the buildings and will take samples of such materials. This position will assure the integrity of the samples and will analyze the sample results. The industrial hygienist will prepare a report to the school district based on this analysis recommend methods to control or remove the asbestos materials. This position will also provide information to contractors and school officials on the proper methods and safeguards that must be used to encapsulate or remove the asbestos material. Other duties include assisting the lead industrial hygienist monitor and evaluate the employer certification program.

13 REQUEST FOR NEW POSITION

AGENCY Labor
PROGRAM Public Protection
BRIJ Occupational Safety & Health
COMPONENT Occupational Safety & Health

FY 85

Page 2 of 4
Revised Date

LEG:F:21

1	Position Title Industrial Hygienist I	Range/Step 19A	Barg. Unit GGU	Form 12 Page/Line	GOV.	REV.	DISAPP.	
2	Type of Position SEAS	Staff Months 10	RP Number	PCN Number	BRU Priority	Location Anch.	Election District	LEG.
3	CONTINUATION LEVEL		ADDITION		JUSTIFICATION This is a one year position responsible for surveying approximately 70 school buildings to determine if there are any asbestos materials present in the buildings and will take samples of such materials. This position will assure the integrity of the samples and will analyze the sample results. The industrial hygienist will prepare a report to the school district based on this analysis recommend methods to control or remove the asbestos materials. This position will also provide information to contractors and school officials on the proper methods and safeguards that must be used to encapsulate or remove the asbestos material. Other duties include assisting the lead industrial hygienist monitor and evaluate the employer certification program.			
4	Type of Expenditure		Amount					
	1	2	3					
	PERSONAL SERVICES							
5	Salary	31,770						
6	Benefits	5,306						
7	Supplemental Benefits	1,948						
8	Fixed Benefits	2,270						
9	TOTAL PERSONAL SERVICES	01	41,294					
10	Travel	02	10,800					
11	Contractual	03	9,412					
12	Commodities	04	2,500					
13	Equipment	05	1,600					
14	Other							
15	TOTAL COST		65,606					
	RECEIPT CODE	FUNDING SOURCE						
16		Federal Receipts	1002					
17		G.F. Match	1003					
18	100	General Funds	1004	65,606				
19		I-A Receipts	1005					
20		Program Receipts	1028					
21		Other						

For M&B Use Only
4A Key Number _____

13 REQUEST FOR NEW POSITION

AGENCY Labor

PROGRAM Public Protection

BRU Occupational Safety & Health

COMPONENT Occupational Safety & Health

FY 85

Page 3 of 4
Revised Date

LEG:F:22

1	Position Title Clerk Typsit III	Range/Step 8B	Barg. Unit GGU	Form 12 Page/Line	GOV. A	GOV.	DISAPP.	
2	Type of Position PFT	Staff Months 12	RP Number	PCN Number	BRIJ Priority	Location Anch.	Election District	LEG.
3	CONTINUATION LEVEL	ADDITION		JUSTIFICATION				
4	Type of Expenditure	Amount		This position will keep track of the asbestos samples taken by the industrial hygienists and will assure that these samples are mailed to and returned from the contract laboratory. The clerk typist will take, type, and process the reports and correspondence about the asbestos program to the school districts, contractors, and Department of Education personnel who are required to be informed of the program. This position will also provide the clerical support necessary for the monitoring and evaluation of employer and employee training certification programs.				
	1	2	3					
PERSONAL SERVICES								
5	Salary	19,176						
6	Benefits	3,202						
7	Supplemental Benefits	1,175						
8	Fixed Benefits	2,724						
9	TOTAL PERSONAL SERVICES	01	26,277					
10	Travel	02	-0-					
11	Contractual	03	12,901					
12	Commodities	04	1,000					
13	Equipment	05	1,600					
14	Other							
15	TOTAL COST		41,778					
RECEIPT CODE FUNDING SOURCE								
16		Federal Receipts	1002					
17		G.F. Match	1003					
18	100	General Funds	1004	41,778				
19		I-A Receipts	1005					
20		Program Receipts	1028					
21		Other						
For M&B Use Only 4A Key Number _____								

13 REQUEST FOR NEW POSITION

AGENCY Labor
PROGRAM Public Protection
BRIJ Occupational Safety & Health
COMPONENT Occupational Safety & Health

FY 85

Page 4 of 4
Revised Date _____

LEG:F:23

SECTIONAL ANALYSIS OF WORK DRAFT FOR SB 373 "An Act establishing an asbestos health hazard abatement program; efd."

Section 1 Findings and purpose. List the medical reasons justifying asbestos abatement.

Section 2 18.28.010. Establishes the asbestos program in the Department of Labor to coordinate work between agencies to eliminate asbestos in schools. The program applies to all construction and renovation projects involving asbestos materials.

18.28.020. Duties of Department of Labor. These duties include providing personnel to inspect and sample, provide information; establish guidelines for inspecting and sampling, evaluate results, approve abatement programs for employee safety, oversee an employee certification program, cooperate with the Department of Education to administer money, guarantee safe working conditions and adopt regulations.

18.28.030. Certification Programs. The Department of Labor will establish guidelines for training programs for people employed to work with asbestos, review programs for certification established by contractors and labor organizations. Provides that a person may not work to abate asbestos unless certified by the Department. Violation is a Class A misdemeanor.

18.28.040. Duties of the Department of Education. Duties include cooperating with Labor and schools to insure asbestos abatement, maintaining records, administering grant money to schools and reimbursing funds spent for abatement, and informing Labor of contracts to insure employee safety.

18.28.050. Duties of school officials. Include maintaining records, informing employees and parents of asbestos hazards, providing for inspections and samples following Labor's guidelines and contracting for renovations with OSHA safety standards in mind.

18.28.090. Definitions

Section 3 Effective date.



Asbestos hazards have been identified in thirteen Borough schools

HA/WK

Attachment I

A JOINT VENTURE OF
HOLDEN & ASSOCIATES AND
WILLIAM J. KING &
ASSOCIATES

January 31, 1984

Mr. Harry Rogers, Superintendent
Petersburg City Schools
P.O. Box 329
Petersburg, Alaska 99833

RE: Petersburg High School
Asbestos Removal

Per your request we have evaluated the quantity and cost of removal of the asbestos pipe insulation in the 1951 portion of the Petersburg High School.

Per your testing information, the known area of asbestos is confined to the heating supply and return mains, and the insulation of the old boiler. We assume that vertical piping in walls or classes would not be removed. The cost of removing the horizontal runs and the boiler insulation is \$107,000.

We have assumed that pieces would be removed in 5' to 10' lengths and properly disposed of according to State and Federal law.

Sincerely,



W. Keith Gerken

cc: Twyla Coughlin, Southeast Regional Resource Center (SERRC)
John Danielsen, City Engineer

PLEASE RESPOND TO:

JUNEAU: MERCHANT'S WHARF, SUITE 225
14 MARINE WAY
JUNEAU, ALASKA 99801
907 584 3386

ANCHORAGE: SUITE 211
750 W. 2ND AVENUE
ANCHORAGE, ALASKA 99501
907 572 3785

FAIRBANKS: BOX 80667
FAIRBANKS, ALASKA 99708
907-479-6474



CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

P.O. BOX 4-1276
Anchorage, Alaska 99509

TELEPHONE (907) 562-2343 ANCHORAGE INDUSTRIAL CENTER
5633 B Street

ANALYTICAL REPORT

From Petersburg Public Schools Product Bulk Insulation Samples
 Address Petersburg, Alaska Date August 6, 1983
 Other Pertinent Data ANALYSIS BY POLARIZING LIGHT MICROSCOPY.

Analyzed by DS Date August 22, 1983 Lab No. 3080

REPORT OF ANALYSIS
 BULK INSULATION SAMPLES
PETERSBURG, ALASKA

Samples received August 6, 1983

FINDINGS:

ASBESTOS PRESENT:

OTHER FIBROUS MATERIAL:

NON-FIBROUS MATERIAL:

.....BOILER ROOM.....

PIPE - OLD
BOILER

OLD BOILER

CHRYBOTILE-15%

CHRYBOTILE-15%

AMOSITE -15%

AMOSITE -15%

NONE SEEN

NONE SEEN

CALCIUM CARBONATE-70%

CALCIUM CARBONATE
70%

CONCLUSION: THE U.S. ENVIRONMENTAL PROTECTION AGENCY HAS DETERMINED THAT A SAMPLE WITH AN ASBESTOS CONTENT GREATER THAN ONE PERCENT BY WEIGHT, IS POSITIVE.



CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

P.O. BOX 4-1276
Anchorage, Alaska 99509

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5633 B Street

ANALYTICAL REPORT

From Petersburg Public Schools Product Bulk Insulation Samples
Address Petersburg, Alaska Date August 6, 1983
Other Pertinent Data ANALYSIS BY POLARIZING LIGHT MICROSCOPY
Analyzed by DB Date August 22, 1983 Lab No. 3080

REPORT OF ANALYSIS BULK INSULATION SAMPLES PETERSBURG, ALASKA

Samples received August 6, 1983

FINDINGS:

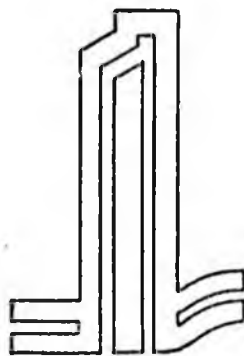
	<u>OLD HIGH SCHOOL PIPE CRAWL WAY</u>	<u>OLD GYM HOT WATER TANK</u>
ASBESTOS PRESENT:	CHRYSTILE-45%	CHRYSTILE-60%
OTHER FIBROUS MATERIAL:	CELLULOSE -45%	NONE SEEN
NON-FIBROUS MATERIAL:	SILICATES -10%	SILICATES - 5% UNKNOWN BINDER-35%

CONCLUSION: THE U.S. ENVIRONMENTAL PROTECTION AGENCY HAS DETERMINED THAT A SAMPLE WITH AN ASBESTOS CONTENT GREATER THAN ONE PER CENT BY WEIGHT, IS POSITIVE.

KODIAK ISLAND BOROUGH SCHOOL DISTRICT

ASBESTOS ABATEMENT COST ESTIMATE

January 13, 1984



Kodiak Island Borough
SCHOOL DISTRICT
RECEIVED

JAN 19 1984

11 12 13 14 15 16 P M

ARCHITECTS ENGINEERS PLANNERS
GOBBELL HAYS PICKERING
821 S. Barksdale, Memphis, Tennessee 38114 (901) 726-0810

GOBBELL HAYS PICKERING

Jan. 16, 1984

Mr. Ray Camardella
Kodiak Island Borough School District
P.O. Box 886
Kodiak, Alaska 99615

Dear Mr. Camardella:

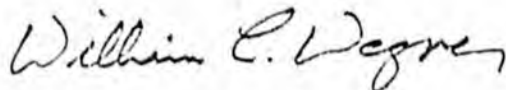
Enclosed is the cost estimate for the asbestos abatement of the spray-applied material in Kodiak High School. We have included our recommendation for abatement, approximate cost and time figures, and phasing possibilities to allow for portions of the building to remain in use during the abatement.

If you have any questions concerning this report or would like to continue on with plans and specifications, please feel free to contact me.

We look forward to working with you on your asbestos abatement problems.

Sincerely,

GOBBELL HAYS PICKERING



William L. Wagner

WLW/cr

Enclosures

KODIAK ISLAND BOROUGH SCHOOL DISTRICT

INTRODUCTION

This report was prepared in response to the Kodiak Island Borough School District's request for the proper selection of appropriate abatement measures and cost estimates. Enclosed are Gobbell-Hays-Pickering's recommendations for abatement and approximate construction cost.

VIEWING THE PROBLEM

Asbestos abatement selection is a highly subjective and often difficult process. There are no standards, governmental or otherwise, which provide for clear-cut choices. Abatement costs must be balanced against present and future building use, building life, health considerations, and legal liability; abatement solutions must take into account that balance.

GOBBELL-HAYS-PICKERING feels it is necessary for all concerned to evaluate the level of existing exposure and chance for potential exposure prior to choosing an abatement method. We consider it our professional responsibility in dealing with this problem to provide recommendations toward establishing a safe environment which functions as originally intended or better. The Attorney General's Asbestos Liability Report to the Congress contains the statement that there is no known safe lower limit of exposure to asbestos fibers. We feel that exposure should be eliminated if at all practical for health reasons and legal ramifications to the owner. Here, too, cost is a factor. For example, one lawsuit in the future could cost the owner more than a more expensive, but possibly better, original abatement choice.

SELECTION OF A CORRECTIVE ACTION

The following is the United States Environmental Protection Agency's comparison of asbestos abatement alternatives for encapsulation and removal, which we feel are the only two appropriate abatement measures for this application. Outlined with each method are their opinions as to some of the advantages and disadvantages and their thoughts as to when the methods are appropriate or inappropriate. Our abatement recommendation is made with these considerations in mind, and also with practical, health and legal considerations tempered with architectural and engineering experience in asbestos abatement projects.

Method: REMOVAL

Advantages of Method

- Eliminates asbestos source

- Eliminates need for special operations and maintenance program

Disadvantages of Method

- Replacement with substitute material may be necessary

- Porous surface also may require encapsulation

- Improper removal may raise fiber levels

Appropriate Applications

- Always

Inappropriate Applications

- Never

General Comments

- Containment barriers needed

- Worker protection required

- Wet removal is required for all types of asbestos

- Disposal may be a problem in some areas

Unusual circumstances, complex surfaces, and the presence of utilities may require special removal techniques

Method: ENCAPSULATION

Advantages of Method

Reduces asbestos fiber release from material

Initial cost may be lower than removal

Does not require replacement of material

Disadvantages

Asbestos source remains and must be removed later

If material is not in good condition, sealant may cause material to delaminate

Periodic reinspection required to check for damage or deterioration

Repair of damaged or deteriorated encapsulated surfaces required

Encapsulated surface is difficult to remove and may require dry techniques for eventual removal

Long-term cost may be higher than removal

Appropriate Applications

Material still retains bonding integrity

Damage to material not likely

Material not highly accessible

Material granular cementitious

Inappropriate Applications

Material does not adhere well to substrate

Material is deteriorating or damaged, or damage is likely

Water damage is evident

Material is fibrous, fluffy

General Comments

Containment barriers needed

Worker protection needed

Airless sprayers should be used

Damaged pipe insulation may be taped but not sprayed

Previously encapsulated materials may have to be re-encapsulated

With our previous experience and the United States Environmental Protection Agency's opinions in mind, we have selected removal of all asbestos-containing spray-applied material in the high school. With encapsulation cost exceeding 70% of removal cost and still requiring a costly maintenance program because the material and owner liability still exist, we feel removal is the optimum solution.

PHASING

We have divided the school into two areas we feel can be done in phases to help keep part of the building open during abatement. Phase I includes the major portion of the affected areas, including the multi-purpose entry, library and classrooms of both levels. Phase II would include the corridor outside the gym and pool and two fan rooms on either side of the gym. The first and second floors were not separated due to complications in access to the stairwell during abatement and with the height of the ceiling in the multi-purpose entry.

KODIAK ISLAND BOROUGH SCHOOL DISTRICT
KODIAK HIGH SCHOOL

TABLE A

Removal/Replacement Cost - Phase I

<u>Item</u>	<u>Quantity</u>	<u>Cost/Item</u>	<u>Total</u>
Demolition			
Dropped Ceiling Removal	24,855 S.F.	2.10	\$ 52,195.50
Asbestos Removal			
Decon Set Up	1 S-up	3,500.00	3,500.00
Fireproofing Removal	42,785 S.F.	13.00	556,205.00
Waste Transportation & Disposal	372 BLS	30.00	11,160.00
Post Removal Encapsulant	42,785 S.F.	0.70	29,949.50
			\$ 600,814.50
Replacement			
New Fireproofing	42,785 S.F.	6.15	263,127.75
Dropped Ceiling Replacemt.	24,855 S.F.	4.38	108,864.90
			\$ 371,992.65
		Phase I Construction Cost	\$1,025,002.65
		Estimated Time for Completion	60 Days
		Air Monitoring Cost	
		50 days @ \$650/day	\$ 32,500.00
		Phase 1 Total Cost*	\$1,057,502.65

Estimated costs are **excluding** A/E fees

KODIAK ISLAND BOROUGH SCHOOL DISTRICT
KODIAK HIGH SCHOOL

TABLE B

Removal/Replacement Cost - Phase II

<u>Item</u>	<u>Quantity</u>	<u>Cost/Item</u>	<u>Total</u>
Demolition			
Dropped Ceiling Removal	1,730 S.F.	2.10	\$ 3,633.00
Asbestos Removal			
Decon Set Up	1 S-up	3,500.00	3,500.00
Fireproofing Removal	2,970 S.F.	13.00	38,610.00
Waste Transportation & Disposal	28 BLS	30.00	840.00
Post Removal Encapsulant	2,970 S.F.	0.70	<u>2,079.00</u>
			\$ 45,029.00
Replacement			
New Fireproofing	2,970 S.F.	6.15	18,265.50
Dropped Ceiling Replacment.	1,730 S.F.	4.38	<u>7,577.40</u>
			\$ 25,342.90
		Phase I Construction Cost	\$ 74,504.90
		Estimated Time for Completion	14 Days
		Air Monitoring Cost	
		10 days @ \$650/day	\$ 6,500.00
		Phase II Total Cost*	\$ 81,004.90

Estimated costs are excluding A/E fees

KODIAK ISLAND BOROUGH SCHOOL DISTRICT
KODIAK HIGH SCHOOL

Cost Summary

Demolition

Phase I	\$ 52,195.50
Phase II	3,633.00
	<u>\$ 55,828.50</u>

Asbestos Removal

Phase I	\$ 600,814.50
Phase II	45,029.00
	<u>\$ 645,843.50</u>

Replacement

Phase I	\$ 371,992.65
Phase II	25,842.90
	<u>\$ 397,835.55</u>

Construction Total	\$1,099,507.55
Air Monitoring Total	39,000.00

Total Project Cost*	\$1,138,507.55
---------------------	----------------

*Estimated costs are excluding A/E fees

NOTE 1: The asbestos removal figures have been developed using wage rates for asbestos workers instead of general laborers. Prices could be reduced if the Department of Labor approves the use of general laborers and does not require asbestos workers for the removal of the fireproofing.

SECTION 1

EXECUTIVE SUMMARY

Swearingen Associates surveyed two school facilities at Delta Junction and Fort Greely which are operated by the Delta/Greely School District, REAA #15. These schools were surveyed for the presence and extent of asbestos. On December 20 and December 21, 1983, the following facilities were evaluated:

Delta Junction

Fort Greely

1. Delta Junction School
2. Univ. of Alaska Bldg.
3. Metals and Ag. Shop
4. Class Module 1, 2, 3, 4, 5
5. Support Module A, B, C

1. Greely School

Asbestos was found in the Delta Junction and Greely schools and in the five (5) class modules. No asbestos-containing materials were identified in the University Building, the Shop Building, or in the three Support Modules.

The asbestos found in these facilities was generally in a sound, cement-like compound used as thermal insulation. In several locations, however, "friable" asbestos was identified: asbestos which is in a condition to release microscopic particles into the air. (Examples of friable asbestos include sprayed-on materials and materials which have been physically damaged.)

Friable asbestos, when inhaled or ingested, is associated with a number of serious illnesses; consequently, the Federal government, mainly the Environmental Protection Agency and the Occupational Safety and Health Administration, have issued strict and comprehensive regulations governing the use of asbestos and the limits of occupational exposure to airborne asbestos fibers.

We have prioritized our findings in order of the most serious potential risks of exposure. These priorities are:

- PRIORITY ONE: The facility contains friable asbestos which is accessible to all building occupants.
- PRIORITY TWO: The facility contains friable asbestos which is accessible to maintenance and custodial personnel only.
- PRIORITY THREE: The facility contains only non-friable asbestos which is accessible to all building occupants.

DEPT 1

PRIORITY FOUR: The facility contains only non-friable asbestos accessible to maintenance personnel only.

The facilities which have a Priority One asbestos hazard are:

The five Classroom Modules at the Delta Junction School

The facilities which have a Priority Two asbestos hazard are:

Delta Junction School
Fort Greely School

No facilities were identified with only a Priority Three asbestos hazard.

No facilities were identified with only a Priority Four asbestos hazard.

The five Classroom Modules have sprayed-on accoustical ceilings which had been previously sampled and found to contain approximately five percent (5%) asbestos. Air monitoring in each of these modules conducted as part of this survey established that air borne fiber count was less than four percent (4%) of the allowable limit. (Note that the EPA standard test for air borne fibers includes all fibers--lint, dust, asbestos, and animal--not just asbestos.)

There are several techniques which are used to reduce the risks of exposure to asbestos fibers. These include removal of the asbestos containing material, sealing or encapsulating the asbestos-containing material to prevent fiber release, enclosing or barricading the asbestos-containing material so that contact with it is unlikely, and administrative controls and procedures. The latter three, encapsulation, enclosing and administrative controls, all require extensive record keeping and periodic re-inspection. They also will seriously impact future facility modifications as well as retaining a potential hazard in the event of a fire or earthquake. Asbestos removal is generally considered to be the most desirable abatement procedure for schools. The initial costs are higher than the alternatives; however, the potential for future damages are gone as are the administrative requirements for record maintenance.

Swearingen Associates developed a cost estimate for the asbestos removal in the facilities schools identified above: The estimated cost of \$99,700 includes asbestos removal and disposal, surface refinishing or insulating, preparation of removal specifications and contract, and, performance verification and certification.

STATE OF ALASKA 1984 LEGISLATIVE SESSION
FISCAL NOTE

Revision Date: _____

REQUEST

Bill/Resolution No.: CS SB 373
Title: "An act establishing an asbestos health hazard abatement"
Sponsor: Josephson
Requestor: Senate HESS
Date of Request: 2/27/84

FISCAL DETAIL

Agency Affected: Labor
Program Category Affected: Public Protection
BRU, Program or Subprogram(s) Affected: Occupational Safety & Health

EXPENDITURES/REVENUES: (Thousands of Dollars)

	FY 84	FY 85	FY 86	FY 87	FY 88	FY 89
OPERATING						
100 PERSONAL SERVICES		158.4	83.1			
200 TRAVEL		32.4	7.6			
300 CONTRACTUAL		80.4	25.9			
400 SUPPLIES		8.5	1.6			
500 EQUIPMENT		16.4	-0-			
600 LAND & STRUCTURES						
700 GRANTS, CLAIMS						
800 MISCELLANEOUS						
TOTAL OPERATING	-0-	296.1	118.2	-0-	-0-	-0-

CAPITAL						
---------	--	--	--	--	--	--

REVENUE						
---------	--	--	--	--	--	--

FUNDING: (Thousands of Dollars)

GENERAL FUND	-0-	296.1	118.2	-0-	-0-	-0-
FEDERAL FUNDS						
OTHER						
TOTAL						

POSITIONS:

FULL-TIME	-0-	2	2	-0-	-0-	-0-
PART-TIME		2				
TEMPORARY						

SOURCE OF FUNDS TO OFFSET FISCAL IMPACT OF BILL:

ANALYSIS: Attach a separate page for analysis

Prepared By: Robert J. Bacolas *R. Bacolas* Phone: 465-4870
Division: Labor Standards & Safety Date: _____

Approved by Commissioner: Jim Robinson *Jim Robinson* Date: 2/29/84
Agency: Department of Labor

LEG:B:6

Distribution (by Agency preparing fiscal note):

- Legislative Finance
- Legislative Sponsor
- Requestor
- Office of Management and Budget
- Impacted Agency(ies)

12/1/83

FISCAL NOTE

THE LEGISLATURE OF THE STATE OF ALASKA

THIRTEENTH LEGISLATURE

BILL/RESOLUTION NO: CS SB 373

TITLE: "An Act relating to establishing asbestos health hazard abatement"

AGENCY AFFECTED: Department of Labor

Page 2

The appropriation bill, CS SB 374, to this legislation, lapses funds after two years (6/30/86). It is important that the survey of school buildings be completed within one year to allow all school districts time to request the monies needed to abate the asbestos health hazards in their school buildings.

It is assumed that the responsibility for training and certification outlined in AS 18.28.030 of CS SB 373 will mainly be with the employer and that the department will only be responsible for establishing guidelines for certification programs.

According to a survey conducted by the U.S. Environmental Protection Agency, approximately 50 percent of the Alaska school districts have surveyed their buildings for asbestos. The respondents include most of the larger school districts. There are approximately 550 school buildings in Alaska. We know that the Juneau, Anchorage, and Fairbanks school districts have surveyed their buildings. These school districts have approximately 115 buildings, therefore, we are estimating that $[550-115]$ divided by 2, or 220 buildings have yet to be surveyed.

Four positions will be needed, three Industrial Hygienists and one Clerk Typist III. In order to assure that the program can be implemented without delay, we plan to hire an Industrial Hygienist on July 1, 1984. We estimate that it will take two months to set up the schedule for surveying schools and for developing the guidelines for the certification program. An industrial hygienist is required to perform this task as this position requires a person who has an educational background and experience in industrial health evaluation. During the two months it takes to set up the program, we will recruit two other industrial hygienists and bring them on board by September 1, 1984. This will assure us three technical field staff who can recognize asbestos problems and properly sample and survey for this hazard and recommend methods to abate the hazard. One clerk typist will provide the necessary clerical support required to keep track of samples collected and sent for analysis, and to set up a system to inform school districts of the sample results and the department's recommendations for abatement of the asbestos hazard. In the first year of operation the special costs includes:

-One set of sampling pumps for all 3 Industrial Hygienists	\$6,000.00
-Training Films	4,000.00
-Protective clothing and respirators	6,000.00
-Contract to analyze the bulk asbestos samples (5 per build.)	38,500.00
-Rent	14,400.00
-Indirect	14,700.00
-Equipment (one-time item)	16,400.00

Position title 1 Industrial Hygienist I				Range/Step 19A	Barg. Unit GGU	Form 1? Page/Line	GOV.	APPROV.	DISAPP.
Type of Position 2 PFT	Staff Months 12	RP Number	PCN Number	BRIJ Priority	Location Anch.	Election District	LEG.		
3 CONTINUATION LEVEL		4 ADDITION		JUSTIFICATION As lead position of the Asbestos Health Hazard Abatement Program this position will set up the scheduling system for surveying approximately 220 buildings and develop guidelines for the certification program. This position will survey approximately 70 buildings the 1st year and 10 buildings the 2nd year. In the second year this position would be maintained to monitor and evaluate the certification program; provide information and training to contractors, their workers, and other interested parties of the potential health hazards of asbestos.					
4 Type of Expenditure		Amount							
1		3							
PERSONAL SERVICES									
5 Salary		2	38,124						
6 Benefits			6,367						
7 Supplemental Benefits			2,337						
8 Fixed Benefits			2,724						
9 TOTAL PERSONAL SERVICES		01	49,552						
10 Travel		02	10,800						
11 Contractual		03	10,175						
12 Commodities		04	2,500						
13 Equipment		05	1,600						
14 Other									
15 TOTAL COST			74,627						
RECEIPT CODE		FUNDING SOURCE							
16		Federal Receipts	1002						
17		G.F. Match	1003						
18	100	General Funds	1004 74,627						
19		I-A Receipts	1005						
20		Program Receipts	1028						
21		Other							
For M&B Use Only 4A Key Number _____									

13 REQUEST FOR NEW POSITION

AGENCY Labor
PROGRAM Public Protection
BRIJ Occupational Safety & Health
COMPONENT Occupational Safety & Health

FY 85

Page 1 of 4
Revised Date

LEG:F:20

1	Position Title Industrial Hygienist I			Range/Step 19A	Barg. Unit GGU	Form 12 Page/Line	GOV.	APPROV.	DISAPP.
2	Type of Position SEAS	Staff Months 10	RP Number	PCN Number	BRU Priority	Location Anch.	Election District	LEG.	
3	CONTINUATION LEVEL		ADDITION		JUSTIFICATION This is a one year position responsible for surveying approximately 70 school buildings to determine if there are any asbestos materials present in the buildings and will take samples of such materials. This position will assure the integrity of the samples and will analyze the sample results. The industrial hygienist will prepare a report to the school district based on this analysis recommend methods to control or remove the asbestos materials. This position will also provide information to contractors and school officials on the proper methods and safeguards that must be used to encapsulate or remove the asbestos material. Other duties include assisting the lead industrial hygienist monitor and evaluate the employer certification program.				
4	Type of Expenditure		Amount						
	1	2	3						
	PERSONAL SERVICES								
5	Salary	31,770							
6	Benefits	5,306							
7	Supplemental Benefits	1,948							
8	Fixed Benefits	2,270							
9	TOTAL PERSONAL SERVICES	01	41,294						
10	Travel	02	10,800						
11	Contractual	03	9,412						
12	Commodities	04	2,500						
13	Equipment	05	1,600						
14	Other								
15	TOTAL COST		65,606						
	RECEIPT CODE	FUNDING SOURCE							
16		Federal Receipts	1002						
17		G.F. Match	1003						
18	100	General Funds	1004	65,606					
19		I-A Receipts	1005						
20		Program Receipts	1028						
21		Other							
For M&B Use Only									
4A Key Number _____									

13 REQUEST FOR NEW POSITION

AGENCY Labor
 PROGRAM Public Protection
 BRU Occupational Safety & Health
 COMPONENT Occupational Safety & Health

FY 85

Page 2 of 4
 Revised Date

LEG:F:21

1	Position Title Industrial Hygienist I			Range/Step 19A	Barg. Unit GGU	Form 12 Page/Line	GOV.	APPROV.	DISAPP.
2	Type of Position SEAS	Staff Months 10	RP Number	PCN Number	BRU Priority	Location Anch.	Election District	LEG.	
3	CONTINUATION LEVEL		ADDITION		JUSTIFICATION This is a one year position responsible for surveying approximately 70 school buildings to determine if there are any asbestos materials present in the buildings and will take samples of such materials. This position will assure the integrity of the samples and will analyze the sample results. The industrial hygienist will prepare a report to the school district based on this analysis recommend methods to control or remove the asbestos materials. This position will also provide information to contractors and school officials on the proper methods and safeguards that must be used to encapsulate or remove the asbestos material. Other duties include assisting the lead industrial hygienist monitor and evaluate the employer certification program.				
4	Type of Expenditure		Amount						
	1	2	3						
	PERSONAL SERVICES								
5	Salary	31,770							
6	Benefits	5,306							
7	Supplemental Benefits	1,948							
8	Fixed Benefits	2,270							
9	TOTAL PERSONAL SERVICES	01	41,294						
10	Travel	02	10,800						
11	Contractual	03	9,412						
12	Commodities	04	2,500						
13	Equipment	05	1,600						
14	Other								
15	TOTAL COST		65,606						
	RECEIPT CODE	FUNDING SOURCE							
16		Federal Receipts	1002						
17		G.F. Match	1003						
18	100	General Funds	1004	65,606					
19		I-A Receipts	1005						
20		Program Receipts	1028						
21		Other							
For M&B Use Only 4A Key Number _____									

13 REQUEST FOR NEW POSITION

AGENCY Labor

PROGRAM Public Protection

BRU Occupational Safety & Health

COMPONENT Occupational Safety & Health

FY 85

Page 3 of 4
Revised Date

LEG:F:22

1	Position Title Clerk Typsit III	Range/Step 8B	Barg. Unit GGU	Form 12 Page/Line	GOV.	APPROV.	DISAPP.			
2	Type of Position PFT	Staff Months 12	RP Number	PCN Number	BRU Priority	Location Anch.	Election District	LEG.		
3	CONTINUATION LEVEL		ADDITION			JUSTIFICATION This position will keep track of the asbestos samples taken by the industrial hygienists and will assure that these samples are mailed to and returned from the contract laboratory. The clerk typist will take, type, and process the reports and correspondence about the asbestos program to the school districts, contractors, and Department of Education personnel who are required to be informed of the program. This position will also provide the clerical support necessary for the monitoring and evaluation of employer and employee training certification programs.				
4	Type of Expenditure		Amount							
	1	2	3							
	PERSONAL SERVICES									
5	Salary	19,176								
6	Benefits	3,202								
7	Supplemental Benefits	1,175								
8	Fixed Benefits	2,724								
9	TOTAL PERSONAL SERVICES	01	26,277							
10	Travel	02	-0-							
11	Contractual	03	12,901							
12	Commodities	04	1,000							
13	Equipment	05	1,600							
14	Other									
15	TOTAL COST		41,778							
	RECEIPT CODE	FUNDING SOURCE								
16		Federal Receipts	1002							
17		G.F. Match	1003							
18	100	General Funds	1004	41,778						
19		I-A Receipts	1005							
20		Program Receipts	1028							
21		Other								
For M&B Use Only 4A Key Number _____										

13 REQUEST FOR NEW POSITION

AGENCY Labor

PROGRAM Public Protection

BRU Occupational Safety & Health

COMPONENT Occupational Safety & Health

FY 85

Page	4	of	4
Revised Date			

LEG:F:23

Joe, Pappy, Paul, Rick

SB 409

Bill Ludwig - recast of personnel for start up date.

14 non-perm. positions at Cook Alet need to be replaced.

1. 649 - March 15th number

Stan Moberly - FRED - F's 6.
Mutcheries.

SB 373 - 374

Bob Landau - DOL

Position Paper - 1/2 schools have complied w/ EPA inspection.

CSHA has worked closely w/ districts in inspections. Has statewide standards, regulates how contractors remove asbestos. No voluntary compliance program.

two minor amendments:

* 18.28.020 (1) and (3)

* 18.28.030 (d) and (e)

civil penalties in place of / addition to criminal

Because of 2 yr time frame; identification should be done first year
assumes only schools & public facilities are covered.

Mick Coltran - Bus. & Labor - Union.

likes certification requirements; lots of experience in state of activities. Has seen work done poorly - very little training

certify program & not employee; no problem.

penalties - retain criminal and add civil.

don't restrict to only schools but public building.

Lee Paulson - APER

Concerned that pub. facilities are eliminated from bill. Great need for other buildings. APER into a concern.

Jim Tozier - D.O.E. - facilities coord.
private schools - problem w/ providing
direction, enforcement - clarify

Bolo Greene - AASB

support attn. to asbestos.
Contracts (pg. 5 (5)) in lg. districts may
be resp. of municipality.

2/13 334

financial rate inc. to 200/ea
vic moves here.

SUGGESTED AMENDMENTS FOR ASBESTOS BILL:

FROM THE DEPARTMENT OF LABOR

1. page 2, lines 17-18 amend to read " survey school buildings to inspect and sample material for the presence of asbestos;"
2. page 2, lines 21-22 amend to read: " answer inquiries concerning sampling and ensure quality control of sampling;"
3. page 4, lines 18-21 subsections (d) and (e): amend to read: "a contractor who violates (b) or (c) of this section shall be subject to citations and civil penalties as set forth in AS 18.60.095(b)."
4. In SB 374, line 10 change the appropriation amount from \$200,000 to \$296,100.

FROM SENATOR VIC FISCHER

5. Eliminate the phrase "school or public facility" on page 3 lines 23 and 28, and page 4 lines 4, 11 and 15 and page 6, lines 10 and 11.
6. Fund a study of public facilities regarding asbestos through the Department of Transportation and Public Facilities.

REGARDING THE STUDY

DOTPF cannot readily provide information concerning asbestos in facilities. They know that there are 9,000 state buildings. They would need to do a mail survey to discover how many local government buildings are in Alaska.

Testing and analysis of samples would need to be done through the Department of Labor. They estimate a minimum of 10 samples per building. After getting the number of facilities, they need to know:

1. The time frame - that will determine the number of employees needed.
2. If any assumptions can be made over dates asbestos was no longer used in construction projects.
3. Transportation costs for employee travel to do sampling based on locations of buildings from survey.

Example of costs:

9,000 buildings x 10 samples each x \$35.00/ea. bulk rate =
\$3,150,000 for samples only (no staff, equipment and travel included).

Joe, Vic, Pappy.

SB 373-374

Ed Cronick - Det. P.F.

Supports Concept.

Marine highway fleet - most exposed areas have been corrected. No changes made if encapsulated.

2,400 - 2,500 pub. facilities. (inc. school)

They are conducting a condition survey of pub. facilities. Asbestos has not been a criteria until this year. Not a formal study (incl. testing/analysis)

⊗ Consult Dept of Law - blimp. limit in territorial days - is there a fed. resp. for asbestos removal.

ly. of pub. fac. - add reference to marine facilities

Eileen

have civil penalties for violations - comfortable w/ status quo.

373 CS w/ amend 1, 2, 3, 5

374 CS 296.1

Letter of intent

expect depart. and districts to exhaust fed funds.

TELEGRAM

ALASKA TELECOM, INC.

PHONE: 907-5806

JUNEAU, AK 99802

1984 FEB 24 AM 9 23

02002 TDA ANIAK AK 31 02-24 855A AST

PMS SENATOR JOE JOSEPHSON

POUCH V

JUNEAU AK

1638

KUSPUK SCHOOL DISTRICT IS AN +ASBESTOS FREE.+ WE HAVE SPENT
CONSIDERABLE MONIES IN THE DISTRICT WIDE CLEANUP. ARE THESE
RELATED EXPENDITURES REIMBURSEABLE UNDER THE PROPOSED
LEGISLATION? JUST CHECKING.

BOB R MCHENRY, SUPERINTENDENT OF SCHOOLS

KUSPUK SCHOOL DISTRICT

675-4320

RECEIVED



SOUTH EAST REGIONAL RESOURCE CENTER
S.E.R.R.C. INC.

538 Willoughby Avenue, Juneau, Alaska 99801
Phone: (907) 586-6806

February 20, 1984

Senator Richard Eliason
Pouch V
State of Alaska
Juneau, Alaska 99811

Dear Senator Eliason:

At the request of Senator Josephson's office, we have reviewed each of our facilities projects in South East for asbestos problems. To the best of our knowledge Skagway School is the only one in your district that has a problem.

Official analysis of the problem was conducted by Chemical and Geological Laboratories of Alaska. The school district's construction manager has estimated the cost of removing the asbestors at about \$25,000.

While we are submitting this information, the district would not need to be considered if construction funds for completing the new school become available.

Sincerely yours,

Dr. Twyla G. Coughlin
Facilities Planner

cc: Senator Josephson

Dave Lanigan
Superintendent Skagway Schools

Attachment



CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

P.O. BOX 4-1276
Anchorage, Alaska 99509

TELEPHONE (907) 562-2343

ANCHORAGE INDUSTRIAL CENTER
5633 B Street



ANALYTICAL REPORT

From Skagway Schools Product Bulk Asbestos
 Address Skagway, Alaska Date July 11, 1983
 Other Pertinent Data ANALYSIS BY POLARIZING LIGHT MICROSCOPY.

Analyzed by DB Date July 17, 1983 Lab No. 2849

REPORT OF ANALYSIS BULK SAMPLES SKAGWAY, ALASKA

Samples received: July 11, 1983

Samples collected by: ----

SAMPLE
D.

SAMPLE LOCATION

ASBESTOS
PRESENT

OTHER FIBROUS
MATERIAL PRESENT

NON FIBROUS
MATERIAL PRESENT

Pipes in furnace room & breezeway
between Gym & M.P. room

NONE SEEN

FIBROUSGLASS-100%

NONE SEEN

Ceiling tile in M.P. room

CHRYBOTILE-
10%

CELLULOSE &
SYNTHETIC FIBER- 1%

CEMENT 90

Ceiling Tiles in Classrooms

NONE SEEN

FIBROUSGLASS- 90%

SILICATES 10

Wrapped pipes in shop

CHRYBOTILE-
20%

NONE SEEN

PLASTER 64

AMOSITE -
15%
CROCIDOLITE-
1%

Supply room downstairs

NONE SEEN

FIBROUSGLASS-100%

NONE SEEN

United States Department of the Interior

Geological Survey

A Survey of Asbestos-related Disease in
Trades and Mining Occupations and in Factory and Mining
Communities as a Means of Predicting Health
Risks of Non-Occupational Exposure to Fibrous Minerals*

by

Malcolm Ross
Open-File Report 82-745

This report is preliminary and has not been reviewed
for conformity with U. S. Geological Survey editorial
standards and stratigraphic nomenclature.

1982

ABSTRACT: A review which is based on thirty six published epidemiological studies is given of the disease patterns that have developed among industrial workers, miners, and millers who were exposed to dusts of one or more of the commercial asbestos minerals or to dusts from minerals perceived to be asbestos-like. Health data is also reviewed for those who were exposed to asbestos dusts in a non-occupational setting. From the published reports it is clear that there are very significant differences in the health effects of the several asbestos or asbestos-like minerals.

Of the commercial asbestos utilized in the United States about 95% has been chrysotile or "white" asbestos, about 2% amosite or "brown" asbestos, and about 2% crocidolite or "blue" asbestos. The common white asbestos has had the least effect on those occupationally exposed whereas blue asbestos has had the most effect. Despite the wide dissemination of white asbestos in our environment; in schools, homes, public buildings, brake lining emissions, etc., there is no evidence that the very frequent non-occupational exposures to this form of asbestos has caused any harm. On the other hand, nonoccupational exposure to blue asbestos has been conclusively proven to have caused significant mortality. The different health effects of the various forms of asbestos require different regulatory responses and remedial actions.

INTRODUCTION

The Problem

The widespread use of amphibole and serpentine asbestos^{1/} by industrial society for such items as service in brake and clutch facings, electrical and heat insulation, fireproofing materials, cement water pipe, tiles, filters, packings, and construction materials, has contributed greatly to human safety and convenience. Yet, while our society was accruing these very tangible benefits, many asbestos workers were dying of asbestosis, lung cancer, and mesothelioma.

The hazards of certain forms of asbestos under certain conditions have been so great that several countries have taken extraordinary actions to greatly reduce or even ban their use. Recent experiments with animals demonstrate that the commercial asbestos minerals as well as other fibrous materials can cause tumors to form when the fibrous particles are implanted within the pleura. These experiments have convinced some health specialists that asbestos-related diseases can be caused by many types of elongate particles; the mineral type according to these health specialists, is not the important factor in the etiology of disease, but rather the size and shape of the particles which enter the human body.

The question now before the World's health and regulatory establishments is whether the hazards of asbestos outweigh the benefits. Should the asbestos minerals and perhaps other asbestos-like minerals be banned from use? Minerals belonging to the amphibole group are particularly important in this regard for they are ubiquitous and commonly have crystal-line habits which are considered by some to be asbestos-like.

The Dilemma

The concern for human health, the great usefulness of many asbestos products, the appearance of asbestos minerals or asbestos-like minerals in the natural background and in many kinds of mining operations, and the uncertainty of the exact health effects of different kinds of minerals, different mineral particle sizes, and different mineral dust concentrations combine to present a formidable problem to minerals scientists, the

^{1/}At present, the most widely used definition of asbestos in the United States, 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 amphibole minerals amosite, crocidolite, anthophyllite, tremolite, and actinolite and the serpentine mineral chrysotile 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 is also defined as asbestos.

minerals industries, and legal and health professionals. Must the use of all commercial asbestos be stopped? Must all mine dusts containing such particles be controlled to the lowest feasible levels and wastes from those mines be considered toxic and thus isolated from surrounding air and water? Must all asbestos be eliminated from our drinking water, our schools, and our public buildings? Must we cease to use asbestos in brake linings, cement water pipe, and structural building materials? Must even low levels of non-occupational exposure to asbestos or asbestos-like materials be avoided at any cost?

In order to obtain an insight that will enable us to intelligently address these questions I will review the role of asbestos in the world economy, the important geological occurrences of commercial asbestos, give estimates of asbestos-related mortality in the United States in the recent past, and document the incidence of asbestos-related disease in the trades occupations, the mining and milling occupations, and in those non-occupationally exposed to asbestos or asbestos-like minerals. As we will see, the six asbestos minerals used in commerce are not identical in their crystal structure, chemical composition, abundance, and geologic occurrence; nor do the different asbestos dusts have the same impact on human health. Instead of treating all asbestos minerals as equally potent carcinogens (apparently the prevailing opinion in the United States) each mineral should be examined on its own merits and demerits with regard to its usefulness to society and its potential to cause disease.

ASBESTOS IN THE WORLD ECONOMY

Early Beginnings

Whereas the general use of asbestos in international commerce dates only to the late 19th century, its utility in human culture goes back to at least 2500 B.C. Archeological studies (Europaeus-Äyräpää, 1930) show that the inhabitants of the Lake Juojarvi region of East Finland knew how to strengthen earthenware pots and cooking utensils with anthophyllite asbestos. This asbestos probably came from the same areas where it has been commercially exploited in recent times. Until recently, however, most other uses of asbestos were trivial; such as its fabrication into such curiosities as cremation cloth, tablecloths, lamp wicks, and purses. Even well into the last century, asbestos could not be regarded as a product of commerce unless one included such endeavors as the small industry developed in Russia during the rule of Peter the Great where chrysotile asbestos from the Urals was used for a short period of time in the production of textiles.

In the 1860's and 1870's, the market for asbestos products rapidly changed - probably for three reasons; the need for insulation for the new steam technology, the formation of an international trading company of Italian and English entrepreneurs, and the reopening of the chrysotile asbestos deposits of northern Italy and simultaneous exploitation of the vast chrysotile resources in Quebec. The supply for the first time was ample, the market was ready.

The Modern Industry

The reopening of the asbestos deposits of northern Italy, deposits which had been worked as far back as Roman times, marked the beginning of the modern asbestos industry. By 1890, the asbestos industry was full blown, with hundreds of applications being introduced (Jones, 1890); by the turn of the century the large South African crocidolite deposits had been opened up and the Russian deposits in the Urals were once again producing in large quantity. Within a few years, the amosite deposits of the Transvaal would be exploited.

From the time of the first recorded use of asbestos by Stone Age man to 1900 the total world production of all types of fiber was probably about 200,000 metric tonnes, certainly no more than 300,000 tonnes. Of this 150,000 tonnes came from Quebec. By 1980 more than 100 million tonnes of asbestos had been mined throughout the World; of this more than 90 percent was chrysotile and more than 5 percent crocidolite and amosite. Nearly 40 million tonnes of this total World production was chrysotile mined in Quebec Province near the towns of Thetford Mines and Asbestos. Total production of anthophyllite asbestos to date is probably no more than 400,000 tonnes; 350,000 tonnes being produced by Finland alone. Production of tremolite asbestos has been sporadic and it has been mined in various parts of the World for short periods of time. Total production to date for this form of asbestos is probably no more than a few thousand tonnes. Commercial exploitation of actinolite asbestos is practically unknown.

The World asbestos production for 1978 is given in Table 1. Russia leads with 46.1 percent and Canada is second with 28.9 percent of the world output. Both countries mine only chrysotile asbestos and most of the fiber comes from the Urals and Quebec. The third leading asbestos producer is the Republic of South Africa (7.1 percent); the asbestos ore consists of amosite, crocidolite, and chrysotile. These three countries furnished 82.1 percent of the World's asbestos in 1978. The other countries listed in Table 1 produce mostly chrysotile.

COMMERCIAL ASBESTOS

The Asbestos Minerals

Standard references published over the past 50 years usually list six forms of commercial asbestos; the amphibole varieties are amosite, crocidolite, anthophyllite, tremolite, and actinolite, the serpentine variety is chrysotile. A detailed understanding of the chemistry and crystal structures of these asbestos minerals postdate their discoveries; thus some of the older literature can be confusing with regard to mineral identifications.

Chrysotile, $Mg_3Si_2O_5(OH)_4$, one of the three common polymorphs of serpentine is generally fibrous although non-fibrous varieties are known. About 90 percent of the past and about 95 percent of the present World production of asbestos was or is the chrysotile form.

Amosite is the very rare asbestiform variety of grunerite amphibole, $(Fe,Mg)_7Si_8O_{22}(OH)_2$; this varietal name is derived from the word *Amosa* - an acronym for the company "Asbestos Mines of South Africa" (Hall, 1978, p. 13-14). This valuable commercial asbestos is mined only in the Transvaal Province of South Africa.

Crocidolite is the asbestiform variety of riebeckite amphibole, ideally $Na_2(Fe^{2+},Mg)_3Fe^{3+}_2Si_8O_{22}(OH)_2$, and has been mined in only four localities; in the Transvaal and Cape Provinces of South Africa, in the Hammersley Range area of Western Australia, and in the Cochabamba area of Bolivia. Only the South African mines are still active.

The only other form of amphibole asbestos that has been mined commercially on a significant scale is anthophyllite, $(Mg,Fe)_7Si_8O_{22}(OH)_2$, from the Paakkila area of East Finland. With the Finnish mines now closed there is now very little anthophyllite asbestos production anywhere in the World.

There are numerous reports of minor occurrences of tremolite asbestos, $Ca_2Mg_5Si_8O_{22}(OH)_2$, and relatively few reports of occurrences of actinolite asbestos, $Ca_2(Fe,Mg)_5Si_8O_{22}(OH)_2$. Tremolite and actinolite asbestos are now, as they have been in the past, of little economic importance.

The Important Geological Occurrences of Commercial Asbestos

Many minerals, including the amphiboles and some serpentines, are described variously as fibrous, asbestiform, acicular, filiform, prismatic; these terms suggest an elongate habit. Although such minerals are extremely

Table 1. World asbestos production in 1978 (Clifton, 1979)

Fiber	Locality	Production (in thousands of metric tonnes)
<u>Chrysotile</u>		
	North America	
	Canada	1620
	United States	93
	South America	
	Argentina	1
	Brazil	100
	Europe	
	Bulgaria	21
	Italy	162
	U.S.S.R.	2582
	Yugoslavia	10
	Africa	
	Zimbabwe	210
	South Africa	118
	Swaziland	48
	other	1
	Asia	
	China	210
	Cyprus	37
	India	21
	Japan	7
	Korea	7
	Taiwan	1
	Turkey	10
	Oceania	
	Australia	<u>58</u>
	(World chrysotile total)	5317
<u>Crocidolite</u>		
	South Africa	210
<u>Amosite</u>		
	South Africa	71

common, in only relatively few places do they have physical and chemical properties suitable to be valuable as commercial asbestos. Locally, amphibole minerals may show an asbestiform habit, for example in vein fillings and in areas of secondary alteration, but usually they do not appear in sufficient quantity to be profitably exploited.

Deposits of commercial asbestos are found in four types of rocks: (I) - alpine-type ultramafic rocks including ophiolites (chrysotile, anthophyllite, and tremolite), (II) - stratiform ultramafic intrusions (chrysotile and tremolite), (III) - serpentized limestone (chrysotile), and (IV) - banded ironstones (amosite and crocidolite). Type I deposits are by far the most important and probably account for more than 85 percent of the asbestos ever mined. The most important Type I deposits are those of Quebec and the Urals.

Type II deposits are found mostly in South Africa, Swaziland and Zimbabwe. These furnish mostly chrysotile asbestos. Type III deposits are small; the most notable of these are located in Globe, Arizona and in the Carolina area of the Transvaal Province of South Africa. Type IV deposits are found only in the Precambrian banded ironstones of the Transvaal and Cape Provinces of South Africa and of Western Australia. Only the South African deposits are still in production. A complete review of the geological occurrences of commercial asbestos is given by Ross (1981).

HEALTH HAZARDS OF ASBESTOS

Diseases Related to Asbestos Exposure

Three principal diseases are related to exposure to one or more of the commercial asbestos minerals. These are: (1) lung cancer which includes cancer of the trachea, bronchus, and lung proper; (2) mesothelioma, a cancer of the pleural and peritoneal membranes which invest the lung and abdominal cavities, respectively; and (3) asbestosis, a diffuse interstitial fibrosis of the lung tissue often leading after long exposure to severe loss of lung function and respiratory failure. The occurrence of lung cancer in asbestos workers is also complicated by the association with cigarette smoking which leads to considerable difficulty in assigning relative risks of asbestos exposure to smokers. Mesothelioma, a disease which is usually fatal in one to two years after diagnosis, is rare, accounting for less than 300 deaths per year in the United States and Canada.

Some epidemiological studies suggest that asbestos workers may suffer excess cancer of the digestive tract (Selikoff and Lee, 1978); other studies do not support this conclusion (McDonald and McDonald, 1980; Meurman et al., 1974; Rubino et al., 1979; Nicholson et al., 1979). Some question still exists then as to the role played by asbestos in the etiology of digestive tract cancers. Becklake (1976), Selikoff and Lee (1978), and Simpson (1979) give a complete review of the subject of asbestos and disease.

Particle size and shape appear to be the factors controlling whether mineral particles enter and remain in the lung or are removed from the lung after entering. Particles such as asbestos fibers which have diameters

greater than approximately 5 μm cannot enter the bronchial airways, those having smaller diameters do. Particles having diameters less than 1.5 μm are particularly dangerous for they can penetrate to the smaller bronchioles and even to the alveolar sacs (Davis, 1981). Most particles which enter the upper respiratory tract (the mainstem, bronchi, and bronchioles) are quickly and effectively removed by the mucociliary escalator. A second lung clearance mechanism operates in the lower respiratory tract (the respiratory bronchioles and alveoli). Here, pulmonary macrophages engulf the foreign particles (phagocytosis) and then: (1) move to the upper respiratory tract to where the mucociliary escalator is operative or (2) move through the alveolar wall into the interstitium and eventually to the lymph channels.

Asbestos fibers which are longer than approximately 10 μm are not readily phagocytized by the macrophage cells and thus tend to remain in the lower respiratory tract or they may penetrate the pleural membrane and enter the interpleural space. Asbestosis may occur when such fibers remain in the lung parenchyma for lengthy periods of time. The asbestos fibers can stimulate deposition of excess interstitial collagen and reticulin fibers. This causes the alveolar septa to become thickened with ensuing impairment of oxygen uptake (Davis, 1981). Long-term residency of fibers in the lung and pleura may also induce lung cancer and mesothelioma; the mechanisms by which this takes place are far from being understood.

As will be described later, pleural cancer seems to be induced by crocidolite asbestos but not by chrysotile or anthophyllite asbestos. Lung cancer is caused by chrysotile, anthophyllite, amosite, and crocidolite asbestos; particularly in asbestos workers who smoke cigarettes. Two completely different substances, asbestos and cigarette smoke, combine to produce a very significant risk to those who have been heavily exposed to asbestos dusts.

Generally, asbestos-related diseases appear in asbestos workers only after many years have elapsed since first exposure. A significant increase in the lung cancer death rate appears 10 to 14 years after first exposure and peaks at 30 to 35 years. The mesothelioma death rate becomes significant 20 years after first exposure but continues to climb even after 45 years have elapsed. The asbestosis death rate becomes significant 15 to 20 years after first exposure and apparently peaks at 40 to 45 years (Selikoff et al., 1980a).

Epidemiology

Before considering the mortality studies of the various occupational groups exposed to asbestos, we should briefly consider the role the three important types of asbestos (amosite, crocidolite, and chrysotile) played in the commerce of North America and Europe, the areas where the major epidemiological studies of asbestos workers were made.

In North America, chrysotile entered the market in large quantities early in this century. Crocidolite was apparently first used in the United States in 1912 when 9 tonnes were imported, but it was not until World War I that its use for high temperature insulation became established - particularly in the ship building industry. By 1930, 35,000 tonnes of crude crocidolite fiber had been imported into the United States. Import statistics for crude crocidolite asbestos from South Africa into the United States are given in Tables 2a and 2b. Large amounts of manufactured goods containing crocidolite were also imported but tonnage estimates cannot be made. Not until the mid 1930's did amosite asbestos gain a market in North America when it began to replace crocidolite for high temperature insulation. Crocidolite was milled in Bound Brook, New Jersey in 1920 and in 1924 the operation moved to larger facilities in Millington, New Jersey. The many advertisements in the trade journal Asbestos from 1920 to 1945 indicate that crocidolite was used in many products and particularly for insulation of steam boilers, locomotives, and pipes. As an example, a product containing crocidolite asbestos and called "85% Magnesite Sectional Pipe Covering" was advertised monthly in Asbestos from 1920 to 1945 (see also, McCullagh, 1980). Amosite, crocidolite, and chrysotile were almost universally used aboard ship during World War II; amosite for high temperature boilers and pipes, crocidolite for packings exposed to acids or salt water, and chrysotile for low temperature and electric insulation.

The use of asbestos in Europe paralleled that in North America, with one notable exception - the extensive use of crocidolite asbestos as a sprayed-on coating to fireproof ships, ^{1/} railroad cars, buildings, etc. Sprayed-on coatings were also used in the United States after World War II but the coatings contained, with few exceptions, chrysotile rather than crocidolite. Sprayed-on asbestos coatings were not used on U.S. ships; the principal use being to fireproof steel building girders and as acoustical coatings in schools and offices.

Asbestos trades workers. A very significant increased incidence relative to the general male population, of lung cancer, asbestosis and mesothelioma is found in men who were employed in the "asbestos trades" - insulation of steam locomotives, boilers, ships, buildings; fabrication and installation of asbestos-containing textiles, roofing materials, cement products, tiles, wallboards, brake linings, clutch facings, filters, packings, gaskets, etc. Those in the "trades" generally used several types of asbestos minerals during their working careers; most commonly these were chrysotile, crocidolite, and amosite, rarely anthophyllite. Significant exposures by any group of workers, at least for the past 40 years, to tremolite or actinolite asbestos dusts has probably not occurred.

^{1/}Mesothelioma is prevalent in the shipyard workers of Europe; at Walcheren, Wilhelmshaven, Plymouth, Trieste, Hamburg, Nantes, Rotterdam, Malmo (McDonald and McDonald, 1977). The extensive use of crocidolite aboard European ships prior to and during World War II is suggested to be an important factor in the etiology of this disease.

Table 2a. Minimum estimates of imports of crude crocidolite asbestos from South Africa into the United States (1907-1929),* (1940-1945)**, (1946-1974).***

<u>Year(s)</u>	<u>Crocidolite crude (short tons)</u>
1907-1908	probably none
1909-1910	no data
1911	little
1912	9
1913	1
1914	no data
1915	probably none
1916	1184
1917	2081
1918	837
1919	1056
1920	2979
1921	704
1922	1684
1923	2040
1924	1457
1925	606
1926	4873
1927	5587
1928	?
1929	9952
<u>Total (1907-1929)</u>	<u>35,050 short tons</u>
1940	2708
1941	2976
1942	4213
1943	4808
1944	2946
1945	3100
<u>Total (1940-1945)</u>	<u>20,751 short tons</u>
<u>1946-1974</u>	<u>346,796 short tons</u>

*Some of the imports were shipped through England. Small amounts of chrysotile may be included in import figures but no amosite. Figures do not include any manufactured asbestos products. Most crocidolite came from the South Cape Prov., some may have come from the Transvaal. Source: Mineral Resources of the United States (1907)...(1929) U.S. Geological Survey, Washington, D.C.

**Crocidolite composed 19.4% of the South African crude asbestos imports into the U.S. during this period - which totaled 107,039 short tons, over 80,000 tons was amosite asbestos. Sources: Minerals Yearbook (1940)...(1945), U.S. Bureau of Mines, Washington, D.C. Mineral Trade Notes, Confidential Series, No. 1-31, U.S. Bureau of Mines, U.S. Dept. Interior, Washington, D.C. (1940-1945).

***Minerals Yearbook (1946)....(1974) U.S. Bureau of Mines, Washington, D.C.

Table 2b. Imports of all crude asbestos from South Africa (1930-1939)*

<u>Year(s)</u>	<u>Asbestos Crude (short tons)</u>
1930	3635
1931	2290
1932-33	1370
1934	4269
1935	2529
1936	?
1937	3025
1938	4243
1939	6422
<hr/>	
Total	27,788 short tons**

*Import statistics do not differentiate between various forms of asbestos. Little chrysotile was imported from South Africa thus the figures are for mostly amosite plus crocidolite. Import data for crocidolite during World War II suggests that at least 20% of the 1930-39 imports were crocidolite. The amosite market was just developing in the U.S. in the 1930's. Most of the crocidolite was from the Cape Province.

**Assuming a ratio of 4:1 of amosite: crocidolite based on WWII import figures, at least 5558 short tons of crocidolite was imported into the U.S. from 1930 to 1939.

Sources: Mineral Resources of the United States (1930)(1931). U.S. Geological Survey, Washington, D.C. Minerals Yearbook (1932)... (1939). U.S. Bureau of Mines, Washington, D.C.

Statistical data for 21 mortality studies of defined cohorts of asbestos trades workers (mostly male) are presented in Tables 3a and 3b. Of those that are continuing prospective studies, the most recent update is given. Twelve of the studies are of asbestos factory workers, eight are of asbestos insulation workers, and one is of asbestos construction workers. In all, 50,143 individuals were followed (1,517 were female); of the 7,166 listed deaths 1,198 (16.7 percent) were reported as due to lung cancer and 402 (5.61 percent) were reported as due to mesothelioma. In the 21 studies, the lung cancer mortality accounted for 6.1 to 26.6 percent of all deaths; mesothelioma mortality accounted for 0 to 16.1 percent of all deaths (Tables 3a, 3b, Fig. 1). The workers involved in study No. VI worked only with chrysotile, those involved in Studies X and XXI worked mostly with crocidolite, and those in the remaining studies probably worked with more than one form of asbestos.

Estimates of expected cancer mortality are very difficult to predict, for cancer rates are modified by the individual's "lifestyle" as well as by occupation. The "lifestyle" contribution to lung cancer is cigarette use. To better assess the significance of these health studies it is necessary to examine the cancer-mortality patterns of cigarette smokers who were not exposed to asbestos dusts. Unless prevalence of smoking within the study group is carefully evaluated it is impossible to predict accurately the health effects of occupational exposure to carcinogens such as asbestos, radon gas, and arsenic. Unfortunately, in few of the studies listed in Tables 3a and 3b have adequate assessments been made of the proportion of workers who smoke cigarettes.

The contribution of cigarette smoking to the increased incidence of disease has been evaluated in several studies and has led to a consensus that this habit produces a very significant increase in risk of dying of lung cancer as well as of the various cardiovascular diseases. The largest study of cigarette smokers is that of E. Cuyler Hammond and colleagues under the auspices of the American Cancer Society. This study is based on questionnaires and mortality follow-up accomplished in the United States between July 1960 and June 1971 for approximately 51,000 men (Hammond et al., 1978). The proportional mortality of lung cancer (percent lung cancer deaths relative to deaths by all causes), based on the Hammond study, is shown graphically in Figure 2. For a group of men who all smoke cigarettes (cohort of 100 percent smokers), lung cancer mortality is approximately 7 percent at age 45, reaches a maximum of approximately 10 percent at age 70, then decreases slightly at older ages. For a cohort of male non-smokers, lung cancer mortality is 2 percent at age 45 and then decreases continuously to approximately 1 percent at age 95.

Smoking is most prevalent in blue-collar occupations relative to professional and managerial occupations (Sterling and Weinkam, 1978). This prevalence also holds true for the asbestos trades, mining, and milling occupations. In a group of 13,722 asbestos insulation workers, whose smoking habits were recorded, 70 percent had a history of cigarette smoking (Selikoff and Hammond, 1975; Saracci, 1977). In a group of 1,015 chrysotile asbestos miners and millers 85 percent were smokers (McDonald et al., 1974). Data given in Figure 2 predicts that the lung cancer mortality for a cohort

Table 1. Mortality among asbestos workers and their relatives (see text for details). Most cases are of progressive asbestosis (1-4) and cancer (1-4, 1952).

Study	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
Number of deaths	35 (2-3)	46	361	446 (316, 26)	122 (54)	66 (20, 26)	217 (161, 31)	146 (167, 67)	224 (1-4, 23)	56	761 (615, 67)
All causes (1946-1972)	0.2			1.41	2.26	0.61	1.10	1.11	1.46		1.20
Cancer-all sites (140-214) or (140-214)	24 (50.2)	23	68	172 (56, 24)	66	13 (17, 41)	50 (51, 32)	50 (42, 77)	55 (3, 53)	23	133 (100, 61)
Cancer-lung, larynx, trachea, bronchus (162)	25 (33.0)	10 (1, 42)	41	79 (17, 47)	35	4 (4, 32)	31 (15, 30)	29 (18, 39)	35 (12, 53)	0	61 (23, 50)
Mesothelioma, peritoneum, pleura (146, 171)	2 (~1930)	3	9	23	13	0	5	4	26	9	2
Cancer-digestive system (150-154)			20								55 (19, 91)
Cancer-G.I. tract (156-158)	13 (19.9)	5 (1, 79)		24 (10, 57)	13	4 (3, 82)			15 (7, 99)	3	
Respiratory disease (490-514)	0.72			2.27	10.7	1.04			1.88		
Non-infectious respiratory disease (410-514)	5			5.34		6.06			5.36		
Asbestosis (515, 2)	0	2	32	26	14	2			15	2	19
Pulmonary tuberculosis (510-511)	0	4, 15	10, 4	5, 41	15, 1	3, 63			12, 8	3, 57	2, 43
Number in cohort	1392	152	1493	7269	172	204	261	679	659	176	1075
Number of males (females)	no females	152 (0)	1265 (720)	7200 (0)	162 (1)	204 (0)	261 (204)	679 (0)	not reported	91 (0)	1075 (0)
% death	-	30.3	24.2	6.17	75.1	24.2	21.6	27.4	19.8	11.8	72.7
Site	Asbestos work Cardiff, Wales	Insulators, New York State	Asbestos Co., U.S.A.	Insulators, Midwest, Central U.S.A.	Insulators, Belfast, N. Ireland	Asbestos factory	Asbestos textile factory, UK	Asbestos textile factory, UK	Asbestos products factory, USA	Asbestos, job work with asbestos filter pans	Asbestos company, U.S.A.
Observation period	1916-1977	1945-1965	1940-1964	1967-1971	1940-1972	1945-1974	1931-1974	1931-1974	1959-1975	1945-1975	1941-1974
Years exposed	20.5	215	varies	not reported	varies	91	215	210	varies	1-2	1-51
Years since first exposure	215	215	varies	not reported	varies	varies	210	210	varies	varies	varies
Controls	death rates, SF males	U.S. National Rates, 1940	Internal, SF yrs.	U.S. National death rates	Male rates, N. Ireland	U.S. National death rates	National death rates, UK	National death rates, UK	not reported	not reported	U.S. National Rates
Smoking data	unknown	Minimal	not reported	not reported	5 cigarettes	not reported	not reported	not reported	not reported	not reported	not reported
Exposure data	years	not reported	not reported	not reported	not reported	200-2500 ft ³ /year since 1942	100-1000 ft ³ /year	1 to 15 ft ³ /year (1936-72)	not reported	light exposure	yes
Asbestos type	Chrysotile + Crocidolite + amphibole cells	not reported	not reported	chrysotile, amosite	not reported	chrysotile only	chrysotile, crocidolite	chrysotile, crocidolite	not reported	bestial, crocidolite, chrysotile	chrysotile, crocidolite

88

1) International Classification of Diseases, 10th Revision (ICD-10)
 2) From the United States, the mortality rate due to asbestos exposure accounted for 1.2% of all deaths in 1970. This rate is based on data from 1940-1970 and is not directly comparable to the rates in this study.

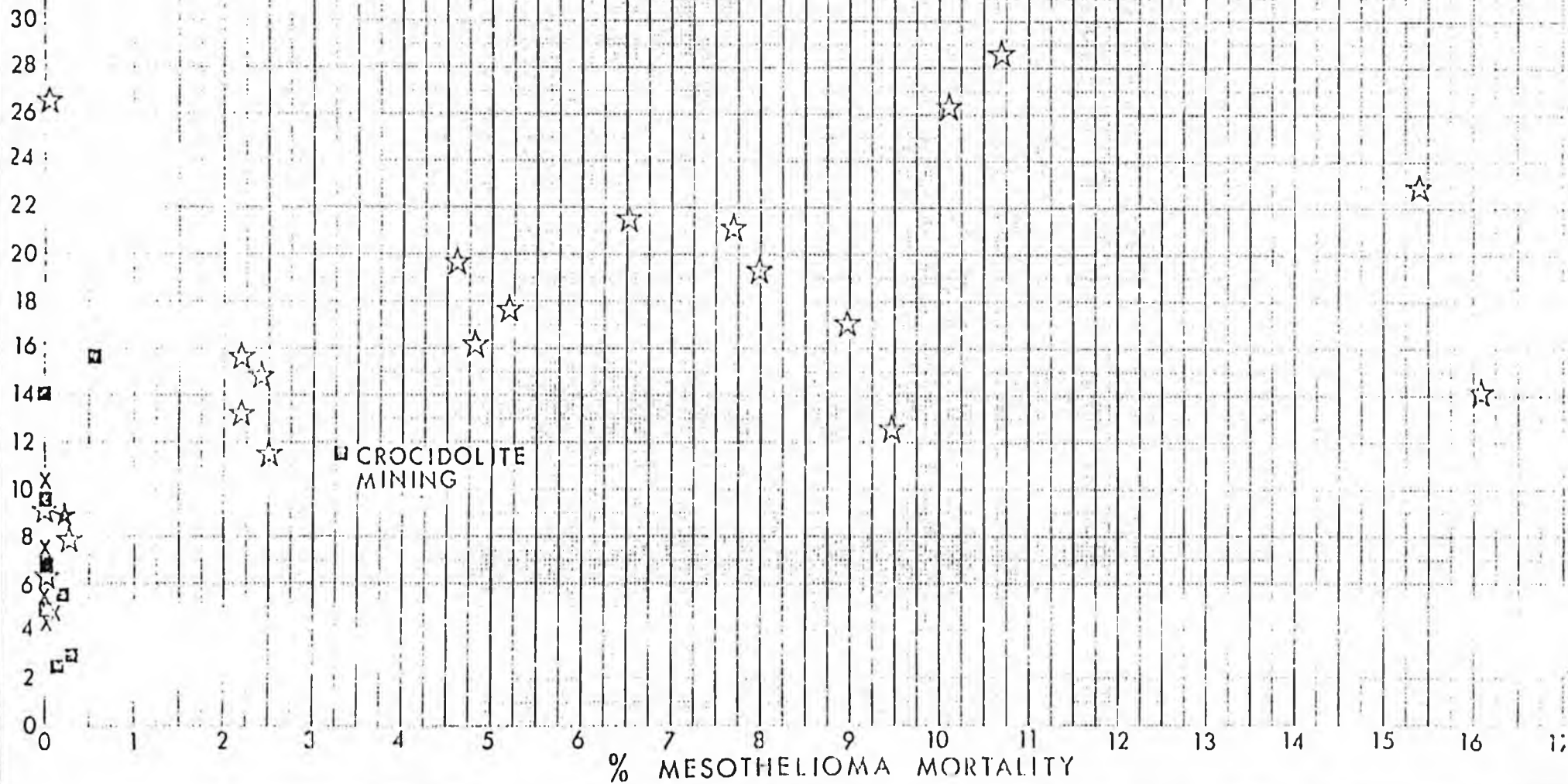
Table 10. Occupational studies of asbestos trades workers; excluding others and others (see Table 4). Most recent update of prospective studies (II-III) is given (1976-84).

Study		III	IIII	IIV	IV	V	VI	VII	VIII	IX	X	XI
Case of death	Number of deaths	Percent et al., 1974	Newhouse and Reilly, 1977	Neill et al., 1979	Seltoff et al., 1979a ¹	Seltoff et al., 1979b ²	Seltoff et al., 1979c ³	Seltoff et al., 1979d ⁴	Seltoff et al., 1979e ⁵	Seltoff et al., 1979f ⁶	Cherniack and Anderson, 1981	Neill et al., 1981
All causes (1974-84)	Obs./Exp.	120(1.42)	745(556.0)	601(690.1)	475(170.9)	87(63.8)	227(1659.4)	79(25.7)	104(150.4)		Not given	14
	% all deaths	1.56	1.34	0.68	1.45	5.76	1.37	1.05	1.97			
Lung cancer (1974-84)	Obs./Exp.	8(3.34)	175(119.41)	120(156.6)	210(57.0)	25(10.1)	95(104.7)	10(16.2)	116(11.4)		167(191.13)	7
	% all deaths	1.40	2.35	0.77	3.55	3.98	3.11	2.41	3.47		1.41	
	% all deaths	1.5	43.6	29.0	43.7	32.3	41.8	49.4	36.2			53.8
Cancer-lung, trachea, bronchus (1974-84)	Obs./Exp.	510(74)	135(46.41)	51(49.2)	91(11.1)	16(2.6)	44(105.6)	21(5.7)	69(10.1)		44(27.31) ⁵	110(70)
	% all deaths	5.32	2.80	1.04	6.96	3.45	4.60	3.68	5.34		3.61	14.7
	% all deaths	26.3	17.4	8.49	12.5	14.1	21.4	25.6	19.7			33.3
Mesothelioma peritoneum, pleura (1974-84)	Obs./Exp.	None reported	67	0	18	3	125	4	14		1	2
	% all deaths		8.99	0	2.95	4.83	2.41	10.1	4.61			14.2
Cancer-digestive system (1974-84)	Obs./Exp.		60(44.2)	25(50.1)								
	% all deaths		1.36	0.50								
	% all deaths		8.05	4.16								
Cancer-col., rectum (1974-84)	Obs./Exp.				43(15.1)	3(1.5)	94(53.4)	1(1.1)	16(6.0)		11(24.4)	1
	% all deaths				7.05	2.61	1.67	0.97	2.90		1.91	1
	% all deaths				3.03	4.41	4.36	3.80	5.26			1.6
Respiratory disease (1974-84)	Obs./Exp.	102(1.24)	102(96.0)									
	% all deaths	0.76	1.31									
	% all deaths	52.6	13.7									
Noninfectious respiratory disease (1974-84)	Obs./Exp.				45(5.5)	7(1.4)	212(5.0)	14(1.7)	24(4.7)			
	% all deaths				4.94	6.35	3.59	4.38	5.11			
	% all deaths				9.41	11.3	3.34	12.7	2.66			
Asthenosis (1974-84)	Obs./Exp.				41	5	168	11	14			
	% all deaths				9.25	9.56	3.40	16.4	5.97			
Number in cohort		41	5527	5035	632	631	17,800	410	682		568	
Number of entry (females)		41(0)	4600(67)	5645(0)	632(0)	631(0)	17,600(0)	403(0)	567(0)		567(0)	567(0)
% lost		15.1	11.5	13.6	15.2	7.14	12.6	16.0	12.7			15.2
Site		Insulators, shipyards, Genoa, Italy	Asbestos textile factory, F. Imbion	Asbestos cement company, New Orleans, LA	Asbestos textile workers	Asbestos textile workers	Asbestos textile workers	Asbestos textile workers	Asbestos textile workers		Asbestos textile workers	Asbestos textile workers
Observation period		1960-1975	1931-1975	to 1974	1945-1976 (10 yr employment)	1944-1975 (10 yr employment)	1967-1976	1967-1975	1967-1975		1967-1975	1967-1975
Years reported		varies	310	varies	varies	varies	varies	varies	varies		varies	varies
Years since first exposure		varies	310	320	most < 20	most < 20	varies	varies	varies		varies	varies
Controls		male rates, Genoa	not given	death rates, Ins. Louisiana, matched controls	95 death rates	95 death rates	95 death rates	5 death rates	5 death rates		death rates, 1000 controls	death rates, 1000 controls
Smoking data		Not reported	yes	None	Not reported	Not reported	Not reported	Not reported	Not reported		yes	yes
Exposure data		Not reported	yes	<10 to 3700 mg-cm ³ -yr.	Not reported	Not reported	Not reported	Not reported	Not reported		None	None
Asbestos type		Not reported	crocidolite, amosite, chrysotile	thrysotile, amosite, crocidolite	Not reported	Not reported	Not reported	Not reported	Not reported		Amosite, chrysotile	thrysotile, amosite, crocidolite

1 International Classification of Diseases, ICD Revision (1974)
 2 within the United States mesothelioma mortality correlated to asbestos exposure reported for
 3 proportionally one death in 1000 in 1975 (estimated from data given by R. Gould and H. Hoidal, 1981)
 4 Asbestos textile workers, except several others than commercial asbestos
 5

☆ ZÜRICH MALE POPULATION
 X MALE NATIONAL POPULATIONS
 □ ASBESTOS MINERS - MILLERS
 ☆ ASBESTOS TRADES WORKERS

Figure 1. Graphical comparison of the proportional mortality due to lung cancer and mesothelioma for the asbestos trades workers (Tables 3a, 3b, Studies I-XXI), the asbestos miners and millers (Table 4, Studies A-J), the male population of the Zürich area of Switzerland, and the male populations of five nations (Table 6).



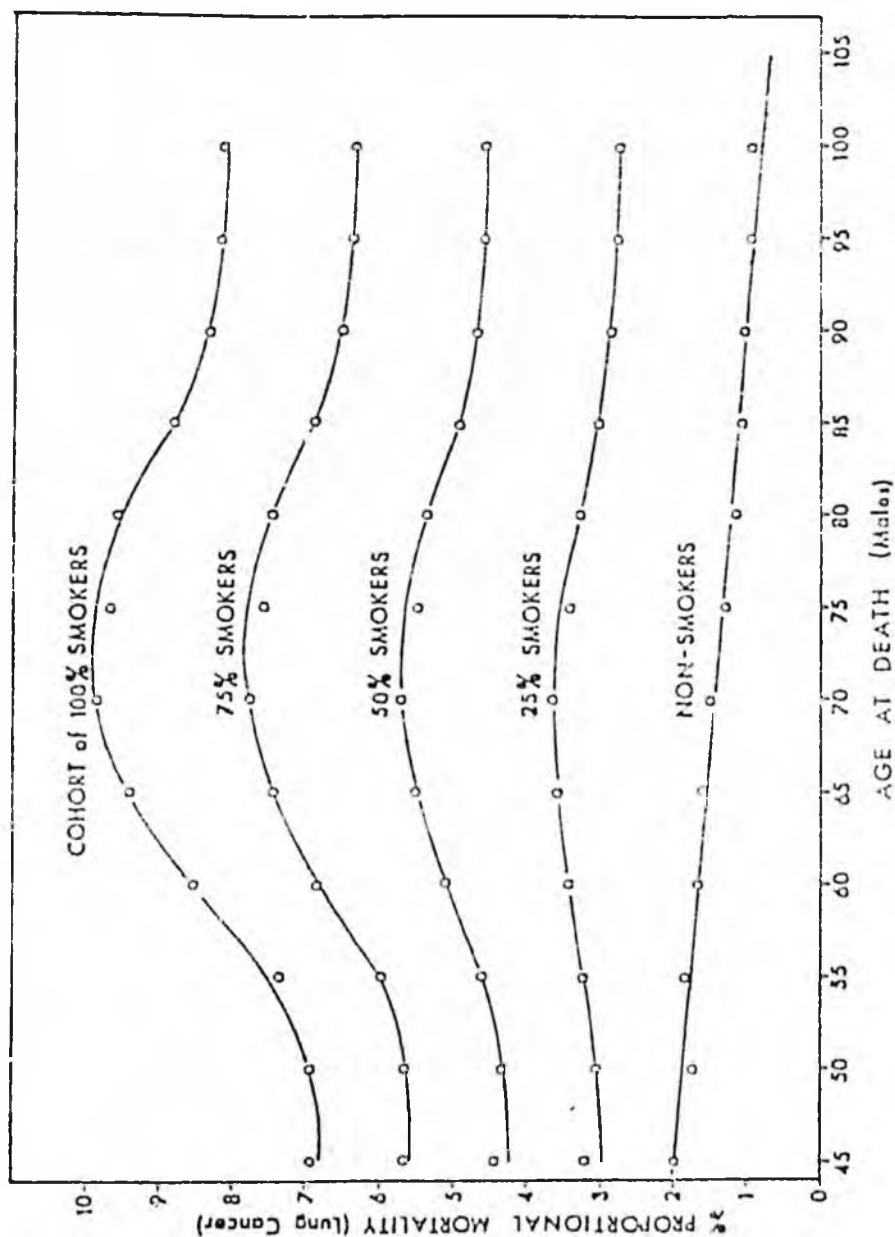


Figure 2. Percent of lung cancer deaths in males relative to deaths by all causes (proportional mortality - lung cancer) plotted with respect to age for four groups (cohorts) having different cigarette-smoking characteristics and for a cohort of non-smokers. For example, for a cohort of 70-year old males which is composed of 75 percent cigarette smokers, 7.8 percent of all deaths at age 70 are predicted to be from lung cancer. Graphical presentation based on data from Hammond et al. (1978).

composed of 75 percent smokers would be at least 6 to 7.5 percent, regardless of occupation. In Tables 3a and 3b we see that the lung cancer mortality for the total of 21 cohorts of asbestos "trades" workers was 16.7 percent - approximately three times that expected if mortality predictions were based only on the apparent smoking habits.

The risk of lung cancer due to asbestos exposure is lower in non-smokers than in smokers (Saracci, 1977, J. C. McDonald, 1980b). There appears to be no relationship between smoking habits and the incidence of mesothelioma, the disease is equally prevalent in smokers and non-smokers alike. Of the studies listed in Tables 3a and 3b, only Study No. VI of chrysotile factory workers shows a lung cancer mortality that would be expected from the smoking habits alone.

Asbestos miners and millers. Men working in the mining and milling of asbestos ore are generally exposed to only one form of fiber. A few exceptions occur in the mining regions of South Africa where some workers have been employed in crocidolite, amosite, and chrysotile mines. Anthophyllite and tremolite asbestos miners may have been exposed to some chrysotile asbestos, for these minerals can coexist in metamorphosed ultramafic rocks, for example, those of Paakkila, Finland.

Epidemiological studies of asbestos miners and millers who were exposed to only one form of asbestos are useful to understand how the different asbestos minerals affect human health. Table 4 gives the mortality data for the five major epidemiological studies of asbestos miners and millers. In addition three studies are given of miners exposed to cummingtonite and grunerite amphibole dusts and one study of tunnel workers exposed to hornblende amphibole dust. Some classify these amphiboles as asbestos even though they do not possess the physical properties requisite to be valuable commercially. Such a classification has been made in the case of taconite mining by the courts (United States District Court for Minnesota, 380 F. Supp. 11) and by the U.S. Environmental Protection Agency (Reserve Mining vs. EPA, U.S. Court of Appeals Eighth Circuit, March 14, 1975); the latter has sued to prevent the Reserve Mining Company from dumping taconite tailings into Lake Superior because of the perception that these tailings contain "amosite asbestos" and thus constitute a threat to public health. For a complete review of the case see 514 Federal Reporter, 2d Series, 492-542, 1975; 256 North Western Reporter, 2d Series, 808-852, 1977. Of interest regarding this suit are the health studies of the Reserve iron ore miners exposed to cummingtonite and grunerite in the taconite rock (Table 4, Study B) and on the Homestake gold miners exposed to cummingtonite in

Table 4. Mortality from selected causes in the principal epidemiological studies of commercial asbestos miners and millers and other hard rock miners and tunnel workers exposed to rock dust containing minerals sometimes defined as asbestos^{1/}

Cause of Death ^{2/}	Number of Deaths	Study A	B	C	D	E	F	G	H	J	Totals
		480 men 1936-1967	5751 men 1952-1976	932 men 1955-1972	440 men 1960-1973	1321 men 1937-1972	-- 1943-1977	631 men 1946-1975	544 men 1961-1977	10439 men 1910-1975	(excluding Study F)
All causes (000-999)	Observed Expected Obs./Exp.	216	298 344 0.87	294 225 1.30	71 52.9 1.34	631 549.7 1.15	519 600.3 0.86	332 214.4 1.55	178 159.9 1.11	4463	6183
Respiratory cancer (162)	Obs. ± all deaths Exp. Obs./Exp.	21 9.7 12.6 1.67	15 5.0 17.9 0.84	21 7.1 13.5 1.60	10 14.1 ^{3/} 2.7 3.0	16 2.5 16.5 0.97	60 11.6 38.9 1.54	10 3.0 10.4 0.96	28 15.7 11.1 2.5	250 5.6	371 5.7
Mesothelioma, peritoneum, pleura (158,163)	Obs. ± all deaths	0 0	0 0		0 0	17 0.167	17 3.3	17 0.302	1 0.56	105/ 0.27	11 + 27 0.17+0.017
Gastro- intestinal cancer (150-154) or (150-159)	Obs. ± all deaths Exp. Obs./Exp.	7 3.2 14.9 0.47	20 6.7 17.6 1.14	10 3.4 11.13 0.90		39 6.2 35.1 1.11		19 5.7 19.3 0.98	10 5.6 9.5 1.05	168 3.8	273 4.7
Pneumoconiosis (500-519)	Obs. ± all deaths		47/ 1.3	20 6.8	5 7.0	37 5.9	214/ 4.0	20 6.0	30 16.9	466/ 1.0	
Asbestosis (515,2) Obs.		17						9	26		
Silicosis (515,0) Obs.						35					
Respiratory tuberculosis (010-011)	Obs. ± all deaths	36 16.7		11 3.7		79 6.2	4 0.77	18 5.4		248 5.6	
Locality		North Savo, Finland	Minnesota, U.S.A.	Manhattan I. N.Y., U.S.A.	Lead, ND, U.S.A.	Lead, ND, U.S.A.	Wittenoom, W. Australia	Balgiano, Italy	Quebec, Canada	Quebec, Canada	
Type of Mining		asbestos	iron ore	tunneling	gold	gold	asbestos	asbestos	asbestos	asbestos	
Type of Rock		ultramafic	taconite	schist, gneiss, amphibolite	qtz-cumming- tonite schist	qtz-cumming- tonite schist	bañal ironstone	serpentinolite	serpentinolite	serpentinolite	
Suspected mineral pathogen		anthophyllite asbestos	cummingtonite, grunerite, quartz	hornblende, quartz	cummingtonite, hornblende, quartz	cummingtonite, hornblende, quartz	crocidolite asbestos, quartz	chrysotile asbestos	chrysotile asbestos	chrysotile asbestos	
Source		Mourant et al., 1974	Higgins, 1981	Selkoff, 1978	Gillam et al., 1976	McDonald et al., 1978	Webb et al., 1950	Rubino et al., 1979	Nicholson et al., 1979	McDonald et al., 1980	

- 1/ Cummingtonite, grunerite, and hornblende (Studies B, C, D, E) may be defined as "asbestos" in U.S. Federal Regulations
2/ International Classification of Diseases, 8th revision (ICD-8)
3/ Includes one carcinoma of the maxillary sinus and one mediastinal carcinoma (unspecified). See footnote 2/ in text.
4/ Pneumoconiosis Board Records (Western Australia) show pneumoconiosis of mixed type, asbestosis, silico-asbestosis, and
silicosis.
5/ Two mesothelioma victims worked with crocidolite in addition to chrysotile.
6/ Pneumoconiosis is probably predominantly asbestosis since rock dust contains little crystalline silica (quartz, etc.)
7/ "Selected respiratory disease"

the gold-bearing schists (Table 4, Study D, E)^{2/}. Studies B and E show no evidence of asbestos-related diseases appearing in the study groups.

Mortality comparisons, trades vs. mines. The cancer mortality pattern for those in the asbestos trades and mining occupations is graphically presented in Figure 1 where percent lung cancer mortality is plotted with respect to percent mortality due to mesothelioma. The studies of the asbestos trades workers (Tables 3a, 3b; Fig. 1, open stars) show a very significant excess of mortality due to mesothelioma relative to that found in the miners (Table 4, Fig. 1, solid squares) - with one exception, the crocidolite miners of Western Australia (Study F).

In regard to high mesothelioma mortality, it is important to note two health studies of specialized factory workers who, during World War II, were employed at the task of manufacturing asbestos-bearing filter pads and of placing them into gas mask canisters. One study (McDonald and McDonald, 1978) was of Canadian workers who, at three factories, were involved with the manufacture or handling of crocidolite-bearing filter pads. The maximum duration of exposure during the period 1939-1941 was no more than two and a half years. The cohort studied was composed of 93 men and 83 women (Study X, Table 3a). Of the 56 now dead, 8 died of lung cancer (14.3%) and 9 of mesothelioma (16.1%).

The second study (Jones et al., 1976, 1980a) was of a cohort of 951 women who worked either at a factory in Nottingham, England or at a factory in Birmingham, England. The Nottingham group worked for only five months in the years 1939-1940 assembling "civilian filter pads" that contained chrysotile asbestos. The Birmingham group worked for up to four and half years during the period 1940-1944 assembling "military filter pads" that contained crocidolite asbestos. The crocidolite was thought to have come from Wittenoom, Western Australia. The mortality data is given in Table 5. None of those exposed only to chrysotile died of lung cancer or mesothelioma whereas there were 11 lung cancer deaths and 16 mesothelioma deaths among those who worked only with crocidolite. None of the women in either factory, as far as is known, was exposed to asbestos occupationally apart from their wartime work. Dust levels, as with the Canadian gas mask workers, was considered to be very light to moderate.

^{2/}Study E (McDonald et al., 1978) discredits Study D (Gillam et al., 1976). Study D was made on a sub-cohort of the Study E cohort. The latter study is much more complete; statistically it is based on 631 deaths whereas Study D is based on 71 deaths. In addition, Study D presents an implausible mortality pattern: (1) No deaths due to silicosis, tuberculosis, or silico-tuberculosis were reported despite the fact that the mining company has been coping with a quartz dust problem for a century and (2) a 14.1 percent respiratory cancer mortality (incorrectly included as respiratory cancer were a sinus and a mediastinal carcinoma) was attributed to "cummingtonite asbestos" yet no mortality due to asbestosis was reported. The cummingtonite found in the quartz-cummingtonite schist host rock is not asbestos; but rather, garden-variety rock-forming amphibole.

Table 5. Mortality Data (Jones et al., 1980a) for a Cohort of 951 Women* (578 traced) who assembled Asbestos-Bearing Filter Pads in English Factories (1939-1944).

<u>Cause of Death</u>	<u>Observed</u>	<u>% Mortality</u>	<u>Asbestos Exposure</u>
All causes	160	100	Crocidolite and chrysotile
G.I. cancer	10	6.0	---
Other cancer	35	21.1	---
Mesothelioma	16	10.2	Crocidolite only
Mesothelioma	1		Crocidolite and chrysotile
Lung cancer	11	7.2	Crocidolite only
Lung cancer	1		Crocidolite and chrysotile

*727 (139 dead) were exposed to only crocidolite, 102 (10 dead) to only chrysotile, 99 (15 dead) to crocidolite plus chrysotile, and 23 (2 dead) unknown exposure.

To make further comparisons it is useful to examine the mortality with respect to lung cancer and mesothelioma in national populations. In Table 6

Table 6. Cancer mortality in men over 24 years of age for 5 nations (McDonald and McDonald, 1977)

<u>Nation</u>	<u>All Deaths (year)</u>	<u>Lung cancer No. (%)*</u>	<u>Mesothelioma No. (%)*</u>
England-Wales	278,617 (1970)	24913 (8.9)	154 (0.06)
Finland	22,332 (1970)	1586 (7.1)	8 (0.04)
Italy	272,795 (1970)	11867 (4.7)	not reported
U.S.A.	988,620 (1969)	50481 (5.1)	250 (0.03)
Canada	82,052 (1970)	4312 (5.3)	25 (0.03)
Totals	1,624,416	93159 (5.7)	437 (0.03)

*percent of all deaths (proportional mortality)

are given the lung cancer and mesothelioma mortality of all males over 24 years of age in five nations. These data are plotted in Figure 1. We find that the average lung cancer mortality of these five national populations is 5.7 percent, a figure identical to the 5.7 percent average mortality of the miners and tunnel workers (Table 4, excluding crocidolite miners). The mesothelioma mortality of the five national populations is 0.03 percent (Table 6) and is probably significantly underreported because of: (1) the great difficulty in diagnosing this disease, even after autopsy (McDonald and McDonald, 1977, 1980; Vejlsted and Hansen, 1980; Kannerstein and Churg, 1980; Legha and Muggia, 1977) and (2) complications arising in properly and consistently coding this disease for later information retrieval.

It may be more meaningful to compare mesothelioma mortality among asbestos workers and miners, in whom this disease is anticipated, with the mortality in a population where the determinations of the causes of death are based on a large number of autopsies and where asbestos exposure is minimal. A review

has been made by Rüttner (1978) of the deaths in the Zürich area of Switzerland where there are no asbestos mines, mills, or industries and where the cause of death is often determined by autopsy. Among the 28,110 male deaths (all autopsied) from 1961 to 1976, 51 deaths were due to mesothelioma (0.18 percent) and 2466 were due to lung cancer (8.8 percent). Among women (22,583 deaths) 23 were caused by mesothelioma (0.10 percent) and 368 caused by lung cancer (1.6 percent). The proportional mesothelioma mortality for hard-rock miners, tunnel workers, and asbestos miners (other than crocidolite) is 0.17 to 0.20 percent (Table 4). The asbestos trades workers, by contrast, have an average mesothelioma mortality of 5.6 percent (Table 3).

Among the asbestos miners and millers there is no question that those exposed to heavy concentrations of chrysotile and anthophyllite dust over long periods of time have suffered a significant excess mortality due to lung cancer and asbestosis - but not to mesothelioma (Studies A, H, Table 4). The most detailed health study of asbestos miners to date is that of the chrysotile asbestos miners of Quebec (Table 4, Study J). Here, McDonald et al. (1980) have carefully documented the relationship between lung cancer incidence and cumulative dust exposure. The average dust concentrations that the miners and millers experienced during the working day were divided into four categories depending on the work tasks performed during their careers in the mines. These are: low level 2.5 to 4.2 mpcf^{3/}, medium level 4.3 to 9.4, high level 14.4 to 23.6, and very high level 46.8 to 82.6 mpcf. The mean within these four categories in terms of chrysotile fibers per cm³ is: low 10 fibers/cm³, medium 21 fibers/cm³, high 95 fibers/cm³, and very high 194 fibers/cm³. For the men exposed for over 20 years (see Table 17, column A) in the low and medium dust categories (averaging 6.6 mpcf or approximately 20 fibers/cm³) total mortality was less than expected (SMR = 0.94). For these men there was a slight risk of excess lung cancer (SMR = 1.15) and respiratory tuberculosis (SMR = 1.14). As exposures of 20 fibers/cm³ are an order of magnitude higher than that experienced now (dust levels for the past few years have been maintained at less than 2 fibers/cm³), miners working a lifetime under the present dust levels are not expected to present any significant health problems relative to those in other mining industries (Liddell, 1981).

McDonald et al. (1980) have also studied the health statistics of a cohort of 440 women who also worked in the Quebec chrysotile asbestos mines and mills. Of the 84 who have died there was one death due to lung cancer and one due to mesothelioma.

^{3/}mpcf = millions of particles of rock dust per cubic foot. Conversions of this figure into asbestos fibers per cubic centimeter, the usual measurement for industrial hygiene monitoring, is difficult but an approximate and conservatively small figure is: 1 mpcf = 3 fibers/cm³ (McDonald et al., 1980, p. 21, 23; see also McDonald and Becklake 1976).

Crocidolite exposure. There are persuasive data, many already surveyed, which show that crocidolite asbestos is much more hazardous than chrysotile, anthophyllite, and amosite. Of the mining populations of the world, only those in the crocidolite mining areas of the Cape Province of South Africa and at Wittenoon Gorge, Western Australia have a statistically significant increase in mortality due to mesothelioma. Also, mesothelioma deaths have been reported among the residents of these areas who are not employed in the mines or mills. For example, Webster (1978) reports that the South African Asbestos Tumour Reference Panel placed 712 cases of mesothelioma on the register, which included all the known cases since 1956. Of these occupational and environmental background was established for 420 cases. Actual mining exposure accounted for 139 of the 420 cases of which 120 were in connection with Cape crocidolite mining and two with Transvaal crocidolite mining. There were only four mesothelioma cases in those associated with amosite mining and two of these had been exposed to Cape crocidolite as well. In the chrysotile mining industry there was only one case - a miner from Rhodesia. Of the 100 environmental cases (those not employed in any occupation where asbestos is used) 93 had been exposed to Cape crocidolite, two to Transvaal crocidolite, and one possibly to amosite.

Additional prevalence studies in the Cape Province (Talent et al., 1980) discovered 65 active cases of mesothelioma in people who had presented themselves for medical examination. Fifteen of these cases appeared in two groups, numbering 755 and 947 individuals, who were once employed in the crocidolite mines. An additional thirty eight mesothelioma cases appeared in a survey of certain patients at the St. Michael's Hospital in Kuruman, Cape Province, who were not responding to treatment for suspected pulmonary tuberculosis. Fourteen of these mesothelioma patients were known to have worked in the crocidolite asbestos mines. Lastly, 12 of the 65 cases appeared in a medical survey of 53 females who, in the past, hand-cobbed crocidolite asbestos.

In contrast to the prevalence of mesothelioma in the Cape Province, this disease is very rare in the Transvaal where all of the world's amosite is mined. Wagner et al. (1960), in regard to their initial discovery of the association of crocidolite asbestos with mesothelioma, state (p.260) "the tumour (referring to mesothelioma) is rarely encountered elsewhere in South Africa. During the past five years, with the exception of the present series (in Cape Province), no neoplasm of this nature has been diagnosed amongst 10,000 lungs examined at the Pneumoconiosis Bureau in Johannesburg, or in the Pathology Department of the South African Institute for Medical Research."

The incidence of mesothelioma in Zimbabwe (Rhodesia), a country which is a major producer of chrysotile but mines no other form of asbestos, is very low. In a communication to Mostert and Meintjes (1979), the Secretary of the Rhodesia Pneumoconiosis Board stated that no cases of mesothelioma were reported in the mining industry. It is of interest to note that two cases of mesothelioma were reported in the Rhodesian railway industry, a locomotive engineer and a storeman. The locomotives were insulated with crocidolite asbestos to which these two men were exposed (Mostert and Meintjes, 1979). Cochrane and Webster (1978) report 12 cases of mesothelioma in men employed as insulators in the locomotive workshops of the South African Railways.

The prevalence of mesothelioma among the miners of Wittenoon Gorge has been discussed (Table 4, Study F). The town of Wittenoon, the center of crocidolite mining in Western Australia, reached a peak population of about 1,000 in the 1960's. At present the population is down to about 200 and the West Australian State Government has suggested the closing of the town and evacuation of the residents because of continuing risks of airborne asbestos dust (Chemical Week, December 8, 1978, p. 25). The risk of mesothelioma among the residents of the town who were not employed by mines is demonstrated by the case of a 27-year-old woman who had an environmental childhood exposure to crocidolite (Langlois et al., 1978).

Effects of Non-occupational Exposure to Asbestos

It is difficult to assess the health effects of non-occupational exposure to asbestos, for cohorts are hard to define, exposure levels are usually low, and any excess of lung cancer is disguised by the strong association of this disease with cigarette smoking. To study the non-occupationally exposed, epidemiologists are thus constrained to look for increased incidence of asbestosis and particularly mesothelioma in two types of cohorts; those who live in neighborhoods surrounding asbestos factories, mills, or mines and those who live within the household of an asbestos worker who presumably carried asbestos dust back to the home on his or her clothing.

Background incidence of mesothelioma. There appears to be a definite "background" mortality due to mesothelioma that is not related to asbestos exposure. McDonald and McDonald (1977), reviewed 4539 fatal mesothelioma cases reported from 22 countries between 1959 and 1976. They found that for 923 of the 2453 cases where a history had been recorded a definite or probable exposure to asbestos could not be shown. More recently, Jones and Silver (1979) report eight cases with no environmental exposure, Brenner et al. (1981a) report of 25 patients entering Memorial Hospital, N.Y. since 1950 with no exposure history, Brenner et al. (1981b) report of seven children dying of mesothelioma who had no exposure history to asbestos, and Griffiths et al. (1980) report on 10 mesothelioma patients with no history of exposure to asbestos who entered Austin Hospital, Melbourne, Australia.

A possible genetic basis for some mesothelioma incidence is suggested by Risberg et al. (1980) in their report of five deaths due to mesothelioma within a single family; the father, 3 sons, and a daughter. Four of the five had worked in the building industry where random exposure to asbestos containing products could have occurred. They lived in a town of 100,000 inhabitants which had no asbestos industry in the vicinity.

An estimate of mesothelioma mortality not related to exposure to asbestos can be obtained from the data given by McDonald and McDonald (1980). Ascertainment, through 7,400 pathologists, of all fatal malignant mesothelioma tumors in Canada (1960-1975) and in the U.S.A. (1972) was made. The pathology review panel accepted 73 and 65 percent of the U.S. and Canadian cases, respectively. Occupational histories indicate that 50 percent of the male and five percent of the female deaths could be attributed

to asbestos exposure. Thus, in the United States in 1972, there were 2-3 cases of mesothelioma reported (189 male, 56 female) and of these, 140 male and 39 female cases are accepted. Assuming a 30 percent underreporting (McDonald and McDonald, 1980, p. 1655), the 1972 incidence in the U.S. is approximately 200 male and 56 female deaths. Of these, about 100 male and 3 female mesothelioma deaths can be attributed to asbestos exposure; the remaining 153 deaths to other causes or background. If these figures are reasonably correct, then the mesothelioma proportional mortality due to "background" in 1972 was 0.008 percent (153 deaths out of 1,963,944). The mesothelioma death rate due to background in 1972 is calculated to be 0.7 deaths per million U.S. population. The study of McDonald and McDonald (1980, see also McDonald, 1979) indicate that the Canadian mesothelioma death rates are very similar to those in the U.S.

Asbestos-related disease in residential areas. The residents of areas where there are asbestos factories, mines or mills may contract asbestos-related diseases even though they are not actually employed in the asbestos industry. The high prevalence of mesothelioma among residents of the crocidolite mining areas of the Cape Province of South Africa has already been discussed. The appearance of 93 mesothelioma deaths among those non-occupationally exposed to Cape crocidolite is in extreme contrast to the rarity of this disease in the amosite mining regions of the Transvaal Province where only one possible case has been reported (Webster, 1978).

Asbestos-related disease among residents of chrysotile mining areas is rare. Theriault and Grand-Bois (1978) report the following mesothelioma mortality in Quebec Province: (1) asbestos-producing regions (observed 2, expected 1.3), (2) areas surrounding the asbestos producing regions (obs. 5, exp. 4.8), (3) other rural regions of Quebec (obs. 12, exp. 32.4), (4) city of Quebec (obs. 7, exp. 4.7), and (5) city of Montreal (obs. 42, exp. 24.4).

McDonald (1980a) has reviewed all known fatal mesothelioma cases in Quebec Province for the period 1960-1978. Of the total of 254 cases registered, 181 were males, 73 females. Occupational and residential histories were obtained from 91% of the men and 36% of the women. About 40% of the male cases and 5.4% of the female cases were attributed to occupational exposure to some form of asbestos. Twenty one cases were individuals who at some time had been employed in the chrysotile mining and milling industry. But 5 of these 21 had been exposed to crocidolite while manufacturing filter pads for gas masks and 2 more possibly exposed to crocidolite in one of the mills, which for about two years processed crocidolite fiber for the gas mask filters. In addition to these 21 cases there were four daughters and two sons of chrysotile miners or millers who died of mesothelioma. Apart from these cases McDonald (1980a) reports of only two persons who died of this disease who lived within 20 miles of the chrysotile mines and mills of Quebec.

Pampalon (1980) reported on the mortality patterns of the Quebec asbestos mining towns of Thetford Mines (population approximately 20,000) and Asbestos (population approximately 10,000). Cancer mortality among the female residents of these towns is particularly informative since very few were employed in the asbestos industry. However, they did receive over

much of their lifetime very heavy non-occupational exposures to chrysotile asbestos contained in the rock dusts emitted from the operation of the nearby mines and mills.^{4/} The mortality data for the female residents of Asbestos and Thetford Mines is given in Table 7 (see also Tables 8 and 9).

Table 7. Mortality Data for Women Living in Quebec Asbestos Mining Towns for the Period 1966 to 1977 (Pampalon, 1979).

<u>Cause of death</u>	<u>Observed</u>	<u>Expected</u>	<u>Excess (Deficiency)</u>
all causes	1225	1356	(131)
all cancer	292	321	(29)
lung cancer	23	23	0
G.I. cancer	97	91	6
resp. disease	35	58	(23)

Another cancer mortality survey of various regions in Quebec was made by Graham (1981). His data, summarized in Table 8, show the rates for various cancers that may be associated with exposure to asbestos dusts for five regions; asbestos mining counties, counties surrounding the asbestos counties, other rural counties, and the cities of Quebec and Montreal. The rates for the asbestos mining counties, which contain the large semi-industrialized towns of Thetford Mines and Asbestos, are intermediate between the rural counties ("other rural" and "peripheral") and the cities of Quebec and Montreal. This is to be expected for cancer rates are highly correlated with the interrelated factors, (1) degree of urbanization, (2) socioeconomic class, and (3) "lifestyle" (Doll and Peto, 1981; Goldsmith, 1980; Higginson and Muir, 1979; Higginson, 1980; Weisberger, 1978; Gori, 1979; Wynder, 1980). Graham (1981) states that the rates for cancers of

^{4/}Even in 1974 and 1975, when rock dust levels at the Quebec asbestos mines and mills had been much reduced from levels as high as 200 million particles per cubic foot (ppcf) in the early 1950's to less than 7 million ppcf in the mid-1970's (McDonald and Becklake, 1976), the rock dust in the ambient air over the town of Thetford mines averaged 80,000 ng/m³ when the mines and mills were in operation and 40,000 ng/m³ when the mining operations were shut down during the strike of April to September, 1975 (Brulotte, 1976). When the mines were operating, the average weight of dust falling daily over the town was 377 kg/km². Recent measurements by Gibbs, Rowlands, and Brulotte (Air Pollution Control Assoc., 1980) of dust in the ambient air of the towns of Thetford Mines and Black Lake show a chrysotile asbestos content of 160 to 11,000 ng/m³ - a considerable environmental exposure even in these better times. In this regard, it is pertinent to cite the work of Nicholson et al. (1980) who analyzed the chrysotile fiber content in the air in houses located in two chrysotile mining districts (Copperopolis, California and Baie Verte, Newfoundland). The 13 air samples taken in homes of chrysotile miners and millers show the following chrysotile content: 4 (50-100 ng/m³), 4 (100-200 ng/m³), 2 (200-500 ng/m³), 2 (500-1000 ng/m³), and 1 (2000-5000 ng/m³). Three samples taken in houses of non-miners in Baie Verte gave concentrations of 32, 45, and 65 ng/m³.

Table 8. Cancer mortality rates (deaths per 100,000 residents) for various geographic localities in Quebec Province and for Upper New York State. Annual average for the period 1969-1973 (Graham, 1981).

Region	Asbestos-mining counties	Peripheral rural counties	Other rural counties	Montreal	Quebec City	All Quebec Province	Upper NY State
<u>MALES</u>							
Lung	33.59	23.71	27.29	48.67	50.53	43.70	59.02
Pleura	1.02	0.28	0.13	0.51	0.20	Not given	Not given
Peritoneum	0.64	0.37	0.32	0.80	0.60	1.48	1.30
Stomach	16.00	12.54	12.61	12.38	18.01	17.74	11.99
Esophagus	2.42	1.38	1.94	3.93	3.56	3.17	4.71
Small Int.	1.11	0.58	0.32	0.68	0.95	0.64	0.78
Large Int.	15.05	13.43	10.92	18.69	20.79	18.11	27.11
Rectum	7.48	10.58	9.99	12.84	14.30	13.55	16.28
	77.31	62.87	63.52	98.5	108.94	98.39	120.41
<u>FEMALES</u>							
Lung	4.39	4.64	3.87	8.70	6.96		
Pleura	0.35	0.20	0.10	0.18	0.18		
Peritoneum	0	0.78	0.53	0.75	1.51		
Stomach	9.34	7.14	6.40	7.51	8.98		
Esophagus	1.04	0.40	0.76	1.23	1.26		
Small Int.	0.38	0.68	0.32	0.65	1.16		
Large Int.	18.75	17.74	15.36	22.64	21.89		
Rectum	10.86	8.78	8.24	9.51	11.26		
	45.11	40.36	35.58	51.17	53.2		

1/Only those cancers known to be associated with excess mortality in asbestos trades workers are listed.

the pleura^{5/}, peritoneum^{5/}, lip, tongue, salivary gland and small intestine^{5/} in males and of the pleura^{5/}, lip^{5/}, kidney, salivary gland and melanoma in females, are in excess^{5/} in the asbestos mining counties. Graham (1981, p. 40) further states that cancer of the colon, stomach, and lung were "at a level so low as to be unimpressive." These are cancers known to be excess in many cohorts of asbestos trades workers (Table 3a, 3b). The low cancer rates found in the asbestos mining localities are not surprising for McDonald et al. (1980, p. 12) report that during the five decades, 1926-1975, 4350 male Quebec asbestos miners and millers died compared to 4107 expected on the basis of Quebec age-and-year specific death rates, giving a standardized mortality ratio (SMR) of 1.06.

It should also be noted that the residents of Thetford Mines and Asbestos, Quebec used drinking water that contained very high concentrations of chrysotile asbestos, ranging from 172 million to 1.3 billion fibers per liter (Wigle, 1977). No evidence of excess cancer mortality could be attributed to asbestos in the drinking water of these towns (Wigle, 1977).^{6/}

Toft et al. (1981) expanded on the study of Wigle (1977) by comparing mortality data from 71 municipalities to the amount of asbestos in the drinking water. Particularly informative are the death rates of the female residents of Thetford Mines relative to the rates found in women who lived in 52 other localities that had very little asbestos in the drinking water. Most of the women of Thetford Mines did not work in the asbestos industry, but they did receive heavy non-occupational exposure to chrysotile asbestos carried in the air and water. Death-rate comparisons (Table 9) indicate that the women of Thetford Mines have not been effected by exposure to chrysotile asbestos.

^{5/}A total of 1 to 3 deaths for these cancers were reported for the five year period 1969-1973. The statistical significance of such small numbers is questioned.

^{6/}In regard to ingestion of asbestos and cancer incidence, a number of animal studies are now complete (Donham et al., 1980); Hallenbeck et al., 1981; Hilding et al., 1981; Smith et al., 1980; DHHS, 1981a; DHHS, 1981b). None of these studies show any evidence that ingestion of asbestos causes tumors in animals. Hallenbeck et al. (1981, p. 349) state, "the results of this study (a baboon gavage with commercial asbestos) indicate that asbestos fibers do not penetrate the gastrointestinal tract of the baboon and migrate to various tissue."

Table 9. Age-adjusted Mortality Rates (per 100,000 Residents) for Females (age 25-69), Ioff et al. (1981).

<u>Cause of Death</u>	<u>Thetford Mines^{1/}</u>	<u>52 Comparison Localities^{2/}</u>
all causes	420	433
all cancer	138	158
lung cancer	8.5	13.4
G.I. tract cancer	42.2	41.5
respiratory system ^{3/}	8.9	16.9

^{1/}Treated water, 110-150 million chrysotile fibers per liter.

^{2/}All localities contained less than 5 million fibers per liter of water.

^{3/}non-neoplastic

Hammond et al. (1979) have given mortality statistics for the residents in the neighborhood of Riverside which surrounds the Patterson, New Jersey amosite asbestos factory. The mortality experience of the workers in this factory is given in Table 3b, Study XIX. The mortality data of Riverside is statistically indistinguishable from that of the control community of Totowa, N.J., situated several miles from the amosite factory (Table 10). One mesothelioma death occurred in Riverside in 1966 but none since.

Table 10. Cancer Mortality Data for Riverside and Totowa, New Jersey for the Period 1962-1976 (Hammond et al., 1979)

<u>Cause of Death</u>	<u>Riverside^{1/}</u>		<u>Totowa^{2/}</u>	
	<u>No.</u>	<u>% Mortality</u>	<u>No.</u>	<u>% Mortality</u>
all causes	780	100.00	1735	100.00
all cancer	163	20.90	353	20.35
lung cancer	41	5.26	98	5.65
colon-rectal cancer	24	3.07	74	4.27
stomach cancer	9	1.15	22	1.27
esophageal cancer	4	0.51	12	0.69

^{1/}Neighborhood near amosite asbestos factory

^{2/}Control neighborhood

Asbestos-related diseases in households of asbestos workers. There are a number of reports of mesothelioma occurring in individuals who, though not occupationally exposed to asbestos, lived in households which included an asbestos worker. Epler et al. (1980, p. 236) summarizes 14 published reports of 43 such mesothelioma cases plus four more found in their own study. Antman et al., (1980) mention 3 more and Vianna and Polen (1978) report on 1 female patients who lived with husbands or fathers employed in asbestos-utilizing occupations. It is difficult, perhaps impossible, to define retrospectively what kinds of asbestos was causing the mesothelioma

in these household contacts, but it is most probable that the workers handled more than one kind of asbestos. The report of Newhouse (1981, see also Newhouse and Thompson, 1965) may enlighten us on this subject. She reports that 11 individuals who died of mesothelioma and had neither worked with asbestos nor had a relative who worked with asbestos all had lived in the immediate vicinity of a factory that was a heavy user of crocidolite asbestos.

ESTIMATES OF MORTALITY IN THE UNITED STATES DUE TO EXPOSURE TO ASBESTOS

Previous Estimates

On September 11, 1978, Joseph A. Califano, then Secretary of the U. S. Department of Health, Education and Welfare, gave a major speech at the AFL-CIO National Conference on Occupational Safety and Health in which he described how the Federal Government was assisting in discovering and preventing occupational disease. One of his statements was that 17 percent of all cancer deaths in the United States each year for the next 30 to 35 years will be associated with previous exposure to asbestos. This translated into 57,000 cancer deaths per year due to asbestos (NCI, NIEHS Press Release, Draft Summary, Sept. 11, 1978). The Califano speech was based upon an unpublished document (Bridbord et al., 1978) prepared by several medical scientists at three of the National Institutes of Health (NCI, NIOSH, NIEHS). Doll and Peto (1981) have reviewed this document and state (p. 1240) "However, these estimates of total risk were so grossly in error that no arguments based even loosely on them should be taken seriously;" see also, Doll and Peto (1981, p. 1241, 1305-1308).

On January 15, 1980, Dr. Irving Selikoff of the Mt. Sinai School of Medicine, New York City, stated at a press conference in conjunction with the annual AMA meeting in Chicago, that 20,000 U.S. asbestos workers will die each year for the next 40 years of "excess disease" (see J. Am. Med. Assoc., vol. 243, p. 211, Jan. 18, 1980). On September 27, 1981, through a press release to Robert Locke (Associated Press Wire Service), Dr. Selikoff stated that 10,000 American workers are dying each year because of asbestos exposure. Dr. Selikoff does not state upon what data he bases these two estimates.

Hogan and Hoel (1981) estimate (p. 74) that future excess cancer deaths among U.S. workers exposed to asbestos could constitute as much as 3.0 percent (range 1.4-4.4%) of an estimated annual cancer death toll of 400,000 persons - or 12,000 asbestos-related cancer deaths per year. These authors based their estimates on an analysis of the number of people possibly exposed to asbestos, possible exposure levels, and estimated exposure-associated cancer risk.

In the above paragraphs, future mortality projections of 57,000, 20,000, 10,000 and 12,000 deaths per year due to asbestos exposure are quoted. Are any of these predictions correct? In the following, a method is proposed of estimating past asbestos-related mortality which can be used to predict future mortality.

Past Mortality Based on Asbestosis Incidence

The number of deaths due to asbestosis reported in the Vital Statistics of the United States (vol. II - Mortality, U.S. Dept. of Health and Human Services, National Center for Health Statistics) for the whole nation for the 11 year period 1967-1977 is: 1967(36 deaths), 1968(29), 1969(34), 1970(26), 1971(33), 1972(58), 1973(42), 1974(35), 1975(45), 1976 (54), and 1977 (55). The average number of asbestosis deaths per year for the period 1967-1977 is 41 with a high of 58 in 1972 and a low of 26 in 1970.

If it is known how many die from asbestosis each year then the total yearly asbestos-related deaths can be estimated from major epidemiological studies of asbestos workers. One of the largest such studies is of the 17,800 North American insulation workers (Selikoff et al., 1979a). This group, of which 2271 are now dead is one of the most severely effected by asbestos dusts. The mortality data and estimates of "excess" death due to asbestos is given in Table 11 (see also Table 3b, Study XVII).

Table 11. Mortality Among 17,800 Insulation Workers (Selikoff et al., 1979a)

<u>Cause of death</u>	<u>Expected</u>	<u>Observed(BE)*</u>	<u>Excess</u>
all causes	1659	2271	612
all cancer	320	995	675
mesothelioma	-	175	175
lung cancer	106	436	330
G.I. cancer	59	99	40
other cancer	155	235	80
Asbestosis	-	168	168
Non-infectious Respiratory disease	59	212	153

*BE-Best Estimate

If the asbestosis deaths given in the Vital Statistics are underreported by the same amount as observed by Selikoff et al. (1979, p. 103, Best Estimate (168)/Death Certificate (78) = 2.15), the average number of asbestosis deaths each year during the period 1967 to 1977 is 41×2.15 or 88. Using disease ratios taken from Table 11 (asbestosis/excess cancer, asbestosis/excess respiratory disease), the average annual asbestos-related mortality in the United States for the period 1967 to 1977 is estimated to be 522 deaths, including 354 cancer deaths (Table 12).

Table 12. Average Yearly Mortality due to Asbestos (1967-1977)
Based on U.S. Recorded Asbestosis Deaths

Mesothelioma	92
Lung cancer	199
G.I. cancer	21
Other cancer	42
Asbestosis	83
Non-infectious resp. disease	80
Total asbestos-related deaths per year	522

Past Mortality Based on the 1972 Mesothelioma Incidence

It is not possible to obtain accurate mortality data for mesothelioma from the Vital Statistics of the United States for this disease is coded (ICD-9) with a number of other neoplasms under the headings: malignant neoplasms of peritoneum and retroperitoneal tissue (158.0, 158.9) and malignant neoplasms of other and unspecified respiratory organs; pleura (163.0), mediastinum (163.1), and site unspecified (163.9). Also, as pointed out previously, mesothelioma is a difficult disease to diagnose. These difficulties in coding and diagnosis make it necessary that national mortality estimates be made on decisions of mesothelioma review panels such as those described by McDonald (1979), Kannerstein et al. (1979), McDonald and McDonald (1980), and Jones et al. (1980b).

The mesothelioma study of McDonald and McDonald (1980) can be used to estimate the excess asbestos-related mortality. Their data, as described above, indicates that approximately 103 mesothelioma deaths in the United States in 1972 can be attributed to exposure to asbestos. Again, using the mortality data of Selikoff et al. (1979a) listed in Table 11 to calculate disease ratios (mesothelioma/excess other cancers, mesothelioma/asbestosis, mesothelioma/excess respiratory disease), the number of asbestos-related deaths in the United States in 1972 is estimated to be 587 of which 398 are due to cancer (Table 13).

Table 13. Mortality due to Asbestos in 1972 Based on Estimated Mesothelioma Deaths of McDonald and McDonald, 1980

Mesothelioma	103
Lung cancer	224
G.I. cancer	24
Other cancer	47
Asbestosis	99
Non-infectious resp. disease	90
Total asbestos-related deaths in 1972	587

In order to obtain a sense of perspective, it is useful to compare the death estimates obtained above for asbestos-related disease (522 and 587 deaths per year) to mortality from other types of industrial dusts, such as those of silica and coal. The Vital Statistics of the U.S. report that there were 215 silicosis deaths (ICD.8, 515.0) and 92 silicotuberculosis deaths (ICD.8, 010) in 1976. If it is assumed that mortality due to silicosis and asbestosis are equally underreported by a factor of 2.15 (Selikoff et al., 1979a, p. 103) and that the ratio of silicosis to excess non-infectious respiratory disease mortality is the same as the ratio of asbestosis to excess non-infectious respiratory disease, then the silica-related mortality for the United States in 1976 is estimated to total 975 deaths (Table 14).

Table 14. Estimated Mortality in 1976 due to Silica Dust

Silicosis	462
Silicotuberculosis	92
<u>Non-infectious resp. disease</u>	<u>421</u>
 Total silica-related deaths in 1976	 975

In 1976, there were 879 reported deaths due to anthracosilicosis (ICD.8, 515.1, Vital Statistics of the U.S.). Underreporting and other excess respiratory disease may have also occurred in coal miners who have suffered the "black lung" diseases.

These estimates of past asbestos-related mortality indicate that there will be nowhere near 10,000 deaths per year in the future. Asbestos-related mortality should peak between 1980 and 1985, 35 to 40 years after the large World War II shipyard employment. Linear regression analysis of past mortality (Vital Statistics of the U.S.) due to asbestosis (515.2, males and females, 1967-1977) and "pleural neoplasms" (163.0, males^{1/1}, 1968-1977) suggests that there has been an increase in the number of deaths with time. Calculated mortality for various years is given in Table 15. The variance (r^2) of the regression line is 0.49 for asbestosis and 0.31 for "pleural neoplasms." If this apparent increase in mortality is real and continues, then the calculated mortality for asbestosis given in Table 15 predicts that a total of 1337 asbestos-related deaths will occur in the year 2000 (calculation by the method given previously). Hopefully, asbestos-related mortality is now peaking and will soon decline.

^{1/1}A significant number of male mesothelioma cases will probably be reported under this code (163.0) thus a trend in this mortality may reflect a trend in total asbestos-related mortality.

Table 15. Calculated mortality based on linear regression analysis of past reported mortality - asbestosis (males + females, 1967-1977) and "pleural neoplasms" (males, 1968-1977) - Vital Statistics of the U.S., 1967-1977.

<u>Year</u>	<u>Asbestosis (males & females)</u>	<u>"Pleural Neoplasms"(males)</u>
1967	27 deaths	184 deaths
1977	52	222
1982	64	241
2000	105	308

In regard to mesothelioma incidence, it is pertinent to note the number of deaths from this disease in the four hospitals of the New York University Medical Center. The reported deaths for the period 1967 to 1976 are (Demopoulos, 1980a): 1967(3 deaths), 1968(2), 1969(3), 1970(4), 1971(1), 1972(2), 1973(1), 1974(3), 1975(4), and 1976(3). No significant trend with time is noted ($r^2 = 0.01$). Sprayed-on chrysotile asbestos was extensively used in building construction in New York City until recently. Also, chrysotile asbestos emissions from brake linings give measurable fiber counts in the ambient air of the New York City streets. For example, Nicholson et al. (1980) report that 43 of the 89 air samples collected in New York City exceeded 50 ng of chrysotile asbestos per m^3 . Samples taken in New York City public schools ranged from 9 to 1950 ng/ m^3 with 15 out of 27 samples exceeding 100 ng of chrysotile per m^3 . Despite the long presence of chrysotile asbestos in the New York City air, Demopoulos (1980b) found no evidence of an increase in the number of mesothelioma deaths in this city over the past 12 years (1967-1978). Vianna et al. (1981) in a study of malignant mesothelioma in New York State (excluding New York City) found that there was no increase in the incidence of disease from 1973 through 1978.

SUMMARY

Asbestos Production

Of the six forms of asbestos, only four have been used to any significant extent in commerce. These are amosite, crocidolite, anthophyllite, and chrysotile. Although asbestos was used by Stone Age man it was not until the latter part of the 19th century that it came into widespread use in the industrialized world. The modern industry began in Italy and England after 1860, with Quebec being the main supplier of the crude fiber. By 1980, more than 100 million tonnes of asbestos had been mined worldwide of which more than 90 million tonnes was the chrysotile variety, about 2.7 million tonnes the crocidolite variety, about 2.2 million tonnes the amosite variety, and about 0.4 million tonnes the anthophyllite variety. Approximately 75 percent of all asbestos ever mined has come from just three chrysotile mining localities, Quebec, Canada and the central and southern Urals of the Soviet Union. The chrysotile-producing countries in order of importance are: the Soviet Union (46.1 percent of the world's total asbestos production in 1978), Canada (28.9%), Zimbabwe (3.8%), China (3.8%), Italy (2.9%), South Africa (2.1%), Brazil (1.3%), U.S.A. (1.7%), and Australia (1.0%).

Comparative Epidemiology

The three principal diseases which are related to asbestos exposure are: (1) lung cancer, (2) cancer of the pleural and peritoneal membranes (mesothelioma), and (3) asbestosis, a condition in which the lung tissue becomes fibrous and thus loses its ability to function. These diseases, however, are not equally prevalent in the various groups of asbestos workers that have been studied; the amount and type of disease depends on the duration of exposure, on the intensity of exposure, and particularly on the type or types of asbestos to which the individual was in contact.

Chrysotile or "white" asbestos. Chrysotile asbestos, sometimes referred to in the trade as "white" asbestos, is the form that is usually used in the United States - as wall coatings, in brake linings, as pipe insulation, etc. About 95 percent of the asbestos in place in the U.S. is the chrysotile variety and a large percentage of this was mined and milled in Quebec. Epidemiological studies of the chrysotile asbestos miners and millers of Quebec undertaken by medical researchers in Canada show that for men exposed for more than 20 years to chrysotile dust averaging 20 fibers/cm³ the total mortality was less than expected (620 observed deaths, 659 expected deaths). Risk to lung cancer was slightly increased; 48 deaths observed, 42 deaths expected (Table 17, column A). Exposures to 20 fibers/cm³ are an order of magnitude greater than those experienced now (generally less than 2 fibers/cm³); thus chrysotile miners working a lifetime under these present dust levels should not be expected to suffer any measurable excess cancer. A similar mortality picture is reported for Italian chrysotile miners and millers (Study G, Table 4).

The results of only one epidemiological study of a cohort of trades workers known to be exposed only to chrysotile asbestos been published (Study VI, Table 3a). This study reports 2 deaths due to asbestosis but no excess of any cancer was detected.

Mesothelioma incidence among those working only with chrysotile asbestos is very low. Thus far, about 16 deaths due to this disease have been reported among chrysotile asbestos miners and millers and none among chrysotile trades workers.^{3/} In addition, 6 deaths among sons and daughters of chrysotile miners and millers and two among others living in chrysotile asbestos mining localities have been reported as being due to mesothelioma.

Four epidemiological studies of the female residents of the Quebec chrysotile mining localities show no statistically significant evidence that their life-long exposure to asbestos dust from the nearby mines and mills has caused excess disease.

Crocidolite or "blue" asbestos. Crocidolite, usually referred to in the trade as "blue" asbestos, was first imported into the United States in 1911 or 1912. By 1930, 35,000 short tons of crude blue fiber had entered the country and by 1946 an additional 21,000 tons were imported. In addition to these imports, much crocidolite came into the United States as manufactured products such as yarns, tapes, and pipe coverings. Almost all of the imported crocidolite came from South Africa.

Epidemiological studies of groups who worked only with crocidolite asbestos show that rather short periods of exposure, or even relatively light exposure, causes a large excess of mortality due to lung cancer, mesothelioma, and asbestosis. This is evident not only in those exposed to crocidolite during gas mask fabrication and building construction but in those employed in the crocidolite mines.

There are only two mining regions in the world where mesothelioma is a statistically significant cause of death. These are the crocidolite mining districts of the Cape Province, South Africa and at Wittenoom, Western Australia. Prevalence studies in the Cape Province report that at least 278 people have died of mesothelioma as a result of exposure to crocidolite; 161 of these people worked in the mines and mills and 117 others lived in the vicinity of the mines.

Thirty-one men who worked in the crocidolite industry at Wittenoom, Western Australia have died of mesothelioma. Of these, 13 had worked for less than 12 months and 9 had light to medium exposure to blue asbestos. Sixty miners and millers at Wittenoom have died of lung cancer; 34 of these men had worked in the industry for less than 12 months and 19 had light to medium exposure to the crocidolite dust. In addition to this occupationally related mortality, 6 others who lived near but did not work in the mines or mills have died of mesothelioma.

Amosite or "brown" asbestos. All amosite asbestos comes from the Transvaal Province of South Africa where between 1977 and 1979 approximately

^{3/}Acheson et al. (1981, p. 1405) cite two new studies (in press) of asbestos trades workers thought to have been exposed to only chrysotile which confirm the rarity of mesothelioma associated with chrysotile.

2.2 million tonnes have been mined. Importation of amosite into the U.S. started in the 1930's.

One complete epidemiological study of trades workers exposed mainly to amosite asbestos has been published. The incidence of asbestos-associated disease in this group of men formerly employed at a factory in Patterson, N.J. was excessive; there being a 19.7% lung cancer mortality (60 cases), a 4.6% mesothelioma mortality (14 cases), and a 5.9% asbestosis mortality (13 cases). An additional study, only partially published, reports on a group of workers exposed mostly to amosite in a London insulation board factory. Here 5 men have thus far died of mesothelioma (Acheson et al., 1981). Only prevalence studies have been made of amosite miners and millers. Two have died of mesothelioma. One resident of an amosite mining district has been reported as having died of this disease.

The rock-forming amphibole minerals grunerite and cummingtonite, which are isostructural and chemically similar to amosite, are considered (incorrectly) by some to be forms of asbestos. Health studies of miners working ores which contain these minerals as gangue do not show any indication of asbestos-related mortality (studies B,E, Table 4).

Anthophyllite asbestos. This form of asbestos has been mined sporadically in many localities but the only major production was at Paakkila, Finland where approximately 350,000 tonnes was mined between 1918 and 1975. The only health study of individuals exposed predominantly to anthophyllite asbestos is that of the Paakkila miners (Study A, Table 4). This group showed a 67% excess of lung cancer and a large mortality due to tuberculosis and asbestosis. None died of mesothelioma. Because anthophyllite was and is used so little in commerce no additional health studies appear possible except for follow-up of the Paakkila miners.

Comparison of health effects of white, blue, and brown asbestos.

There is a large contrast in the incidence of mesothelioma among those who were exposed to only one form of the three commonly used asbestos minerals - chrysotile, crocidolite, and amosite. This is demonstrated by comparing the total asbestos production to the number of mesothelioma deaths reported in the literature for miners, millers, and residents of four major asbestos mining localities. The pertinent data are given in Table 16. The difference between mesothelioma mortality reported in the chrysotile mining district and that reported in the crocidolite and amosite mining districts may be even greater than indicated in Table 16. This is because asbestos-related mortality is probably much underreported in Western Australia and South Africa due to the transient nature of the mining populations where many are lost from view. Quebec, on the other hand, has a very stable mining and residential population, the medical surveillance of which has been excellent.

Table 16. Mesothelioma Mortality^{1/} in Four Asbestos Mining Districts
Relative to Asbestos Production

	Quebec Canada	Western Australia	Cape Province South Africa	Transvaal Prov. South Africa
Asbestos type	chrysotile	crocidolite	crocidolite	amosite
Tonnes mined	40,000,000	155,000	2,700,000	2,200,000
Years mined	1373-Pres.	1938-1966	1893-Pres.	1917-Pres.
No. deaths (mesothelioma)	22 ^{2/}	37	278	33 ^{3/}
deaths/100,000 tonnes mined	0.06	23.9	10.3	0.14

^{1/}Reported in the scientific literature up to 1979 for miners, millers and other residents of the mining districts

^{2/}Excludes 7 mesothelioma cases that were exposed to crocidolite.

^{3/}Excludes 4 mesothelioma cases that were exposed to crocidolite.

Several studies (Jones et al., 1980a, 1980b; McDonald, 1980b; McDonald, 1980c) have been made on the types and amounts of asbestos fiber in the lung tissue of asbestos workers who died of mesothelioma and in "controls" who died of other diseases and who were not occupationally exposed to asbestos. For example, Jones et al. (1980b) found that chrysotile was present no more frequently nor in greater amounts, in the mesothelioma cases than in the control cases. They further state (p. 197) that "this study therefore provides no evidence to indict chrysotile in the etiology of mesothelioma." Similar findings are reported by McDonald (1980b) and McDonald (1980c). The above cited studies also show that amphibole fibers (crocidolite and amosite) were more prevalent in the lung tissues of the mesothelioma cases than in the controls.

The contrast in mortality holds also for lung cancer and asbestosis. All three forms cause significant excess of these two diseases in those exposed for long periods of time to high dust levels. However, short term exposure to moderate levels of crocidolite dust appears to be more dangerous than long term exposure to high levels of chrysotile dust. This can be seen by comparing the mortality data for the Quebec chrysotile asbestos miners and millers who were exposed to high to very high dust levels for 20 or more years (Table 17, column B) to the data for the Canadian gas mask assemblers who were exposed to moderate levels of crocidolite dust for no more than 2.5 years (Table 17, column C). For further comparison, mortality data is given for Quebec miners and millers who were exposed to low to medium dust levels (column A).

Table 17. Mortality Data for Quebec Chrysotile Miners and Millers (columns A,B) with 20 or more years service and for Canadian Gas Mask Assemblers (column C).

Exposure	<u>A</u> ^{1/}			<u>B</u> ^{1/}			<u>C</u> ^{2/}	
	Low-medium(10-21 f./cm ³)			High-V.high(95-194 f./cm ³)			Moderate	
Cause of death	Obs.	Exp.	% ^{3/}	Obs.	Exp.	% ^{3/}	Obs.	% ^{3/}
All causes	620	658.8	100	478	367.7	100	56	100
All cancer	147	150.6	23.7	132	92.8	27.6	23	41.1
Lung cancer	48	41.6	7.7	56	23	11.7	8	14.3
G.I. cancer	47	58.7	7.6	45	32.6	9.4	3	5.4
Asbestosis	11	0.7	1.8	25	0.4	5.2	2	3.6
Other Resp.	28	34.3	4.5	31	13.4	6.5	4	7.1
Mesothelioma	-	-	-	-	-	-	9	16.1

^{1/}Data from McDonald et al. (1980, Table 7d).

^{2/}Exposed to moderate levels of crocidolite dust for no more than 2.5 years (McDonald and McDonald, 1978). See also Study X, Table 3a.

^{3/}Percent of all observed deaths.

The contrast between cancer mortality in the mining-milling cohorts (Table 4) and the trades cohorts (Table 3a,b) is clearly seen in Figure 1 where the proportional mortality due to lung cancer is plotted with respect to mesothelioma proportional mortality. The average mortality for the 8 mining-milling cohorts (excluding the crocidolite miners, Study F, Table 4) is: mesothelioma (0.2%), lung cancer (5.7%). For the 21 trades cohorts, the average mortality is: mesothelioma (5.6%), lung cancer (16.7%). The cancer mortality pattern of the crocidolite mining cohort is very similar to that of the trades cohorts; 3.3% of this group having died of mesothelioma and 11.6% of lung cancer.

Many of the men in the trades cohorts were probably exposed to crocidolite asbestos at some time during their working career. They also were probably often exposed to very high concentrations of asbestos dust, particularly during installation or removal of asbestos in closed spaces such as heating conduits, ship compartments, etc.

Peto (1978, 1980) and Peto et al. (1982) suggest that chrysotile asbestos contributes significantly to mesothelioma mortality. Peto bases his conclusions on a study of workers in an asbestos textile factory in the UK (Peto et al., 1977; Peto 1978, Peto 1980). Exposure was mainly to chrysotile asbestos but crocidolite fiber was processed in this factory at various times since 1933 (Peto, 1978, p. 487). Peto does not cite the work of Jones et al. (1930a) and McDonald and McDonald (1978) on the gas mask assemblers, nor the work of Hilt et al. (1931) on construction workers; studies which clearly show the extreme hazard of crocidolite. Only brief exposure to crocidolite can set up a disease pattern very similar to that

found in trades workers heavily exposed to asbestos for many years. From this we can conclude that mortality studies of asbestos workers who are exposed to crocidolite, even for short periods of time, are not valid in predicting the health effects of other forms of asbestos.

Estimates of Asbestos-related Mortality in the United States

In various press releases and scientific publications, it has been suggested that asbestos exposure in the United States will cause from 10,000 to 67,000 deaths per year for the next 20 to 30 years. These estimates do not appear to be valid when compared to estimates of past mortality that are based on reported asbestos-related death due to mesothelioma or asbestosis. For example: (1) utilizing the mortality pattern of excess disease in 17,800 North American asbestos insulation workers and the incidence of mesothelioma in 1972 given by a pathology review panel, it is estimated that 587 individuals died in that year because of exposure to asbestos; or (2) taking the reported number of asbestosis deaths as given in the Vital Statistics of the United States and again utilizing the mortality data of the North American insulation workers, it is estimated that the average yearly asbestos-related mortality in the United States during the period 1967-1977 was 522 deaths. There is some suggestion from the mortality data given in the Vital Statistics that the incidence of asbestos-related disease has increased somewhat during this same period.

COMMENTARY

The Relative Hazards of the Asbestos Minerals

It is pertinent to repeat one of the questions asked in the introduction of this review: Must the use of all commercial asbestos be stopped? The answer is an emphatic no - but with qualifications presented below.

Non-occupational exposure to chrysotile asbestos, despite its wide dissemination in urban environments throughout the world, has been shown by epidemiological studies to be of no health significance whatsoever. If it were, the women of Thetford Mines, Quebec, where over 20 million tonnes of chrysotile asbestos has been mined, would be dying of asbestos-related diseases. They are not. The health studies accomplished in Canada show that populations can safely breathe air and drink water that contain significant amounts of chrysotile fiber. These studies also show that there is a "threshold" value for chrysotile asbestos exposure below which no measurable health effect will occur.

The same fiber dose-disease response relationships observed for chrysotile asbestos do not hold for crocidolite asbestos. Health studies of those exposed to only crocidolite show it to be much more hazardous than chrysotile; with respect to mesothelioma perhaps 100 to 200 times more hazardous. No study has been reported comparable to that made for chrysotile which indicate what a safe level of exposure to crocidolite would be. The danger of crocidolite dust is particularly emphasized by the many mesothelioma deaths occurring among the residents of the crocidolite mining districts of the Cape Province, South Africa whose only exposure was in a non-occupational setting. Such mortality is practically unknown among residents of the chrysotile mining localities of Quebec. Control of crocidolite dust, particularly in the mines and mills, presents a considerable engineering problem in that dust levels at or below the 1969 British Standard of 0.2 fibers/cm³ can be achieved hardly anywhere (Simpson, 1979, p. 74).

The hazards of amosite asbestos are more difficult to access. The amosite factory employees of Patterson N.J., who worked under very dusty conditions during World War II, have experienced a great deal excess mortality due to lung cancer, asbestosis, and mesothelioma. In contrast to these factory workers, amosite miners and millers, at least with regard to mesothelioma, do not appear to be at much risk. This suggests that dust controls are possible which can much reduce or prevent the occurrence of asbestos-related diseases in amosite workers.

The fear caused by heavy handed statements such as "one fiber can kill you" and by the much exaggerated predictions of the amount of asbestos-related mortality expected in the next 20 or 30 years has generated great political pressure to remove asbestos from our environment and to greatly reduce or even stop its use. An example of this is the concerted effort in several industrial nations including the United States to remove asbestos from schools, public buildings, homes, ships, appliances, etc. This is being done, even though most asbestos in the U.S. is of the chrysotile variety, and even though asbestos dust levels in schools, public

buildings and city streets is much lower than found in chrysotile asbestos mining communities where no asbestos-related disease appears in the non-occupationally exposed residents. The impetus for these costly removals and appliance recalls (hair dryers, for example) apparently comes from propagandizing the "one fiber can kill you" concept. Not only is this program costly - it could be dangerous if the removal of blue asbestos is not accomplished with great care. In most cases, asbestos coatings and insulation, where necessary, can be repaired at no risk and at a fraction of the cost of complete removal.

Substitutes for Asbestos

If all use of asbestos were to be discontinued, substitutes would have to be developed to meet many diverse requirements such as non-flammability, high strength, flexibility, reasonable cost, and safety. With respect to safety, the substitutes must not induce disease in those exposed to them and also must not endanger lives in other ways because of inferior strength and durability, increased flammability, etc. A high cost for a good substitute must not force instead the use of an inadequate replacement. Possible problems with substitutes may occur, for example, with the replacement of chrysotile asbestos in drum brake linings. The chance of increased automobile accidents due to a possibly inferior substitute material must be weighed against the probability of anyone being harmed by the small amounts of chrysotile asbestos that are emitted from drum brakes. Also, the health effects of emissions from substitute brake linings must be considered.

The requirements of strength and flexibility necessitate that asbestos substitutes be fibrous. Generally, the thinner and longer the fibers, the stronger, more flexible, and useful they are. However, fibers longer than 4 microns and less than 1.5 microns in diameter are capable of producing malignant neoplasms when implanted into the pleura of rats (Stanton et al., 1981). The test fibers in these studies included aluminum oxide, fiber glass, wollastonite (CaSiO_3), silicon carbide, dawsonite (NaAlCO_3OH), and potassium octatitanate.

Lee et al. (1981a, 1981b) studied the effects on rats, hamsters, and guinea pigs of inhalation of different concentrations of "Fybex", a commercially made potassium octatitanate fiber used to strengthen materials. They found that in addition to the development of pulmonary fibrosis in many animals, 3 hamsters developed pleural mesothelioma, a rare disease in the control animals.

In the report of the Advisory Committee on Asbestos, Health and Safety Commission of Great Britain, the following statement is made in regard to substitutes for asbestos (Simpson, 1979, vol. 1, p. 69).

"As a general principle we take the view that control of any useful but hazardous material is preferable to the ultimate sanction of prohibition. It is very easy to say that a dangerous substance or process should be banned and to hope that that will solve the problem. In our view this is a gross

over-simplification of a complex equation of inter-linked factors. It ignores the possibility that prohibition of a particular substance may directly result in an increase in health or safety risks, for example from fire, which the use of that substance currently prevents or reduces. It also ignores the implications of statutorily enforcing substitution by materials or substances which at present appear to be suitable but may at a later date be found to constitute a risk to health. The social and economic consequences of the possible closure of factories using the original material or process need to be taken into account."

The recent animals experiments such as those cited above make the Advisory Committee's statement particularly meaningful.

The cost of asbestos substitutes is of particular importance to the "Third World" countries whose developing economies are very dependent upon making the maximum use of cheap, domestically produced materials wherever possible. Asbestos cement is such a material and large quantities of it are vital to the industrialization of these nations. Importation of possible substitutes, for example, plastic and metal water pipe and construction materials, is not an economic choice for many nations. It is significant that several countries are greatly expanding their chrysotile mining and milling operations; the U.S.S.R., Zimbabwe, Greece, Mexico, Yugoslavia (Asbestos, vol. 63, January 1982).

The Ubiquitous Fibrous Minerals and Future Health and Regulatory Policy

Those outside the mining and geoscience professions probably do not appreciate how common fibrous minerals are. Most hard rock mines contain some gangue minerals that are considered by some to be asbestos or asbestos-like. For example, the common rock-forming mineral cummingtonite found in the Reserve Mining Company's iron ore deposits near Lake Superior, Minnesota is considered to be asbestos by the U.S. Environmental Protection Agency and the Courts of Minnesota, although I know of no geologist who would call this mineral asbestos. However, be it as it may, if cummingtonite and other amphiboles are considered to be asbestos for regulatory purposes then a great many mining operations will also be considered asbestos mining operations. The mining and milling of gold and iron ore, talc, vermiculite, and crushed stone have already been effected by asbestos regulations.

In addition to the fibrous minerals found in numerous ore deposits, they are also found in many water supplies, in soils and sediments, in certain sand and gravel deposits, in drilling muds, in portland cement, in ceramic materials, and in large areas overlain by volcanic ash. Should the public be told that even low doses of these mineral fibers can possibly cause cancer? Should human exposure to these fibers be regulated to the lowest feasible limit? Should extreme measures be taken such as moving people out of regions where fibrous minerals are endemic? Such action

was proposed by P. C. Elmes, Director of the MRC Pneumoconiosis Unit, Llandough Hospital, Penarth, Wales. He writes (Elmes, 1980, p. 529),

"Populations living on soils contaminated with the fibers under dry climatic conditions need to be moved."

In regard to his proposal, it is noted that fibrous zeolite minerals occur in many areas of the southwestern United States and that fibrous clay minerals are common in the coastal plane sediments of the eastern United States.

One does not have to consider the above questions very long before coming to realize that if answered in the affirmative they would present a regulatory, legal, and economic nightmare.

Instead of overreacting to every perceived health risk (this seems to occur particularly in regard to suspected carcinogens) we must allocate our scientific and economic resources to our environmental health problems in proportion to their seriousness. Billions of dollars have been spent directly and indirectly, in understanding and mitigating asbestos-related cancers. Many billions more may be awarded to those filing claims against asbestos companies. In contrast, relatively little has been spent on understanding and mitigating the more serious non-neoplastic lung diseases such as the pneumoconioses caused by inhalation of crystalline silica and coal dusts.

A great deal has been accomplished in understanding the relationships between the intensity of exposure to the several forms of commercial asbestos and the incidence of the asbestos-related diseases. Epidemiological studies have shown that modern dust control methods now in effect can prevent most morbidity and mortality related to exposure to chrysotile asbestos. Similar studies should be completed in order to set dust levels to protect the anthophyllite and amosite asbestos workers (in this regard see the Simpson Report, Simpson, 1979).

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Inlandboatmen's Union of the Pacific



MARINE DIVISION — INTERNATIONAL LONGSHOREMEN'S & WAREHOUSEMEN'S UNION
NATIONAL OFFICE • 2700 FIRST AVENUE, ROOM 211 • SEATTLE, WASHINGTON 98121 • 622-9738

January 31, 1984

Honorable Joe Josephson
Alaska State Legislature
Pouch V (MS 3100)
Juneau, AK 99811

Dear Senator:

The Inlandboatmen's Union of the Pacific, Alaska Region, would like to commend your sponsorship of SB 373, ASBESTOS HEALTH HAZARD PROGRAM, and are in total support of the bill.

I have spoken with Steve Kadish and he recommended that I write you with one concern we have with the legislation. Our organization represents all the unlicensed employees working aboard the vessels of the Division of Marine Highway Systems, Department of Transportation and Public Facilities. While it appears that the primary focus of ASBESTOS HEALTH HAZARD PROGRAM is toward schools in the State, public facilities will also be inspected. Our concern is that the nine vessels of the Division may not be included under the PROGRAM if not specifically addressed in the legislation as being a "public facility". Our position is that the nine vessels should fall under the jurisdiction of the PROGRAM by including the vessels, by definition, as being a public facility.

We would be happy to meet with you or your staff in a effort to clarify the bill to include the vessels of the Alaska Marine Highway System. If you have any questions, please contact my office in Juneau.

Sincerely,

INLANDBOATMEN'S UNION OF THE PACIFIC

RECEIVED

Michael Wilson
Patrolman, Juneau
586-2120

cc Steve Kadish
Senator Vic Fischer's staff

028A/mw

REGIONAL OFFICES

PUGET SOUND
2700 FIRST AVE., RM. 201
SEATTLE, WA 98121
622-5117

COLUMBIA RIVER
7433 NW FRONT
PORTLAND, OR 97209
228-6000

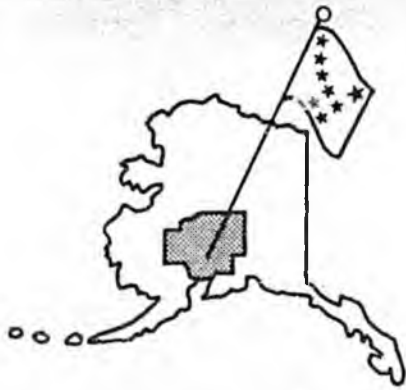
SAN FRANCISCO
501 ARMY ST., RM. 208
SAN FRANCISCO, CA 94124
826-0556

HAWAII
1001 BILLINGHAM BLVD., No. 214
HONOLULU, HI 96817
847-0611

SOUTHERN CALIFORNIA
728 LAGOON AVE.
WILMINGTON, CA 90734
549-6730

ALASKA
P.O. BOX 6300
KETCHIKAN, AK 99901
225-6360

JUNEAU
307 FRANKLIN ST., RM. 202
JUNEAU, AK 99801
586-2120



MATANUSKA-SUSITNA BOROUGH SCHOOL DISTRICT

BOX AB • PALMER, ALASKA 99645-1646 • PHONE 745-4822

GORDON C. TOPE
SUPERINTENDENT OF SCHOOLS

March 1, 1984

Honorable Joe P. Josephson
Alaska State Senate
Pouch V
Juneau, Alaska 99811

Senator Josephson:

At the request of Superintendent Gordon Tope of the Matanuska-Susitna School District, I have reviewed Senate Bill No. 373 and 374 and found them to be very thorough and complete. I believe the Bills address a real need in the State regarding the health and safety of the public in our public facilities although the dollar amount may be far too low.

The major portion of the asbestos abatement program has been completed in our District. Any asbestos remaining that has been identified at this date has been declared as safe by the Borough Inspector. Your involvement and concern in the asbestos abatement issue is appreciated.

Respectfully,

Norm Palenske
Director of Planning & Facilities

fc



Administrative Offices

P.O. Box 60309
Nenana, Alaska 99760
(907) 832 5594

Joe B. Cooper, Ed.D.
Superintendent

February 22, 1984

Senator Joe P. Josephson
Pouch V
Juneau, Alaska 99811

Dear Senator Josephson:

In reference to the senate bills 373 and 374 regarding asbestos removal. In our district, we have not identified any asbestos hazardous. We have examined all of our buildings that we are currently using and feel that we do not have any problems with these. As we were strongly impacted by the small high program, most of our facilities are new enough that they were built since asbestos was being used heavily. Therefore the bills you mentioned would have very little impact on our district.

Sincerely,

Joe B. Cooper, Ed.D.
District Superintendent

JBC/jm



Alaska Laborers Training School

13500 OLD SEWARD HIGHWAY • (907) 345-3853
ANCHORAGE, ALASKA 99515

ADMINISTERED BY
LABOR TRUST SERVICES

February 21, 1984

EMPLOYER TRUSTEES

DERALD SCHOON
SECRETARY

P. O. KOON
RETIREMENT

WILLIAM REEVES
LEGAL

HARVEY W. MARLIN
TRAINING

EMPLOYEE TRUSTEES

RAY LEE
CHAIRMAN

MANO FREY
TRAINING

JIM SAMPSON
LEGAL

JOE THOMAS
RETIREMENT

TRAINING DIRECTOR
LEELIE N. LAUNGER

AFFILIATED WITH:

LABORERS - AGC
EDUCATION & TRAINING
FUND

Senator Joe Josephson
Pouch V
Juneau, Alaska 99811

RE: Senate Bill #374

"An Act making special appropriations for an asbestos health hazard abatement program; and providing for an effective date."

Dear Senator:

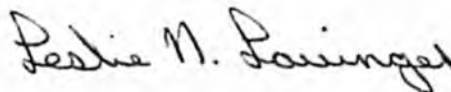
I think the bill is written clearly and well. I think it is very important that anyone working in an asbestos abatement project should be aware of the dangers that asbestos presents as well as how to properly perform the work. The skill involved is knowing how to remove and dispose of asbestos safely! A certification program certainly is an important step in insuring that abatement work is done safely with minimum risk to the worker, their families, and the general public. It will help create a professional attitude in this area of work where asbestos abatement is concerned.

I think this bill should cover our schools and public facilities as is stated. However, I believe we need to extend it to cover all such work in this state. Asbestos is the same and presents the same hazards irregardless of schools or public facilities or any other building that contains it. I am concerned that we may not treat it the same if it is found in buildings that do not fall under the classifications of schools and public facilities. The hazards remain the same! I would like to see this bill cover all such work in the state.

I would like to see further studies undertaken that would identify any asbestos problems so people are aware of exactly what they are dealing with. As you know, only

through lab tests are we sure that what we are looking at is really asbestos. I would think and hope that money is available to study and test for asbestos. Only through an effective program along these lines can we minimize the risks to the public effectively.

Sincerely,



Leslie N. Lauinger
Training Director

LNL/cz



CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

P.O. BOX 4-1276
Anchorage, Alaska 99509

TELEPHONE (907) 562-2343

ANCHORAGE INDUSTRIAL CENTER
5633 B Street



February 16, 1984

Senator Joe Josephson
Pouch V (MS-3100)
Juneau, Alaska 99811

Dear Senator Josephson:

I have a copy of Senate Bill Number 373 and 374. This type of bill is very necessary to eliminate the asbestos problems we presently have in our schools and government buildings. The part of bill #374 that could be improved upon is Section #1. There are highly trained individuals within the state that could perform the service of going into a facility doing on-site inspections and showing the potential danger areas to the proper school or government representatives. These professionals could point out the problems in the buildings and make recommendations on how to eliminate the dangers of potential health hazards for all concerned, including our children.

We are not against training personnel from the facility in asbestos recognition and proper handling for their own protection, but we feel that complete facility inspections should be performed by experts who are trained in this field and experienced in doing this type of work---people who know where to look and what to look for.

I think you will find these inspections are reasonable in costs and will provide for more reliability than utilizing someone from each building that attends a one-time training seminar.

Please consider in your final bill the above suggestion that facilities utilize professionals in their on-site inspections.

Thank you so much.

Sincerely,

Eugene T. Yonkin
Executive Vice President

ETY:ml

xc: Senator Vic Fischer
Senator Tim Kelly
Senator Rick Halford
Senator Arliss Sturgulewski



Alaska Health Project

417 West Eighth Avenue — P. O. Box 10-1037, Anchorage, Alaska 99510 — (907) 276-2864

February 17, 1984

Senator Joe Josephson
Pouch V
Juneau, Alaska 99811

Dear Senator Josephson:

Enclosed are Alaska Health Project's comments on SB 373 relating to the establishment of an asbestos health hazard abatement program.

We appreciate your continued interest in the asbestos issue. This legislation is an important first step in preventing and eliminating unnecessary exposure to this dangerous substance.

Our major concern with SB 373 centers around the Certification Program, Sec. 18.28.030. We feel that this section is extremely important, but that its scope is too limited as presently written in SB 373. Currently, the bill only requires that workers involved in asbestos abatement programs in schools or public facilities be certified. The Health Project feels that such a program should be a statewide requirement for all workers involved in asbestos abatement programs in all facilities, public, private, or otherwise.

We suggest the deletion of the phrase "in a school or public building" on page 3, lines 23 and 28; and on page 4, lines 11 and 15.

I am available to discuss these proposed deletions with you at any time.

Sincerely,

David Wigglesworth
Occupational/Environmental
Health Specialist

cc: Senator Vic Fischer
Nancy Lord
Steve Kadish
Nancy Dietrick



Alaska State Legislature

Senate Committee on State Affairs

Vic Fischer, Chairman • 1024 W. 6th Ave., Suite 204 C,
Anchorage, Alaska 99501
(907) 278-3654

Official Business

February 29, 1984

Dr. Ed Holstein
Department of Environmental Medicine
Mt. Sinai School of Medicine
1 Gustave Levy Place
New York, New York 10029

Dear Dr. Holstein,

Our office has been involved in the development of legislation to abate asbestos health hazards in public schools and to establish a program to certify the competency of those performing asbestos abatement.

We believe that this measure has a good chance of becoming law this legislative session, however there are those who are not convinced that non-occupational asbestos exposure is in fact a health hazard. This belief is based upon the findings of a 1982 paper prepared for the US Department of Interior Geological Survey (enclosed).

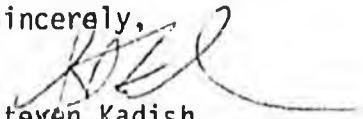
I would appreciate if you could review this report and comment on its accuracy and integrity. We continually refer to the research performed at Mt. Sinai on asbestos and acknowledge the role this research has played internationally. Your comments would be received with a great amount of respect and attention.

Please let me know if you have any questions. I have also enclosed a copy of the proposed legislation.

We do need a response as soon as possible. I can be reached at 907-465-4954 or 907-278-3654.

Thank you for your time and attention.

Sincerely,


Steven Kadish
Legislative Aide

cc; Nancy Dietrick, Senator Joe Josephson



Harborview Medical Center

OCCUPATIONAL MEDICINE PROGRAM
DEPARTMENT OF MEDICINE
UNIVERSITY OF WASHINGTON

Mailing Address:
325 NINTH AVENUE, ZA-66
SEATTLE, WASHINGTON 98104
(206) 223-3005

February 6, 1984

SEATTLE
FEB - 8 1984
U.A. LOCAL #32

Al Sexton
Business Manager
United Association of the Plumbing &
Pipefitting Industry
Local 32
Seattle, Washington 98121

Dear Al,

It has now been about 15 months since we initiated the surveillance program for members of your local, and about one year since I reported to you the results of the evaluation of the first 100 persons. We have now seen about 600 plumbers and pipefitters, the majority from Local 32 and a smaller number from Local 82. We have had a chance to examine in detail the evaluation of the first 400 and have presented these results at a recent scientific meeting. The following summarizes these results. I will be happy to provide to you and any interested members further details as needed. I also welcome any suggestions you have about the best way to disseminate these results to your members, such as through a newsletter or through a union meeting. As always, our goal continues to be to have as many of your members participate in this program as is possible.

As over 97% of the plumbers and pipefitters evaluated to date have been male, and none of the women have been found to have any work-related abnormalities (owing in large part to their younger age and shorter length of time in the trade), the following results refer to the first 400 male participants. About 1/4 had their most recent employment in the shipyards and 3/4 in the building trades. Their trades of longest duration were broken down as follows:

Marine pipefitters	31%
Plumbers	27%
Steamfitters	19%
Refrigeration	11%
Welders	5%
other	7%

The mean age was 43 years.

Sexton
February 6, 1984
page two

Of those evaluated, 62 percent had fully normal xrays without any evidence of asbestos effects. Thirty-eight percent, however, did have some abnormalities on their xray that were likely to be related to asbestos exposure; these changes ranged from mild to severe.

As would be expected with asbestos exposure, there was an increased risk for asbestos-related lung changes as workers got older, or spent more time in the trade. Only 2% of those workers who had spent less than nine years in the trade had evidence of probable or definite asbestosis, compared to 12% for those in the trade from ten to nineteen years, 29% for those in the trade from 20 to 29 years, and 41% for those in the trade from 30 to 39 years. Seventy-eight percent of those in the trade for 40 or more years showed evidence of probable or definite asbestos-related changes. Workers' compensation forms were initiated for 11% (44 workers). All claims to date have been accepted or are pending.

The second most common problem detected was that of work-related hearing loss. About 25% of the population had evidence of hearing loss consistent with noise exposure. As many of these people were seen by their own physicians or by our Ear, Nose and Throat Clinic in follow-up, we are uncertain as to the exact number who had workers compensation filed for this problem. We have initiated a number of claims for hearing loss through our clinic as well.

There have been a number of other medical problems detected for which patients received follow-up. These included common problems such as hypertension, diabetes and blood test abnormalities. There have been a number of significant conditions which we were able to detect on the screening program which called for prompt medical follow-up; these included a potentially serious case of a vitamin deficiency as well as a couple of cases of a non-work-related related inflammatory lung disease.

On the basis of abnormal chest xray or lung function tests, 47% of this group have been asked to return for re-evaluation in one rather than two years. Although health problems may have been detected in the remainder, it was not felt that it was necessary for them to have the comprehensive physical examination repeated before the two-year interval.

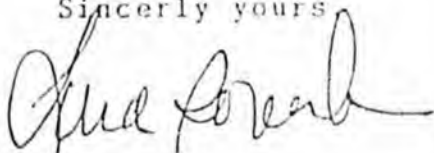
Sexton
February 6, 1984
page three

We are beginning to see individuals for one-year follow-up exams now and are reporting directly to them whether or not there has been any change in their xray or lung function beyond that which would be expected. We will be giving you summaries of these results as the numer of patients coming through the program increases.

In summary, we have now seen a substantial number of workers in your local. Unfortunately, there is a relatively high rate of asbestos-related effects among the group. Although we have had some problems with individuals with billing, I hope that these have mostly been resolved by this time. We have made every effort to accomodate those who develop problems, including trying to cancel bills for those who did not understand that they would be responsible for certain follow-up tests.

Your cooperation and help in this program has been exceptional. I hope you will find this summary useful and that you will let me know if I can provide any further information to you about it.

Sincerly yours



Linda Rosenstock, MD, MPH
Director

cc: William D. Bostwick
/ahp

(2) Requiring the owner or operator of a stationary source, other than a stationary source owned or operated by the United States, to obtain permits, licenses, or approvals prior to initiating construction, modification, or operation of such source.

Sec. 116, Clean Air Act as amended (42 U.S.C. 7416)

38 FR 8626, Apr. 6, 1973, as amended at 43 FR 6800, Mar. 3, 1978

61.17 Circumvention.

No owner or operator subject to the provisions of this part shall build, erect, install, or use any article, machine, equipment, process, or method, the use of which conceals an emission which would otherwise constitute a violation of an applicable standard. Such concealment includes, but is not limited to, the use of gaseous dilutants to achieve compliance with a visible emissions standard, and the piecemeal carrying out of an operation to avoid coverage by a standard that applies only to operations larger than a specified size.

30 FR 43299, Oct. 14, 1975

Subpart B—National Emission Standard for Asbestos

61.20 Applicability.

The provisions of this subpart are applicable to those sources specified in 61.22.

61.21 Definitions.

Terms used in this subpart are defined in the act, in Subpart A of this part, or in this section as follows:

(a) "Asbestos" means actinolite, mosite, anthophyllite, chrysotile, crocidolite, tremolite.

(b) "Asbestos material" means asbestos or any material containing asbestos.

(c) "Particulate asbestos material" means finely divided particles of asbestos material.

(d) "Asbestos tailings" means any solid waste product of asbestos mining or milling operations which contains asbestos.

(e) "Outside air" means the air out-

(f) "Visible emissions" means any emissions which are visually detectable without the aid of instruments and which contain particulate asbestos material.

(g) "Asbestos mill" means any facility engaged in the conversion of any intermediate step in the conversion of asbestos or into commercial asbestos. Outside storage of asbestos materials is not considered a part of such facility.

(h) "Commercial asbestos" means any variety of asbestos which is produced by extracting asbestos from asbestos ore.

(i) "Manufacturing" means the combining of commercial asbestos, or in the case of woven friction products the combining of textiles containing commercial asbestos, with any other material(s), including commercial asbestos, and the processing of this combination into a product as specified in § 61.22(c).

(j) "Demolition" means the wrecking or taking out of any load-supporting structural member and any related removing or stripping of friable asbestos materials.

(k) "Friable asbestos material" means any material that contains more than 1 percent asbestos by weight and that can be crumbled, pulverized, or reduced to powder, when dry, by hand pressure.

(l) "Control device asbestos waste" means any asbestos-containing waste material that is collected in a pollution control device.

(m) "Renovation" means the removing or stripping of friable asbestos material used on any pipe, duct, boiler, tank, reactor, turbine, furnace, or structural member. Operations in which load-supporting structural members are wrecked or taken out are excluded.

(n) "Planned renovation" means a renovation operation over a number of successive operations, in which the amount of friable asbestos material that will be removed or stripped within a given period of time can be predicted. Operations that are individually non-scheduled are included, provided a number of such operations can be predicted to occur during a given period of time

(o) "Emergency renovation" means a renovation operation that results from a sudden, unexpected event, and is not a planned renovation. Operations necessitated by non-routine failures of equipment are included.

(p) "Adequately wetted" means sufficiently mixed or coated with water or an aqueous solution to prevent dust emissions.

(q) "Removing" means taking out friable asbestos materials used on any pipe, duct, boiler, tank, reactor, turbine, furnace, or structural member from any building, structure, facility, or installation.

(r) "Stripping" means taking off friable asbestos materials from any pipe, duct, boiler, tank, reactor, turbine, furnace, or structural member.

(s) "Fabricating" means any processing of a manufactured product containing commercial asbestos, with the exception of processing at temporary sites for the construction or restoration of buildings, structures, facilities or installations.

(t) "Inactive waste disposal site" means any disposal site or portion thereof where additional asbestos-containing waste material will not be deposited and where the surface is not disturbed by vehicular traffic.

(u) "Active waste disposal site" means any disposal site other than an inactive site.

(v) "Roadways" means surfaces on which motor vehicles travel including, but not limited to, highways, roads, streets, parking areas, and driveways.

(w) "Asbestos-containing waste material" means any waste which contains commercial asbestos and is generated by a source subject to the provisions of this subpart, including asbestos mill tailings, control device asbestos waste, friable asbestos waste material, and bags or containers that previously contained commercial asbestos.

(x) "Structural member" means any load-supporting member, such as beams and load-supporting walls; or any non-load-supporting member, such as ceilings and non-load-supporting walls.

38 FR 8626, Apr. 6, 1973, as amended at 39 FR 15398, May 3, 1974; 40 FR 48299, Oct. 14, 1975; 42 FR 19197, Mar. 3, 1977

§ 61.22 Emission standard.

(a) Asbestos mills: There shall be no visible emissions to the outside air from any asbestos mill except as provided in paragraph (f) of this section.

(b) Roadways: The surfacing of roadways with asbestos tailings or with asbestos-containing waste that is generated by any source subject to paragraphs (c), (d), (e) or (h) of this section is prohibited, except for temporary roadways on an area of asbestos ore deposits. The deposition of asbestos tailings or asbestos-containing waste on roadways covered with snow or ice is considered "surfacing."

(c) Manufacturing: There shall be no visible emissions to the outside air, except as provided in paragraph (f) of this section, from any of the following operations if they use commercial asbestos or from any building or structure in which such operations are conducted.

(1) The manufacture of cloth, cord, wicks, tubing, tape, twine, rope, thread, yarn, roving, lap, or other textile materials.

(2) The manufacture of cement products.

(3) The manufacture of fireproofing and insulating materials.

(4) The manufacture of friction products.

(5) The manufacture of paper, millboard, and felt.

(6) The manufacture of floor tile.

(7) The manufacture of paints, coatings, caulks, adhesives, sealants.

(8) The manufacture of plastics and rubber materials.

(9) The manufacture of chlorine.

(10) The manufacture of shotgun shells.

(11) The manufacture of asphalt concrete.

(d) Demolition and renovation: The requirements of this paragraph shall apply to any owner or operator of a demolition or renovation operation who intends to demolish any institutional, commercial, or industrial building (including apartment buildings having more than four dwelling units), structure, facility, installation, or portion thereof, which contains any pipe,

ed or coated with friable asbestos material, except as provided in paragraph (d)(1) of this section; or 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 material is stripped or removed, or more than 160 square meters (ca. 160 square feet) of friable asbestos material used to cover or coat any duct, boiler, tank, reactor, turbine, furnace, or structural member are stripped or removed.

(1)(i) The owner or operator of a demolition operation is exempted from the requirements of this paragraph provided, (A) the amount of friable asbestos material in the building or portion thereof to be demolished is less than 80 meters (ca. 260 feet) used to insulate pipes, and less than 15 square meters (ca. 160 square feet) used to insulate or fireproof any duct, boiler, tank, reactor, turbine, furnace, or structural member, and (B) the notification requirements of paragraph (d)(1)(ii) are met.

(ii) Written notification shall be prepared and delivered to the Administrator at least 20 days prior to commencement of demolition and shall include the information required by paragraph (d)(2) of this section, with the exception of the information required by paragraphs (d)(2)(iii), (vi), (vii), and (ix), and shall state the measured or estimated amount of friable asbestos materials which is present. Techniques of estimation shall be planned.

(iii) Written notice of intention to demolish or renovate shall be provided to the Administrator by the owner or operator of the demolition or renovation operation. Such notice shall be prepared and delivered to the Administrator at least 10 days prior to commencement of demolition, or as early as possible prior to commencement of emergency demolition subject to paragraph (d)(6) of this section, and as early as possible prior to commencement of renovation. Such notice shall include the following information:

(i) Name of owner or operator.

(iii) Description of the building, structure, facility, or installation to be demolished or renovated, including the size, age, and prior use of the structure, and the approximate amount of friable asbestos materials present.

(iv) Address or location of the building, structure, facility, or installation.

(v) Scheduled starting and completion dates of demolition or renovation.

(vi) Nature of planned demolition or renovation and method(s) to be employed.

(vii) Procedures to be employed to meet the requirements of this paragraph and paragraph (j) of this section.

(viii) The name and address or location of the waste disposal site where the friable asbestos waste will be deposited.

(ix) Name, title, and authority of the State or local governmental representative who has ordered a demolition which is subject to paragraph (d)(6) of this section.

(3)(i) For purposes of determining whether a planned renovating operation constitutes a renovation within the meaning of this paragraph, the amount of friable asbestos material to be removed or stripped shall be:

(A) For planned renovating operations involving individually non-scheduled operations, the additive amount of friable asbestos material that can be predicted will be removed or stripped at a source over the maximum period of time for which a prediction can be made. The period shall be not less than 30 days and not longer than one year.

(B) For each planned renovating operation not covered by paragraph (d)(3)(i)(A), the total amount of friable asbestos material that can be predicted will be removed or stripped at a source.

(ii) For purposes of determining whether an emergency renovating operation constitutes a renovation within the meaning of this paragraph, the amount of friable asbestos material to be removed or stripped shall be the total amount of friable asbestos material that will be removed or stripped as

event that necessitated the renovation.

(4) The following procedures shall be used to prevent emissions of particulate asbestos material to outside air:

(i) Friable asbestos materials, used on any pipe, duct, boiler, tank, reactor, turbine, furnace, or structural member, shall be removed from any building, structure, facility or installation subject to this paragraph. Such removal shall occur before wrecking or dismantling of any portion of such building, structure, facility, or installation that would preclude access to such materials for subsequent removal. Removal of friable asbestos materials used on any pipe, duct, or structural member which are encased in concrete or other similar structural material is not required prior to demolition, but such material shall be adequately wetted whenever exposed during demolition.

(ii) Friable asbestos materials used on pipes, ducts, boilers, tanks, reactors, turbines, furnaces, or structural members shall be adequately wetted during stripping, except as provided in paragraphs (d)(4)(iv), (d)(4)(v) or (d)(4)(vi) of this section.

(iii) Pipes, ducts, boilers, tanks, reactors, turbines, furnaces, or structural members that are covered or coated with friable asbestos materials may be taken out of any building, structure, facility, or installation subject to this paragraph as units or in sections provided the friable asbestos materials exposed during cutting or disjuncting are adequately wetted during the cutting or disjuncting operation. Such units shall not be dropped or thrown to the ground, but shall be carefully lowered to ground level.

(iv) The stripping of friable asbestos materials used on any pipe, duct, boiler, tank, reactor, turbine, furnace, or structural member that has been removed as a unit or in sections as provided in paragraph (d)(4)(iii) of this section shall be performed in accordance with paragraph (d)(4)(ii) of this section. Rather than comply with the

ventilation and collection system may be used to prevent emissions to the outside air. Such local exhaust ventilation systems shall be designed and operated to capture the asbestos particulate matter produced by the stripping of friable asbestos material. There shall be no visible emissions to the outside air from such local exhaust ventilation and collection systems except as provided in paragraph (f) of this section.

(v) All friable asbestos materials that have been removed or stripped shall be adequately wetted to ensure that such materials remain wet during all remaining stages of demolition or renovation and related handling operations. Such materials shall not be dropped or thrown to the ground or a lower floor. Such materials that have been removed or stripped more than 50 feet above ground level, except those materials removed as units or in sections, shall be transported to the ground via dust-tight chutes or containers.

(vi) Except as specified below the wetting requirements of this paragraph are suspended when the temperature at the point of wetting is below 0°C (32°F). When friable asbestos materials are not wetted due to freezing temperatures, such materials on pipes, ducts, boilers, tanks, reactors, turbines, furnaces, or structural members shall, to the maximum extent possible, be removed as units or in sections prior to wrecking. In no case shall the requirements of paragraphs (d)(4)(iv) or (d)(4)(v) be suspended due to freezing temperatures.

(vii) For renovation operations, local exhaust ventilation and collection systems may be used, instead of wetting as specified in paragraph (d)(4)(ii), to prevent emissions of particulate asbestos material to outside air when damage to equipment resulting from the wetting would be unavoidable. Upon request and supply of adequate information, the Administrator will determine whether damage to equipment resulting from wetting to comply with the provisions of this paragraph would be unavoidable. Such local exhaust ventilation systems shall be designed and operated to capture the as-

stripping and removal of friable asbestos material. There shall be no visible emissions to the outside air from such local exhaust ventilation and collection systems, except as provided in paragraph (f) of this section.

(5) Sources subject to this paragraph are exempt from the requirements of § 61.05(a), 61.07, and 61.09.

(6) The demolition of a building, structure, facility, or installation, pursuant to an order of an authorized representative of a State or local governmental agency, issued because that building is structurally unsound and in danger of imminent collapse is exempt from all but the following requirements of paragraph (d) of this section: (i) The notification requirements specified by paragraph (d)(2) of this section;

(ii) The requirements on stripping of friable asbestos materials from previously removed units or sections as specified in paragraph (d)(4)(iv) of this section;

(iii) The wetting, as specified by paragraph (d)(4)(v) of this section, of friable asbestos materials that have been removed or stripped;

(iv) The portion of the structure being demolished that contains friable asbestos materials shall be adequately wetted during the wrecking operation.

(e) Spraying: There shall be no visible emissions to the outside air from the spray-on application of materials containing more than 1 percent asbestos, on a dry weight basis, used on equipment and machinery, except as provided in paragraph (f) of this section. Materials sprayed on buildings, structures, pipes, and conduits shall contain less than 1 percent asbestos on dry weight basis.

(1) Sources subject to this paragraph are exempt from the requirements of § 61.05(a), § 61.07, and § 61.09.

(2) Any owner or operator who intends to spray asbestos materials which contain more than 1 percent asbestos on a dry weight basis to insulate or fireproof equipment and machinery shall report such intention to the Administrator at least 20 days prior to the commencement of the spraying operation. Such report shall include the following information:

(ii) Address of owner or operator.

(iii) Location of spraying operation.

(iv) Procedures to be followed to meet the requirements of this paragraph.

(3) The spray-on application of materials in which the asbestos fibers are encapsulated with a bituminous or resinous binder during spraying and which are not friable after drying is exempt from the requirements of paragraphs (e) and (e)(2) of this section.

(f) Rather than meet the no-visible-emission requirements as specified by paragraphs (a), (c), (d), (e), (h), (j), and (k) of this section, an owner or operator may elect to use the methods specified by § 61.23 to clean emissions containing particulate asbestos material before such emissions escape to, or are vented to, the outside air.

(g) Where the presence of uncombined water is the sole reason for failure to meet the no-visible-emission requirement of paragraphs (a), (c), (d), (e), (h), (j), or (k) of this section, such failure shall not be a violation of such emission requirements.

(h) Fabricating: There shall be no visible emissions to the outside air, except as provided in paragraph (f) of this section, from any of the following operations if they use commercial asbestos or from any building or structure in which such operations are conducted.

(1) The fabrication of cement building products.

(2) The fabrication of friction products, except those operations that primarily install asbestos friction materials on motor vehicles.

(3) The fabrication of cement or silicate board for ventilation hoods; ovens; electrical panels; laboratory furniture; bulkheads, partitions and ceilings for marine construction; and flow control devices for the molten metal industry.

(i) Insulating: Molded insulating materials which are friable and wet-applied insulating materials which are friable after drying, installed after the effective date of these regulations, shall contain no commercial asbestos. The provisions of this paragraph do not apply to preformed materials

which are spray applied; such materials are regulated under § 61.22(e).

(j) Waste disposal for manufacturing, fabricating, demolition, renovation and spraying operations: The owner or operator of any source covered under the provisions of paragraphs (c), (d), (e), or (h) of this section shall meet the following standards:

(1) There shall be no visible emissions to the outside air, except as provided in paragraph (j)(3) of this section, during the collection; processing, including incineration; packaging; transporting; or deposition of any asbestos-containing waste material which is generated by such source.

(2) All asbestos-containing waste material shall be deposited at waste disposal sites which are operated in accordance with the provisions of § 61.25.

(3) Rather than meet the requirement of paragraph (j)(1) of this section, an owner or operator may elect to use either of the disposal methods specified under (j)(3) (i) and (ii) of this section, or an alternative disposal method which has received prior approval by the Administrator:

(i) Treatment of asbestos-containing waste material with water:

(A) Control device asbestos waste shall be thoroughly mixed with water into a slurry and other asbestos-containing waste material shall be adequately wetted. There shall be no visible emissions to the outside air from the collection, mixing and wetting operations, except as provided in paragraph (f) of this section.

(B) After wetting, all asbestos-containing waste material shall be sealed into leak-tight containers while wet, and such containers shall be deposited at waste disposal sites which are operated in accordance with the provisions of § 61.25.

(C) The containers specified under paragraph (j)(3)(i)(B) of this section shall be labeled with a warning label that states:

CAUTION

Contains Asbestos

Avoid Opening or

Breaking Container

Breathing Asbestos Is Hazardous

to Your Health

Alternatively, warning labels specified by Occupational Safety and Health Standards of the Department of Labor, Occupational Safety and Health Administration (OSHA) under 29 CFR 1910.93a(g)(2)(ii) may be used.

(ii) Processing of asbestos-containing waste material into non-friable forms:

(A) All asbestos-containing waste material shall be formed into non-friable pellets or other shapes and deposited at waste disposal sites which are operated in accordance with the provisions of § 61.25.

(B) There shall be no visible emissions to the outside air from the collection and processing of asbestos-containing waste material, except as specified in paragraph (f) of this section.

(4) For the purposes of this paragraph (j), the term all asbestos-containing waste material as applied to demolition and renovation operations covered by paragraph (d) of this section includes only friable asbestos waste and control device asbestos waste.

(k) Waste disposal for asbestos mills: The owner or operator of any source covered under the provisions of paragraph (a) of this section shall meet the following standard:

(1) There shall be no visible emissions to the outside air, except as provided in paragraph (k)(3) of this section, during the collection, processing, packaging, transporting or deposition of any asbestos-containing waste material which is generated by such source.

(2) All asbestos-containing waste material shall be deposited at waste disposal sites which are operated in accordance with the provisions of § 61.25.

(3) Rather than meet the requirement of paragraph (k)(1) of this section, an owner or operator may elect to meet the following requirements in paragraphs (k)(2)(B) and (k)(2)(C):

ceived prior approval by the Administrator:

(i) There shall be no visible emissions to the outside air from the transfer of control device asbestos waste to a tailings conveyor, except as provided in paragraph (f) of this section. Each waste shall be subsequently processed either as specified in paragraph (k)(3)(ii) of this section or as specified in paragraph (j)(3) of this section.

(ii) All asbestos-containing waste material shall be adequately mixed, with wetting agent recommended by the manufacturer of the agent to effectively wet dust and tailings, prior to deposition at a waste disposal site. Each agent shall be used as recommended for the particular dust by the manufacturer of the agent. There shall be no discharge of visible emissions to the outside air from the wetting operation except as specified in paragraph (f) of this section. Wetting shall be suspended when the ambient temperature at the waste disposal site is less than -9.5°C (ca. 15°F). The ambient air temperature shall be determined by an appropriate measurement method with an accuracy of $\pm 1^{\circ}\text{C}$ ($\pm 2^{\circ}\text{F}$) and recorded at least at hourly intervals during the period that the operation of the wetting system is suspended. Records of such temperature measurements shall be retained at the source for a minimum of 2 years and made available for inspection by the Administrator.

(i) The owner of any inactive waste disposal site, which was operated by sources covered under § 61.22(a), (c) or (d) and where asbestos-containing waste material produced by such sources was deposited, shall meet the following standards:

(1) There shall be no visible emissions to the outside air from an inactive waste disposal site subject to this paragraph, except as provided in paragraph (i)(5) of this section.

(2) Warning signs shall be displayed at all entrances, and along the perimeter of the site or along the perimeter of the sections of the site where asbestos-containing waste material was deposited, at intervals of 100 m (ca. 300 ft) or less, except as specified in

shall be posted in such a manner and location that a person may easily read the legend. The warning signs required by this paragraph shall conform to the requirements of 20" x 14" upright format signs specified in 29 CFR 1910.145(d)(4) and this paragraph. The signs shall display the following legend in the lower panel, with letter sizes and styles of a visibility at least equal to those specified in this paragraph.

LEGEND

ASBESTOS WASTE DISPOSAL SITE

DO NOT CREATE DUST

Breathing Asbestos is Hazardous to Your Health

Notation

1" Sans Serif, Gothic or Block

3/4" Sans Serif, Gothic or Block

14 Point Gothic

Spacing between lines shall be at least equal to the height of the upper of the two lines.

(3) The perimeter of the site shall be fenced in a manner adequate to deter access by the general public, except as specified in paragraph (i)(4) of this section.

(4) Warning signs and fencing are not required where the requirements of paragraphs (i)(5) (i) or (ii) of this section are met, or where a natural barrier adequately deters access by the general public. Upon request and supply of appropriate information, the Administrator will determine whether a fence or a natural barrier adequately deters access to the general public.

(5) Rather than meet the requirement of paragraph (i)(1) of this section, an owner may elect to meet the requirements of this paragraph or may use an alternative control method for emissions from inactive waste disposal sites which has received prior approval by the Administrator.

(i) The asbestos-containing waste material shall be covered with at least 15 centimeters (ca. 6 inches) of compacted non-asbestos-containing material, and a cover of vegetation shall be

adequate to prevent exposure of the asbestos-containing waste material; or

(ii) The asbestos-containing waste material shall be covered with at least 60 centimeters (ca. 2 feet) of compacted non-asbestos-containing material and maintained to prevent exposure of the asbestos-containing waste; or

(iii) For inactive waste disposal sites for asbestos tailings, a resinous or petroleum-based dust suppression agent which effectively binds dust and controls wind erosion shall be applied. Such agent shall be used as recommended for the particular asbestos tailings by the dust suppression agent manufacturer. Other equally effective dust suppression agents may be used upon prior approval by the Administrator. For purposes of this paragraph, waste crankcase oil is not considered a dust suppression agent.

[38 FR 8826, Apr. 6, 1973, as amended at 39 FR 15398, May 3, 1974; 40 FR 48290, Oct. 14, 1975; 43 FR 26374, June 19, 1978]

§ 61.23 Air-cleaning.

If air-cleaning is elected, as permitted by §§ 61.22(f) and 61.22(d)(4)(iv), the requirements of this section must be met.

(a) Fabric filter collection devices must be used, except as noted in paragraphs (b) and (c) of this section. Such devices must be operated at a pressure drop of no more than 4 inches water gage, as measured across the filter fabric. The airflow permeability, as determined by ASTM method D737-69, must not exceed 30 ft³/min/ft² for woven fabrics or 35 ft³/min/ft² for felted fabrics, except that 40 ft³/min/ft² for woven and 45 ft³/min/ft² for felted fabrics is allowed for filtering air from asbestos ore dryers. Each square yard of felted fabric must weigh at least 14 ounces and be at least one-sixteenth inch thick throughout. Synthetic fabrics must not contain fill yarn other than that which is spun.

(b) If the use of fabric filters creates a fire or explosion hazard, the administrator may authorize the use of wet collectors designed to operate with a unit contacting energy of at least 40 inches water gage pressure.

(c) The administrator may authorize

than that described in paragraphs (a) and (b) of this section if the owner or operator demonstrates to the satisfaction of the administrator that the filtering of particulate asbestos material is equivalent to that of the described equipment.

(d) All air-cleaning equipment authorized by this section must be properly installed, used, operated, and maintained. Bypass devices may be used only during upset or emergency conditions and then only for so long as it takes to shut down the operation generating the particulate asbestos material.

[38 FR 8826, Apr. 6, 1973, as amended at 40 FR 48302, Oct. 14, 1975]

§ 61.24 Reporting.

The owner or operator of any existing source to which this subpart is applicable shall, within 90 days after the effective date, provide the following information to the administrator:

(a) A description of the emission control equipment used for each process;

(b) If a fabric filter device is used to control emissions, the pressure drop across the fabric filter in inches water gage.

(1) If the fabric filter device utilizes a woven fabric, the airflow permeability in ft³/min/ft² and, if the fabric is synthetic, indicate whether the fill yarn is spun or not spun.

(2) If the fabric filter device utilizes a felted fabric, the density in oz/yd², the minimum thickness in inches, and the airflow permeability in ft³/min/ft².

(c) For sources subject to §§ 61.22(j) and 61.22(k):

(1) A brief description of each process that generates asbestos-containing waste material.

(2) The average weight of asbestos-containing waste material disposed of, measured in kg/day.

(3) The emission control methods used in all stages of waste disposal.

(4) The type of disposal site or incineration site used for ultimate disposal, the name of the site operator, and the name and location of the disposal site.

(d) For sources subject to § 61.22(l):

(2) The method or methods used to comply with the standard, or alternative procedures to be used.

(c) Such information shall accompany the information required by § 61.10. The information described in this section shall be reported using the format of Appendix A of this part.

Sec. 114, Clean Air Act as amended (42 U.S.C. 7414)

(32 FR 8826, Apr. 6, 1973, as amended at 40 FR 48302, Oct. 14, 1975; 43 FR 8800, Mar. 3, 1978)

§ 61.25 Waste disposal sites.

In order to be an acceptable site for disposal of asbestos-containing waste material under § 61.22(j) and (k), an active waste disposal site shall meet the requirements of this section.

(a) There shall be no visible emissions to the outside air from any active waste disposal site where asbestos-containing waste material has been deposited, except as provided in paragraph (e) of this section.

(b) Warning signs shall be displayed at all entrances, and along the property line of the site or along the perimeter of the sections of the site where asbestos-containing waste material is deposited, at intervals of 100 m (ca. 330 ft) or less except as specified in paragraph (d) of this section. Signs shall be posted in such a manner and location that a person may easily read the legend. The warning signs required by this paragraph shall conform to the requirements of 20" x 14" upright format signs specified in 29 CFR 1910.145(d)(4) and this paragraph. The signs shall display the following legend in the lower panel, with letter sizes and styles of a visibility at least equal to those specified in this paragraph.

LEGEND	
ASBESTOS WASTE DISPOSAL SITE	Do Not Create Dust
Breathing Asbestos is Hazardous to Your Health	Notation
1" Sans Serif, Gothic or Block	1" Sans Serif, Gothic or Block
¾" Sans Serif, Gothic or Block	14 Point Gothic

Spacing between lines shall be at least equal to the height of the upper of the two lines.

(c) The perimeter of the disposal site shall be fenced in order to adequately deter access to the general public except as specified in paragraph (d) of this section.

(d) Warning signs and fencing are not required where the requirements of paragraph (c)(1) of this section are met, or where a natural barrier adequately deters access to the general public. Upon request and supply of appropriate information, the Administrator will determine whether a fence or a natural barrier adequately deters access to the general public.

(e) Rather than meet the requirement of paragraph (a) of this section, an owner or operator may elect to meet the requirements of paragraph (c)(1) or (c)(2) of this section, or may use an alternative control method for emissions from active waste disposal sites which has received prior approval by the Administrator.

(1) At the end of each operating day, or at least once every 24-hour period while the site is in continuous operation, the asbestos-containing waste material which was deposited at the site during the operating day or previous 24-hour period shall be covered with at least 15 centimeters (ca. 6 inches) of compacted non-asbestos-containing material.

(2) At the end of each operating day, or at least once every 24-hour period while the disposal site is in continuous operation, the asbestos-containing waste material which was deposited at the site during the operating day or previous 24-hour period shall be cov-

based dust suppression agent which effectively binds dust and controls wind erosion. Such agent shall be used as recommended for the particular dust by the dust suppression agent manufacturer. Other equally effective dust suppression agents may be used upon prior approval by the Administrator. For purposes of this paragraph, waste crankcase oil is not considered a dust suppression agent.

(40 FR 48302, Oct. 14, 1975)

Subpart C—National Emission Standard for Beryllium

§ 61.30 Applicability.

The provisions of this subpart are applicable to the following stationary sources:

(a) Extraction plants, ceramic plants, foundries, incinerators, and propellant plants which process beryllium ore, beryllium, beryllium oxide, beryllium alloys, or beryllium-containing waste.

(b) Machine shops which process beryllium, beryllium oxides, or any alloy when such alloy contains more than 5 percent beryllium by weight.

§ 61.31 Definitions.

Terms used in this subpart are defined in the act, in subpart A of this part, or in this section as follows:

(a) "Beryllium" means the element beryllium. Where weights or concentrations are specified, such weights or concentrations apply to beryllium only, excluding the weight or concentration of any associated elements.

(b) "Extraction plant" means a facility chemically processing beryllium ore to beryllium metal, alloy, or oxide, or performing any of the intermediate steps in these processes.

(c) "Beryllium ore" means naturally occurring material mined or gathered for its beryllium content.

(d) "Machine shop" means a facility performing cutting, grinding, turning, honing, milling, deburring, lapping, electrochemical machining, etching, or other similar operations.

(e) "Ceramic plant" means a manufacturing plant producing ceramic items.

(f) "Foundry" means a facility engaged in the melting or casting of beryllium metal or alloy.

(g) "Beryllium-containing waste" means material contaminated with beryllium and/or beryllium compounds used or generated during any process or operation performed by a source subject to this subpart.

(h) "Incinerator" means any furnace used in the process of burning waste for the primary purpose of reducing the volume of the waste by removing combustible matter.

(i) "Propellant" means a fuel oxidizer physically or chemically combined which undergoes combustion to provide rocket propulsion.

(j) "Beryllium alloy" means any metal to which beryllium has been added in order to increase its beryllium content and which contains more than 0.1 percent beryllium by weight.

(k) "Propellant plant" means any facility engaged in the mixing, casting, or machining of propellant.

§ 61.32 Emission standard.

(a) Emissions to the atmosphere from stationary sources subject to the provisions of this subpart shall not exceed 10 grams of beryllium over a 24-hour period, except as provided in paragraph (b) of this section.

(b) Rather than meet the requirement of paragraph (a) of this section, an owner or operator may request approval from the Administrator to meet an ambient concentration limit on beryllium in the vicinity of the stationary source of 0.01 µg/m³, averaged over a 30-day period.

(1) Approval of such requests may be granted by the Administrator provided that:

(i) At least 3 years of data is available which in the judgment of the Administrator demonstrates that the future ambient concentrations of beryllium in the vicinity of the stationary source will not exceed 0.01 µg/m³, averaged over a 30-day period. Such 3-year period shall be the 3 years ending 30 days before the effective date of this standard.

(ii) The owner or operator requests

date.

ASSOCIATION OF ALASKA SCHOOL BOARDS

326 Fourth St., Suite 510 • Juneau, Alaska 99801 • (907) 586-1083

ASBESTOS SURVEY

School District	Information Gathered
Adak	Removal project will be under way this summer through H.H.S. at a total cost of \$120,000 which included capsulating the pipes earlier this school year.
Alaska Gateway	No asbestos problem
Aleutian Region	No asbestos problem
Anchorage	Approximately \$10 million dollars. Asbestos expert, Wayne Tenzel, will be available for testimony January 24 and 25 as well as the first part of February. (Written report will be mailed to AASB.)
Chatham	No asbestos problem
Copper River	No asbestos problem
Cordova	Cost estimates range from \$34,000-\$38,000 bid (direct contact with contractors) to \$80,000 estimates from engineers who will set up removal plans. Usual engineering costs 10-15% of the contract price. Additional factor replacement of material removed - \$20,000-\$40,000.
Fairbanks	Total cost for all 21 schools in the Fairbanks area is \$1,568,045.00. (Written report will follow via mail.)
Galena	No asbestos problem
Haines	No asbestos problem
Kenai	No asbestos problem
King Cove	No asbestos problem
Lake and Peninsula	No asbestos problem
Nenana	No dollar amount has been determined to date.
Nome	No asbestos problem
North Slope	No asbestos problem

ASBESTOS SURVEY
Page two

<u>School District</u>	<u>Information Gathered</u>
Pribilof Islands	Entire outer skin of school is made of asbestos, but no cost estimates yet. In process of building new school, so hopefully it won't be a problem anyway.
Railbelt	No asbestos problem
Sitka	Only in boiler room of Etolin High School. (Sitka did not report cost estimates)
Skagway	No asbestos problem
Southeast Islands	No asbestos problem
Valdez	No asbestos problem
Yukon Koyukuk	No asbestos problem

NO RESPONSE TO DATE FROM:

Annette Island	Sand Point
Bering Strait	Southwest Region
Bristol Bay	Tanana
Chugach	Unalaska
Craig	Wrangell
Delta/Greely	Yakutat
Dillingham	Yukon Flats
Hoonah	
Hydaburg	
Iditarod	
Juneau	
Kake	
Ketchikan	
Klawock	
Kodiak	
Kuspuk	
Lower Kuskokwim	
Lower Yukon	
Mat Su	
Northwest Arctic	
Pelican	
Petersburg	
St. Marys	

DWYER DISTRICT



U.S. ENVIRONMENTAL PROTECTION AGENCY

REGION X
ALASKA OPERATIONS OFFICE
3200 HOSPITAL DRIVE
SUITE 101
JUNEAU, ALASKA 99801

REPLY TO
ATTN OF:

February 1, 1984

RECEIVED

Joe Cladouhos, Director
Division of Environmental Quality Management
Alaska Department of Environmental Conservation
Pouch 0
Juneau, Alaska 99811

Josephson

RE: Senate Bill No.'s 373 and 374 introduced on 1/25/84

Dear Mr. Cladouhos:

As a result of a request by your staff, we have provided a review of the current asbestos regulations and our comments on Senate Bills 373 and 374. We strongly support the concept of both these Bills. The EPA Alaska Operations Office (A00) has been actively involved in 1) providing guidance to schools on school regulation 40 CFR Part 763, 2) providing information to contractors conducting demolition/renovation of friable asbestos, 3) inspecting asbestos demolition/renovation projects and 4) responding to all complaints in this area. The A00 also notifies the State Department of Labor (SDoL) on each demolition/renovation asbestos project for which we receive a notification.

Our staff in Alaska is limited to .1 of a person year for asbestos activities; therefore, we strongly support efforts from state agencies which supplement our efforts. We feel that Senate Bill 373 in conjunction with the present EPA, U. S. Department of Labor (DoL), and SDoL regulation would provide for a more complete asbestos program for Alaska; however, appropriations in Bill 374 may not be adequate to fulfill all the designated tasks for the asbestos program.

Background:

At the present time the U. S. Environmental Protection Agency (EPA) requires the identification of friable asbestos in schools in accordance with regulations (40 CFR Part 763) promulgated under the Toxic Substance Control Act (TSCA). In addition, all projects involving the demolition and/or renovation of friable asbestos in buildings are regulated by EPA in accordance with 40 CFR Part 61, Subpart B. These regulations were promulgated under the authority provided to EPA in the Clean Air Act (CAA). The U. S. Department of Labor and the SDoL also have regulations addressing removal and demolition of asbestos from structures (29 CFR 1910.1001 and OH&EC 04.0102 respectively).

Unlike regulations promulgated under the CAA, the school regulations promulgated in accordance with TSCA cannot be delegated to state or local governing agencies. This does not prevent a state or local governing agency from developing its own asbestos program for schools. For the most part Senate Bill 373 would supplement the present EPA school regulations; however, some overlap occurs in the requirement to establish guidelines for schools to identify asbestos health hazards [18.28.050 (5)]

Detailed Comments:

According to Section (1) (b) of Senate Bill 373 there are three main purposes for the Act. Our comments on each of these is discussed in the following text:

1) We support the testing and analysis of friable materials for asbestos content. According to the Bill, the Alaska Department of Environmental Conservation (ADEC) would provide this service. In accordance with EPA regulations (40 CFR Part 763) all local education agencies were to complete the following tasks by June 28, 1983:

- conduct inspections of schools for friable materials
- collect samples of all materials identified as friable.
- have each sample analyzed by Polarized Light Microscopy (PLM) for asbestos content.

During 1984 the EPA will be conducting inspections of three major school districts in Alaska; however, there have been no inspections of Alaska schools conducted to date. As a result it is not known which schools in Alaska are in compliance with the EPA regulation and therefore some schools may require sampling.

There are approximately 550 schools in Alaska. Each specific friable material type is required to be sampled in three separate areas. Assuming only one type of asbestos is present in each school, 1,650 samples would be representative of the total schools. The information that schools have voluntarily supplied to EPA on their compliance status indicates that schools have more than one type of friable material. Depending on the laboratory, sample analysis costs range from \$25.00 to \$45.00 per sample. Based on this information the appropriation of \$75,000.00 to ADEC may not be adequate to accomplish the analysis of samples from schools and public facilities in Alaska if commercial laboratories are utilized.

2) We support the dissemination of information pertaining to friable asbestos material. Both U. S. Department of Labor and EPA have information and videotapes available that pertain to identification and removal of friable asbestos. The U. S. Department of Health and Human Services has information available on the health effects resulting from asbestos exposure. There is a need for coordinating the distribution of the current and newly generated asbestos publications to the public. Again, the present Bill assigns this responsibility to ADEC but the \$75,000.00 allocation may be inadequate.

3) Section 18.28.050 (5) of Senate Bill 373 requires ADEC to establish guidelines for determining asbestos health hazards. These guidelines would be used by school officials to establish a sampling plan for friable asbestos. This overlaps with EPA regulations 40 CFR 763.105 and 763.107 on the inspection and sampling of friable material.

We support the correction of identified asbestos health hazards in schools and public facilities. Senate Bill 373 goes one step beyond the EPA school regulations by requiring schools that have the potential to release asbestos fibers, to eliminate friable asbestos material. (It is our understanding that elimination includes an action which would correct the asbestos hazard, but does not necessarily require removal).

We strongly support the appropriations to the Department of Community and Regional Affairs (CRA) for correcting identified asbestos hazards in schools and public facilities. The EPA has not been successful in acquiring an appropriation from Congress for schools requesting financial support for abatement of friable asbestos.

If you should have any questions on our comments please contact Kathryn Pazera of my staff.

Sincerely,



Ronald A. Kreizenbeck, Director
Alaska Operations Office

cc: S. Hungerford ✓

1. EPA published rules 27 May, 1982 telling school districts (local education agencies) it is their responsibility to inspect, sample and have analyzed for asbestos, their school buildings; requiring that results be posted etc. by 27 May, 1983 (28 June, 1983?) Under TSCA this activity was required once.
2. EPA provided a 2-volume guidance document dated March 1979, to all schools in 1979 and again with the regulations in June 1982 to all school districts and private schools.
 - a) These documents are available in the DEC library, and are mailed on request by EPA (100 more copies on order)
3. EPA provided two films/videos on _____ and _____. These are available in the Juneau and Anchorage State Libraries. The EPA film can be copied (at least 25 copies have been mailed from Juneau and _____ from Anchorage.)
4. EPA Region X has a staff of 3 and 1 asbestos co-ordinator, the Alaska Operations Office is also used as a resource for providing information etc.
 - a) Jim Tozier, Department of Education is working with EPA on this
 - b) ADEC does provide information - 2 weeks/year/office no technical knowledge via school sanitation or hazardous waste staff
 - c) ADEC issued "Asbestos in Alaska" information sheet April 1983
5. EPA regulations do not require report of findings be submitted, only kept on file and posted if asbestos is present. No reinspection/sampling is required.
 - a) EPA prepared inventory forms for use by the school and the district, and mailed them in August 1982 along with a reminder of the availability of the guidance documents -- sent to districts and private schools.
 - b) A number of school districts have "voluntarily" notified EPA of the results of their sampling program.
6. In September of 1982, EPA held workshops in Juneau, Anchorage and Fairbanks for school district representatives on the regulations.
7. In early June 1983, via Department of Education, EPA reminded school districts of the impending "deadline" and requested copies of the inspection/testing reports. (see 5b)
8. EPA plans to inspect (sample ?) representative schools in Juneau/Fairbanks/Anchorage (probably) for compliance.
9. Removal/Encapsulation/Elimination is not required nor was it funded via EPA -- US Department of Education did issue rules related to a grant/loan program -- 34 CFR 230 in 1981.

Points to be made

1. a) DEC has limited staffing the 1-2 weeks/year/office is about all we can tolerate in the information available mode.

b) No staff is, or can afford to be, trained to provide technical advice about ..

sampling
health risks
control] -- 1/2 year

c) No staff is available to do -

training
sampling] -- 1/2 year

Q/A
analyse] -- 1/2 year

regulate
establish guidelines] -- 1/2 year

2. a) EPA's program and regulations under TSCA can not be delegated to the state, so the part related to schools would result in a double program.

b) Perhaps Department of Labor and Department of Transportation/Public Facilities could regulate state/local buildings by reference to EPA's rules.

c) Seems inappropriate for DEC to get involved in what is really an OSHA "world."

3. a) It is important to determine how the \$17.0mm will be spent.

b) It is necessary to evaluate results of testing, recommended "elimination" technique(s) set up and follow priority-setting standards, approve cost-effective projects, before awarding monies. Thus statutes should set up a regulatory scheme; if DEC writes regulations for C&RA to follow in evaluating project, prioritizing it and awarding funds etc., it puts us in an awkward position.

DRAFT

Recommendations:

- a) Let EPA finish (and enforce) their inspection sampling of schools.
- b) Have Department of Education require and obtain results required by EPA.
- c) Instruct Department of Education to award (a single?) contract to evaluate and recommend appropriate "elimination" projects for each school (district) in which asbestos is found.
- d) Establish regulations for applying/awarding grants.
- e) Instruct DOT/PF (for state buildings) D of L (for local government buildings) to enforce EPA's regulations (inspect/sample) and prepare recommendations for correction.
- f) Have Department of Education contract for programs to use (on Learn Alaska) to
 1. instruct school principals and local governments in their responsibilities
 2. give teachers/students facts about asbestos and health hazards
- g) Have one agency responsible for evaluating all projects, awarding grants. Individual contract managers should be:
 1. School district supervisors
 2. DOT/PF
 3. Municipal official
 - i) Department of Labor would be most appropriate since the affected buildings are all "work places"
 - ii) DOT/PF might be appropriate since they are experienced in construction projects
 - iii) DEC might be appropriate since we already have a system for awarding grants to health-related projects (VSW & water/sewer)
- h) Provide personnel to operate the program
 - One - technical/health person
 - One - construction techniques person
 - One - grant auditor
 - One - public information/field investigator
- i) Make grant money "2-year." The program can not be started up and all these funds responsibly awarded in 12 months.
- j) Institute a continuous monitoring program for facilities which do not elect to remove asbestos -- posting warnings on "solid asbestos" so future maintenance/renovation does not create health hazards.

Fairbanks North Star Borough - Program for Progress

Project Title

Fairbanks Schools Asbestos
Identification and Removal Project

- Equipment Road
 Structure Utility
 Service

Capital Request

\$1,385,000

**Estimated Annual
M & O Cost**

No Increase in Annual M & O Costs.

**Description, Objectives
and Public Benefit**

During November 1983, sixteen school facilities of the Fairbanks North Star Borough were surveyed by a professional consultant for the presence and extent of asbestos. Asbestos was found in thirteen of the sixteen schools surveyed. This asbestos is "friable" or in a condition to release small fibers into the air. Non-friable asbestos was also found in these schools, usually in a cement-like compound on pipe elbows and fittings.

Friable asbestos is associated with a number of serious illnesses; consequently, the Federal government has issued strict regulations governing the use of asbestos and occupational exposure to airborne asbestos fibers.

The objective of this project is to protect the health of all Borough school building users by the removal or encapsulization of the asbestos materials.

The asbestos hazards were assessed and prioritized in order of the most serious potential risks of exposure. These priorities are:

- | | |
|---------------|---|
| URGENT: | Requires immediate attention to eliminate or reduce the risk of severe exposure to asbestos fibers. |
| PRIORITY ONE: | The facility contains friable asbestos which is accessible to all building occupants. |
| PRIORITY TWO: | The facility contains asbestos which is accessible to maintenance and custodial personnel. |

A summary of asbestos findings and cost estimates for removal are given in Table I.

Project Schedule

Encapsulization began December 1983 with local fund appropriation.
Removal scheduled for summer 1984.

Project Contact

Larry Crouder, FNSB, Department of Public Works
Borough Engineer

TABLE I

SUMMARY OF ASBESTOS FINDINGS AND COST ESTIMATES

<u>SCHOOL</u>	<u>EXPOSURE</u>	<u>CONDITION</u>	<u>PRIORITY</u>	<u>REMOVAL COST</u>
Barnette Elementary	Maintenance	Friable	P-TWO	\$134,390
Denali Elementary	Public	Friable	URGENT	118,512
Hunter Elementary	Maintenance	Friable	P-TWO	137,455
Hutchison Career Center	Public	Friable	URGENT	21,474
Joy Elementary	Public	Friable	URGENT	35,264
Lathrop High school	Public	Friable	URGENT	309,954
Nordale Elementary	Public	Friable	P-ONE	158,502
North Pole Elementary	Public	Friable	URGENT	37,245
North Pole Jr/Sr High	None	NO ASBESTOS FOUND		-0-
Ryan Jr. High	Maintenance	Friable	P-TWO	86,704
Salcha Elementary	Maintenance	Friable	P-TWO	2,741
Tanana Jr. High	None	NO ASBESTOS FOUND		-0-
University Park Elementary	Maintenance	Friable	P-TWO	22,531
West Valley High School	Public	Friable	P-ONE	4,675
Woodriver Elementary	NONE	NO ASBESTOS FOUND		-0-
		SUBTOTAL		1,069,447
		CONTINGENCY		128,333
		DESIGN		117,637
		ADMINISTRATION, DP, ACCOUNTING		<u>69,514</u>
		TOTAL		\$1,384,931

ANCHORAGE SCHOOL DISTRICT
PRELIMINARY CAPITAL IMPROVEMENT SUMMARY SHEET

CATEGORY 1

ESSENTIAL FOR THE HOUSING OF STUDENTS

<u>PRIORITY</u>	<u>PROJECT</u>	<u>ESTIMATED COST</u>
1	Asbestos removal.	10,000,000
2	Eagle River - Four-room addition, site improvements, lands purchase.	4,918,020
3	Fire Lake Elementary School.	10,114,700
4	Section 16 Elementary School.	10,402,600
5	Chugiak High - 22-classroom and library addition.	13,304,600
6	School Site Acquisition Program - Phase II.	6,200,000
7	Maintenance Requests - Roofing repairs.	7,901,801
8	Microcomputer Project.	1,500,000
9	Food Education and Service Center.	3,641,800
10	Emergency communication system.	385,000
11	Denali Fundamental - Heating system renovation.	550,000
	SUBTOTAL (CATEGORY 1)	<hr/> \$ 68,918,521

SCHOOL OR DEPARTMENT	PRIORITY	PROJECT TITLE	PROJECT DESCRIPTION	ESTIMATED COSTS
ANCHORAGE SCHOOL DISTRICT S-E,F,G,H/H-9,11,13,15	1	Asbestos removal. (Preliminary estimate. Final estimates are pending the completion of studies on asbestos removal which are currently in progress.)	Federal health and safety guidelines specify that friable asbestos should be identified where it exists in public school buildings. While not termed to be immediately dangerous, the presence of this substance may be, in the long term, potentially hazardous. Schools currently designated as being included within the priority one grouping for immediate removal are: Bartlett, Dimond, East, and West High Schools, Clark Junior High, and Mt. Spurr Elementary.	Project Estimate: 10,000,000

News Miner
2/1/84

EPA: schools ignore law about asbestos warnings

WASHINGTON (AP)—Local school officials, worried about their budgets or about "panic and hysteria," are widely ignoring a federal law requiring parents to be notified about dangerous asbestos in their school buildings, a government study says.

The study by the Environmental Protection Agency said that study said.

In many cases, the study said, school officials did not want to notify parents because of the money the school district would have to spend if forced to clean up the asbestos hazard.

School officials "are reluctant to notify parents because they believe this will result in a redirection of limited operating funds and/or create unnecessary panic and hysteria," the study said.

But whatever the reason, the EPA study added, it is undermining the program to get rid of hazards from asbestos that face millions of schoolchildren.

"The success or failure of the asbestos in schools rule, which relies heavily upon public involvement, is the degree to which information is communicated to the public," the study said. "Poor public awareness has resulted in only slight activity on the part of the parent groups in schools."

The findings are included in an internal program review requested by EPA Deputy Administrator Al Alm and completed in December. A copy was obtained by The Associated Press.

The study involves asbestos insulation that once was widely used in schools and other public buildings. Health officials now say that some types of asbestos can flake into mic-

roscopic particles that can be inhaled, causing lung cancer or other lung diseases. There is no known safe exposure level.

Under federal law, school officials are required to inspect their buildings for hazardous asbestos and to notify parents and school employees if it is found. It is then up to the local officials to decide what to do.

The law covers more than 37,000 public, private and parochial school systems with more than 50 million students.

The EPA study was intended to find out how well the program was working. Some of its findings, including the conclusion that two-thirds of the nation's schools are in violation of some part of the law, have been reported earlier.

The EPA study did not blame school officials alone. It also found that the agency itself needed to devote more money and people to the program, including more than doubling the EPA inspection program.

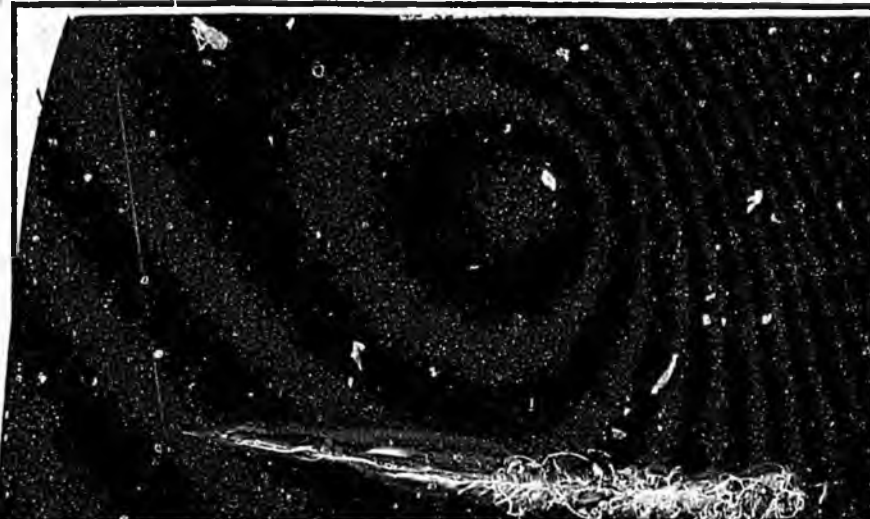
"The agency has not issued a high-

level statement detailing the risks of exposure to asbestos and the importance of considering various abatement options," the study said. "The regions and the public have not been made fully aware and have received mixed signals on the seriousness of asbestos health hazards."

The congressional author of the asbestos in schools law, Rep. George Miller, D-Calif., focused on those shortcomings in his analysis of the report.

"This document, drafted by EPA's own experts, again confirms the shocking inadequacy of this administration's approach to a threat that endangers the health of millions of school children," Miller said. "It is apparent that at least some officials within EPA are trying to warn their agency about the consequences of the current policies."

Whatever the failings of the agency however, the study indicated that school officials have not endorsed the program wholeheartedly.



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Josephson

A-4 The Anchorage Times, Wednesday, February 1, 1984

Funding limits asbestos removal

Associated Press

Washington — Local school officials, worried about their budgets or about "panic and hysteria," are widely ignoring a federal law requiring parents to be notified about dangerous asbestos in their school buildings, a government study says.

The study by the Environmental Protection Agency said that of 275 schools inspected by EPA, 190 were found to be violating the federal law on asbestos insulation. Of those 190, the EPA said, 134 had violated the requirement that parents be notified of the excess levels.

"Consequently, we can conclude that the parents of students exposed are in many cases unaware of the existence of such a hazard," the study said.

In many cases, the study said, school officials did not want to notify parents because of the money the school district would have

to spend if forced to clean up the asbestos hazard.

School officials "are reluctant to notify parents because they believe this will result in a redirection of limited operating funds and-or create unnecessary panic and hysteria," the study said.

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Whatever the failings of the agency, however, the study indicated that school officials have not endorsed the program wholeheartedly.

Federal funds to help remove asbestos

by Stephen J. Downes
Times Writer

2/9/81

The federal government has offered at least \$2.1 million to help remove asbestos at Bartlett High School, a school district official said Wednesday.

—And federal dollars will also pay for removing asbestos at Mount Spurr Elementary School, said assistant superintendent Tom Freeman.

Freeman said the federal Department of Education made the offer in a letter received by the district Tuesday, after three months of lobbying by the school district and members of the school board.

The district wanted the federal government to pay a portion of the bill for the schools because they are both on federal land.

About 35 acres of Bartlett is on federal land and technically belongs to the federal government, Freeman said. The other 118 acres have been deeded to the municipality, he said. The district operates the whole school.

Mount Spurr is on Elmendorf Air Force Base. The school district estimates it will cost \$80,000 to remove asbestos at the school,

Negotiations between the district and the DOE that might result in even more money being obtained are still continuing. The district is seeking additional funds because cost estimates for Bartlett are increasing, Freeman said.

The \$2.1 million represents 30 percent — the federal government's share — of what the district originally believed the Bartlett project would cost: \$5.5 million.

"We've informed them that it may be more," Freeman said.

Howard Games, a DOE project engineer in Seattle, said a request for the money would go to DOE offices in Washington as soon as the school district provides a revised estimate of the cost. The estimate could come as early as next week.

Construction firms will be asked to come up with estimated costs of removing asbestos at Bartlett. The firms will also seek a way to complete the work without disrupting the school year, which could mean higher costs.

The federal Environmental Protection Agency has linked exposure to asbestos with lung can-

cer and other diseases. The Anchorage School Board last year ordered asbestos removed from all district buildings.

The state legislature is now considering a district request for \$10 million to remove asbestos from six schools, among them Bartlett and Mount Spurr. Bartlett is the top priority and has by far the most asbestos.

Anchorage lawmakers have already proposed \$8.7 million for Anchorage asbestos removal.

DOE representatives will come to Anchorage in the next couple of weeks to advertise for bids on the Mount Spurr project, Freeman said.

The bid specifications will be drawn up by Gobbell, Hays and Pickering, the firm evaluating the asbestos problem for the school district.

Another DOE official, Jim Ishihara, said the federal government is also paying for asbestos removal on other Alaska schools: a \$2.2 million project at Reeve Junior and Senior High School in Adak, and a \$250,000 project at nine schools in Fairbanks.



ADEC NEWS

PRESS RELEASE FROM THE PUBLIC INFORMATION OFFICE
ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
JUNEAU, ALASKA 99811 (907) 465-2606

Bill Sheffield, Governor

Richard A. Nevé, Commissioner

Joe Ferguson, Information Officer

FOR IMMEDIATE RELEASE

April 20, 1983

ASBESTOS IN ALASKA
by Jana Baumann, Information Officer
Department of Environmental Conservation

JUNEAU--Twenty years ago the word "asbestos" meant progress, indestructibility; a nearly perfect component for building materials to insulate and to fireproof.

Today the mention of asbestos may bring a grim response and thoughts of cancer and lung diseases. What was once thought of as a miracle material is now known to be extremely harmful, especially when it is dispersed into the air and inhaled.

What is asbestos?

Asbestos is a naturally occurring mineral that can be separated into fibers. It is very lightweight and nearly indestructible. Before the early 1970s, asbestos was widely used as a component in thermal, electrical, and acoustical insulation, fireproofing, ceiling tiles, and decoration. These applications were most cost effective in large buildings like schools, factories and office buildings.

What are the harmful effects of asbestos?

The danger to human health from asbestos occurs when minute fibers are breathed and become lodged in the lungs. Asbestos containing materials are often friable which means the fibers can be readily separated from the material in which it is

-MORE-

used and become airborne. Fireproofing or insulation which is damaged and crumbling can release invisible asbestos fibers into the air.

Cancers of the chest and lungs and other organs have been positively associated with asbestos exposure. There is no known "safe" exposure. Even brief contact could result in irreversible damage that may not be detected until many years after exposure.

When the health effects of asbestos exposure were documented, many corrective programs were initiated for workers who handle it and for the public who may be unknowingly exposed at their school or workplace. In Alaska, several state and federal agencies regulate asbestos exposure, handling and disposal. Following is a brief summary of agency responsibilities.

Schools and Public Buildings

The U.S. Environmental Protection Agency regulates inspection of schools for identifying asbestos containing materials. The superintendent of each school district in Alaska has been instructed to inspect all school buildings in the district for friable asbestos by June 23, 1983. Each type of friable material located in the school buildings must be tested for asbestos content. Samples must be tested using Polarized Light Microscopy.

School districts are required to keep a record of all the inspections and results from each school building. If asbestos containing material is found in a school, additional information on the location and quantity of this material must be kept on file at the administrative office of the school and at the school district office. The school district must notify employees and the parent-teacher association about the presence of asbestos containing materials.

Asbestos Disposal

The U.S. EPA has regulations which regulate handling and disposal of asbestos. Materials containing friable asbestos must be specially contained and wetted. Landfills or disposal sites must meet certain specifications in order to accept the material. Operators of the disposal site must cover it and post warning signs.

Following is a list of agencies which regulate some aspect of asbestos in Alaska, the situations for which they are responsible, and the person to contact.

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Instruction is available on how to inspect public buildings and schools which may contain friable asbestos. Booklets and video tapes may be borrowed from the Alaska Operations Office of the U.S. Environmental Protection Agency in Juneau or from the Alaska State Library.

Asbestos emissions to the air inside the work place

The Alaska Department of Labor, Division of Occupational Safety and Health, regulates exposure of workers to airborne asbestos fibers inside the work place. The regulations also govern asbestos exposure during demolition and renovation work.

The regulations set standards for exposure levels of asbestos fibers in the air, and specify work practices such as ventilation and clothing and engineering controls for most workers in the state. Exposure criteria for federal employees and workers on offshore oil rigs or seafood processors are regulated by the U.S. Department of Labor, Occupational Safety and Health.

Questions regarding asbestos exposure or work practices in the work place should be directed to Alaska Department of Labor, Division of Occupation Safety and Health. Sampling of our materials in the work place is also done by this agency.

Asbestos emissions to the outside air

The U.S. EPA has established standards to limit emissions of asbestos to the outside air. These rules govern manufacturing plants which produce cement, fireproofing materials, insulation, and other materials which include asbestos as a component. The rules also govern materials used in roadway surfacing and emissions from asbestos milling operations. These regulations also limit release of asbestos to the air during renovation and demolition activity and fabricating operations that utilize commercial asbestos.

Asbestos Disposal

The U.S. EPA has regulations which regulate handling and disposal of asbestos. Materials containing friable asbestos must be specially contained and wetted. Landfills or disposal sites must meet certain specifications in order to accept the material. Operators of the disposal site must cover it and post warning signs.

Following is a list of agencies which regulate some aspect of asbestos in Alaska, the situations for which they are responsible, and the person to contact.

Responsible Agency	Asbestos Situation
U.S. Environmental Protection Agency Alaska Operations Office 3200 Hospital Drive, Suite 101 Juneau, Alaska 99801 Phone: 586-7619 Contact: Kathy Pazera or Steve Torok	Emission to the outside air Disposal of materials containing friable asbestos Rules for landfill or disposal site handling Exposure in public buildings and schools
U.S. Department of Labor Occupational Safety and Health Administration Federal Building and U.S. Courthouse 701 C Street Box 29 Anchorage, Alaska 99513 Phone: 271-5125 Contact: Leonardo Limitiaco	Federal employees Offshore oil rig or floating seafood processor employees
Alaska Department of Labor Division of Occupational Health and Safety 3301 Eagle Street, Suite 303 Pouch 7-022 Anchorage, Alaska 99510 Phone: 264-2597 Contact: Stan Godsoe	Asbestos in the air at the work place Work practices for handling asbestos

PRIVATE LABORATORIES WHO TEST SAMPLES FOR FRIABLE ASBESTOS

- NHS Incorporated
 Environmental Health Sciences Lab
 805 Goethals Avenue
 Richland, Washington 99352
 Phone: (509) 376-6980
- Chemical & Geological Labs of Alaska
 5633 B Street
 Anchorage, Alaska 99502
 Phone: (509) 562-2343
- Microlab Northwest
 7609 140th Place, N.E.
 Redmond, Washington 98502
 Phone: (206) 885-9419

Asbestos-control funds sought from legislatures

The Environmental Protection Agency is threatening to require schools to eliminate asbestos or face closure.

In autumn 1982, the U.S. House of Representatives voted to appropriate \$50 million to provide school districts with interest-free loans to help defray the cost of removing or controlling asbestos in school buildings. But the measure, authorized under the Asbestos School Hazard Detection and Control Act that was passed in 1980 but never funded, failed to win the support of the Senate. When a conference committee also decided against asbestos-control funds, the chances that Washington would provide money for removal became remote.

The defeat of the funding measure is likely to mean that state legislatures will feel increased pressure from school officials to come up with asbestos-control funds. Some states — New York and Alabama, for example — already have provided such funds. Alabama uses a \$75-million fund drawn from oil and gas revenues. In Mississippi, state education officials planned to go to the Legislature to ask for funds to offset the estimated \$20 million it will cost to remove asbestos from schools.

The continued absence of federal funding comes at a time when public pressure to deal with asbestos in the schools is increasing in many areas, in

part because the Environmental Protection Agency may now issue a press release announcing which schools have not met the requirements of its regulation. Under the EPA regulation, all public and private schools were required to inspect for friable (crumbling) asbestos by June 28, 1983. If they found asbestos but took no action, the schools were required to notify parents and staff members. Although there is no federal requirement that asbestos be removed from the schools, the belief was that knowledge of its presence would generate enough public pressure to force action.

What this strategy of the EPA did not take into account, however, is that many school districts lack the money to pay for the often costly abatement procedures, and would instead simply fail to notify anyone of the presence of crumbling asbestos. As of last fall, an EPA survey outlined in an internal memorandum found that about 66 percent of all schools had not complied with some component of the regulation. The most common violation, the survey found, was failure to notify.

Although more school districts are belatedly complying with the regulation, according to EPA officials, the problem of funding remains serious for some. A report prepared for the Senate Appropriations Committee by the U.S. Department of Education estimated the cost of removing asbestos from schools nationwide at \$1.4 billion. Under the loan program authorized in the 1980 legislation, the federal share of this would be \$700 million. Acknowledging that there are no firm data to support this estimate, the report places the number of schools with an asbestos problem at 15,000. The estimated cost of removal is \$100,000 per school, according to the draft report. That

figure is dramatically higher in some areas: Jackson, Miss., faces a \$6-million bill, and in Philadelphia school officials estimated the cost at \$17 million. Others, of course, will require much less money because their asbestos situation is less dire.

A growing concern that they will be held liable for any asbestos-related illness — cancer, for example — contracted by students or staff is also prompting some school officials to step up the removal process and accelerate their quest for outside funding. Lawyers who handle asbestos litigation argue that, although no school suit of this type has

been filed, school officials who do not remove a substance known to be hazardous will indeed be legally liable.

Some school districts — about 35 as of last fall — have filed suits of their own against asbestos manufacturers. Should one of these cases be decided in favor of a school district, more suits may follow, and favorable rulings would allow districts to recoup the cost of removal. Until then — barring the possibility of federal funding — districts have few places to turn and state legislators may find themselves the recipients of pleas from school officials.

— Susan Walton

States help employees buy out failing firms

Since the mid-1970s, more than 6,000 businesses across the nation have become, wholly or in part, owned by their employees. In most cases, employees have simply purchased stock through Employee Stock Ownership Plans (ESOPs), and there has been little state involvement.

When the number of plant shutdowns and relocations rose during the recent recession, however, legislators in several states sought ways to encourage "buyouts" of ailing firms by employees to save their jobs.

At least 12 states — California, Delaware, Illinois, Maryland, Massachusetts, Michigan, Minnesota, New Jersey, New York, Ohio, Oregon, and West Virginia — have laws concerning worker ownership. Although some of these laws simply direct that state agencies study the issue, others, such as in California, Illinois, Michigan, and New York, have broader provisions that provide venture capital, technical assistance, and other help to workers attempting a buyout.

Maryland and Wisconsin also have strong legislation pending, while an attempt to add to New Jersey's law was vetoed last year by Governor Thomas H. Kean.

Essentially, there are two types of employee buyouts. The first is the most widely publicized — but least frequent — when, in a last-ditch attempt, employees try to save their jobs by buying a failing or unprofitable plant in danger of being closed. Weirton Steel in West Virginia is a recent example. This kind of buyout, however, constitutes "only about 1 percent of the total," according to Corey Rosen, director of the Center for Employee Ownership in Washington, D.C.

Far more common are ESOPs. In a typical plan, workers are simply offered company stock at market value rates.

Workers of firms that offer ESOPs typically own from 15 to 30 percent of the stock, although often the stock offered is nonvoting. ESOPs are encouraged by various federal tax incentives, and little state legislation has been enacted.

Instead, some state lawmakers have designed their efforts specifically to help employees purchase failing firms, particularly in already hard-hit urban areas. For example, in Illinois, Democratic state Representative Wyvetter H. Younger, hoping to "subsidize employment rather than unemployment," sponsored a bill that passed and was sign-



Office
Send to all school districts and private schools

NOTE: Under TAP, in 1979 all schools were sent copies of Guidance Document 1 & 2



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUN 10 1982

THE ADMINISTRATOR

Dear School Administrator:

On May 27, 1982, the Environmental Protection Agency (EPA) published a rule in the Federal Register (47 FR 23360-23389) requiring all public and private elementary and secondary schools in the United States to identify friable asbestos-containing materials, maintain records, and notify employees of the location of the friable materials which contain asbestos. When friable asbestos-containing materials are found, schools must provide the employees with instructions on reducing exposure to asbestos, and notify the school's parent-teacher association.

Since 1979, EPA has operated a Technical Assistance Program (TAP) to help schools identify and correct potential hazards due to asbestos in schools. However, many schools did not respond to EPA's effort under the TAP. EPA is now requiring all schools to identify friable asbestos-containing materials and notify employees and parent-teacher organizations of their presence. These actions must be completed by June 28, 1983.

To assist schools in complying with the rule, we are enclosing a copy of the rule along with copies of "Asbestos-Containing Materials in School Buildings: A Guidance Document, Parts 1 and 2." Should you need a copy of any forms for this rule or other general information, please contact the Industry Assistance Office (TS-799), Office of Toxic Substances, Environmental Protection Agency, Rm. E-511, 401 M Streets, S.W., Washington, D.C. 20460. Phone: Toll free, 800-424-9065. In Washington, D.C., call 544-1404. Outside the Continental U.S., call Operator-202-554-1404. If you need technical assistance, please contact the appropriate Regional Asbestos Coordinator listed in the rule on page 23361.

RECEIVED

AUG 1 1982

COMPLIANCE BRANCH
EPA - REGION X

Sincerely,

Handwritten signature of Douglas C. Bannerman in cursive.

Douglas C. Bannerman
Acting Director,
Industry Assistance Office

ROUTING AND TRANSMITTAL SLIP

TO: (Name, office symbol, room number, building, Agency/Post)	Initials	Date
1. Lisa Smith		
2. Andy Christensen		
3.		
4.		
5.		

Action	File	Note and Return
Approval	For Clearance	Per Conversation
As Requested	For Correction	Prepare Reply
Circulate	For Your Information	See Me
Comment	Investigate	Signature
Coordination	Justify	

REMARKS

Attached are schools in Alaska which were sent the schools rule package. Also, attached is an address change.

RECEIVED
SEP 16 1982

DO NOT use this form as a RECORD of approvals, concurrences, disposals, clearances, and similar actions.

FROM: (Name, org. symbol, Agency/Post) EPA - Room No. - Bldg.
 Phone No.

5041-102

WASH. D.C.

Dave Mayer, EPA,

Acting Team leader for Asbestos

OPTIONAL FORM 41 (Rev. 7-76)
Prescribed by GSA
FPMR (41 CFR) 101-11.206

SUPERINTENDENT
BRISTOL BAY BOROUGH SCH D
NANKER AK 99633

SUPERINTENDENT
ALASKA GATEWAY SCH DIST
TOK AK 99720

SUPERINTENDENT
CRAIG CITY SCH DIST
CRAIG AK 99921

SUPERINTENDENT
DELTA GREELY SCH DIST
DELTA JUNCT AK 99737

SUPERINTENDENT
GATEWAY BOROUGH SCH DIST
KETCHIKAN AK 99901

SUPERINTENDENT
ANCHORAGE SCH DIST
ANCHORAGE AK 99502

SUPERINTENDENT
HAINES BOROUGH SCH DIST
HAINES AK 99627

SUPERINTENDENT
HOONAH CITY SCH DIST
HOONAH AK 99829

SUPERINTENDENT
KENAI PENINSULA BOROUGH S
SOLDOTNA AK 99669

SUPERINTENDENT
KING COVE CITY SCH DIST
KING COVE AK 99612

SUPERINTENDENT
LAKE AND PENINSULA SCH DI
NANKER AK 99633

SUPERINTENDENT
LOWER KUSKOKWIM SCH DIST
BETHEL AK 99559

SUPERINTENDENT
IDITAROD AREA SCH DIST
MCGRATH AK 99627

SUPERINTENDENT
ANNETTE ISLAND SCH DIST
METLAKATLA AK 99926

SUPERINTENDENT
NORTH STAR BOROUGH SCH DI
FAIRBANKS AK 99701

SUPERINTENDENT
NORTH SLOPE BOROUGH SCH D
BARROW AK 99723

SUPERINTENDENT
PETERSBURG CITY SCH DIST
PETERSBURG AK 99833

SUPERINTENDENT
PRIBILOF ISLAND SCH DIST
ST PAUL AK 99860

SUPERINTENDENT
ALEUTIAN REGION SCH DIST
ANCHORAGE AK 99503

SUPERINTENDENT
BERING STRAIT SCH DIST
NOME AK 99752

SUPERINTENDENT
CORDOVA CITY SCH DIST
CORDOVA AK 99574

SUPERINTENDENT
COPPER RIVER REAA SCH DIS
GLENNALLEN AK 99568

SUPERINTENDENT
DILLINGHAM CITY SCH DIST
DILLINGHAM AK 99576

SUPERINTENDENT
GALENA CITY SCH DIST
GALENA AK 99741

SUPERINTENDENT
JUREAU BOROUGH SCHOOLS
DOUGLAS AK 99824

SUPERINTENDENT
SITKA BOROUGH SCH DIST
SITKA AK 99825

SUPERINTENDENT
HYDABURG CITY SCH DIST
HYDABURG AK 99922

SUPERINTENDENT
KAKE CITY SCH DIST
KAKE AK 99830

SUPERINTENDENT
KLANCK CITY SCH DIST
KLANCK AK 99925

SUPERINTENDENT
KODIAK ISLAND BOROUGH SCH
KODIAK AK 99615

SUPERINTENDENT
LOWER YUKON SCH DIST
MT VILLAGE AK 99632

SUPERINTENDENT
MATANUSKA-SUSITNA BOR SCH
PALMER AK 99645

SUPERINTENDENT
NENANA CITY SCH DIST
NENANA AK 99750

SUPERINTENDENT
NOME CITY SCH DIST
NOME AK 99762

SUPERINTENDENT
NORTHWEST ARCTIC SCH DIST
KOTZEPUE AK 99752

SUPERINTENDENT
PELICAN CITY SCH DIST
PELICAN AK 99832

**PLEASE NOTE: THE FOLLOWING PAGES WERE TREATED
AS A UNIT IN THE ORIGINAL DOCUMENT**

SUPERINTENDENT
SAINT MARYS CITY SCH DIST
ST MARYS AK 99658

SUPERINTENDENT
SAND POINT SCHOOLS
SAND POINT AK 99661

SUPERINTENDENT
SOUTHWEST REGION SCH DIST
DILLINGHAM AK 99576

SUPERINTENDENT
UNALASKA CITY SCH DIST
UNALASKA AK 99685

SUPERINTENDENT
RAIL BELT SCHOOL DISTRICT
CLEAR AK 99704

SUPERINTENDENT
YUKON FLATS SCH DIST
FORT YUKON AK 99740

SUPERINTENDENT
WRANGELL CITY SCH DIST
WRANGELL AK 99929

SUPERINTENDENT
YAKUTAT CITY SCH DIST
YAKUTAT AK 99689

SUPERINTENDENT
SKAGWAY CITY SCH DIST
SKAGWAY AK 99840

SUPERINTENDENT
SOUTHEAST ISLAND SC
KETCHIKAN AK
99901

SUPERINTENDENT
CHATHAM REGION SCHOOLS
ANGOON AK 99820

SUPERINTENDENT
KUSPUK SCHOOL DIST
ANIAK AK
99557

SUPERINTENDENT
VALDEZ CITY SCH DIST
VALDEZ AK 99686

SUPERINTENDENT
CHUGACH SCH DIST
WHITTIER AK
99507

4 of 4

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Private Schools
for requests

Office copy

A. B. Christensen

DATE: 2 August, 1982

SUBJECT: Identification and Notification requirements for Friable Asbestos-Containing Materials in Schools

FROM: A. B. Christensen, Asbestos Technical Advisor, Region X

TO:

Each public school district has been mailed a separate package containing copies of "Asbestos-Containing Materials in School Buildings: A Guidance Document", Parts I & II (the orange colored booklets) and the new Regulation dated Thursday May 27, 1982, "Friable Asbestos-Containing Materials in Schools: Identification and Notification" (which requires inspection of all public and private schools for the presence of friable asbestos-containing material).

The responsibility for compiling and maintaining records in each school district (Local Education Agency) is placed on the individual districts. This mailing is designed to assist you to fulfill the requirements. You may find much of the work was already accomplished under the "Voluntary Asbestos Survey Program".

To assure each district and school have in their file the required information, we have made up some "check-off" lists for your use. One blank copy for the district and blank copies for the individual schools in the district are attached. For those districts and schools that are not complicated by the presence of any friable materials it will be a simple matter to fill in the blanks which apply. Those districts and schools which have friable materials are, obviously, required to complete inspections and analysis and to comply with the additional requirements of the rule as outlined on the "check-off" list and spelled out in the regulation. Please retain a copy of the "check-off" list with your file.

The check lists are made out to try to cover every situation so please bear with the seeming duplication on the second page of each list.

Should you require copies of any of the following reference materials:

- (1) Guidance Documents, Parts I & II,
- (2) Mathematical formula referred to in Part I, Chapter 7, page 14 (The Algorithm),
- (3) Polarized Light Microscopy (PLM) laboratory listing,
- (4) Any other pertinent information, please call or write direct to:

Environmental Protection Agency
School Asbestos Program M/S 524
1200 Sixth Avenue
Seattle, WN 98101 / (206) 442-7255

3200 Hospital DR
Suite 101
Juneau, AK 99801

386-7619

Your assistance to complete the identification of friable asbestos-containing materials in your school district is appreciated.

Recordkeeping required by Chapter 1 of Title 40, Code of Federal Regulations, Part 763 - ASBESTOS Subpart F - Friable Asbestos-Containing Materials in Schools; Identification and Notification

Cover Sheet

LOCAL EDUCATION AGENCY
INSPECTION FOR FRIABLE ASBESTOS-CONTAINING MATERIALS

Cover Sheet

Name and Address of the Agency (School District)

Local Education Agencies shall inspect each school building which they lease, own, or otherwise use as a school building, to locate all friable material. Inspection shall consist of looking for and touching all suspect material, including surfaces behind suspended ceilings or other non-permanent structures which may be entered during normal building maintenance or repairs.

Listing of All Schools Under Agency Authority	Inspected for Friable Materials		Contains Friable Materials	
	Yes	No	Yes	No
1.				
2.				
3.				
4.				
5.				
6.				

(Attach additional listing to include all schools in agency)

Record of Friable Materials in schools which were sampled and analyzed

School	Sampled Yes or NO Analyzed	Analysis Results	Total Area Analyzed Material (Friable Asbestos)
1.			
2.			
3.			
4.			
5.			
6.			

(Attach additional listing to include all schools in Agency which contain Friable Asbestos-Containing Materials)

For each school which contains friable asbestos-containing materials, the total number of school employees who regularly work in that school

Administrative	Faculty	Custodial
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Page 2 (Continued) Identification and Notification of Friable Asbestos-Containing Material in Schools

Warnings and Notifications

(a) Local Education Agencies shall post in the primary administrative and custodial offices and in the faculty common rooms of each school under their authority a completed copy of the Notice to School Employees unless no friable asbestos-containing material is present in the school. The Notice shall remain posted indefinitely in any school which has friable asbestos-containing material.

Date Posted _____ Copies Attached - Yes _____ No _____

(b) Local Education Agencies shall provide to all persons employed in school buildings under their authority which contain friable asbestos-containing materials a written Notice of the location, by room or building area, of all friable asbestos-containing materials in the school

Date Notice Provided _____ Copies Attached - Yes _____ No _____

(c) "A Guide for Reducing Asbestos Exposure", shall be provided to all custodial or maintenance employees.

Date Guide Provided _____

(d) Local Education Agencies shall provide notice of the results of inspections and analysis in each school in which friable asbestos materials are found to the appropriate parent-teacher association of that school. If there is no parent-teacher association for the school, the Local Education Agency shall notify directly the parents of the pupils.

Date Notice Provided to: PTA _____ Parents _____

(e) Each Local Education Agency shall complete and retain in the administrative office of the Local Education Agency the form "Inspections for Friable Asbestos-Containing Materials".

Copy Completed - Yes _____ No _____

CERTIFICATION:

I hereby certify that this Agency has complied with the EPA Regulation 40 CFR, 763.100 through 763.117, "Asbestos-Containing Materials in Schools; Identification and Notification", and that the information on this form is, to the best of my knowledge, true and complete.

Signature	Typed or Printed Name
Typed or Printed Title	Date

Please send copies of this form completed to:

- (1) State Department of Education, Pouch F, Juneau, AK 99811, ATTN: Facilities
- (2) EPA M/S 524 EPA-900
1200 6th Ave. 3200 Hospital Dr.
Seattle, WN 98101 Switch 101
Juneau, AK 99801

Recordkeeping required by Chapter 1 of Title 40, Code of Federal Regulations, Part, 763-
 ASBESTOS Subpart F - Friable Asbestos-Containing Materials in Schools; Identification
 and Notification

Cover
 Sheet

INDIVIDUAL SCHOOL INSPECTION
 FOR FRIABLE ASBESTOS-CONTAINING MATERIALS

Cover
 Sheet

Name and Address of the School

Local Education Agencies shall inspect each school building which they lease, own, or otherwise use as a school building, to locate all friable material. Inspection shall consist of looking for and touching all suspect material, including surfaces behind suspended ceilings or other non-permanent structures which may be entered during normal building maintenance or repairs.

Listing of All Buildings Used by School	Inspected For Friable Materials	Friable Materials Present/ Not Present
1.		
2.		
3.		
4.		
5.		
6.		

(Attach additional listing to include all buildings - (§763.103 (h))

FOR EACH SCHOOL BUILDING WHICH CONTAINS FRIABLE MATERIALS, THE FOLLOWING INFORMATION MUST BE MAINTAINED IN THAT SCHOOL'S ASBESTOS FILE:

1. A blueprint, diagram, or written description of the building which identifies clearly the location(s) and approximate area(s) in square feet of each sampling area of such material(s), the locations at which samples were taken, and the identification number of each sample, and which shows clearly whether each sampling area of friable material contains asbestos, including an estimate of its percent asbestos content as determined by calculating the average of the percent asbestos content of all samples taken in the area.
2. A copy of all laboratory reports and all correspondence with laboratories concerning the analysis of samples taken.
3. For each school, copies of the "Guide for Reducing Asbestos Exposure", and one copy of "Asbestos-Containing Materials in School Buildings: A Guidance Document, Parts 1 & 2.

Warnings and Notifications

(a) Local Education Agencies shall post in the primary administrative and custodial offices and in the faculty common rooms of each school under their authority a completed copy of the Notice to School Employees unless no friable asbestos-containing material is present in the school. The Notice shall remain posted indefinitely in any school which has friable asbestos-containing material.

Date Posted _____ Copies Attached - Yes _____ No _____

(b) Local Education Agencies shall provide to all persons employed in school buildings under their authority which contain friable asbestos-containing materials a written Notice of the location, by room or building area, of all friable asbestos-containing materials in the school.

Date Notice Provided _____ Copies Attached - Yes _____ No _____

(c) "A Guide for Reducing Asbestos Exposure", shall be provided to all custodial or maintenance employees.

Date "Guide" Provided _____

(d) Local Education Agencies shall provide notice of the results of inspections and analysis in each school in which friable asbestos-containing materials are found to the appropriate parent-teacher association of that school. If there is no parent-teacher association for the school, the Local Education Agency shall notify directly the parents of the pupils.

Date Notice Provided To: PTA _____ Parents _____

CERTIFICATION:

I hereby certify that this school has complied with the EPA Regulation 40 CFR 763.100 through 763.117, "Asbestos-Containing Materials in Schools; Identification and Notification", and that the information on this form is, to the best of my knowledge, true and complete.

Signature	Typed or Printed Name
Typed or Printed Title	Date

THE FOLLOWING DOCUMENT(S) MAY NOT FILM
LEGIBLY BECAUSE OF POOR QUALITY OF THE
ORIGINAL.

copy of the friable-asbestos results of any Alaska school that complies with the present regulation.

3) List of those schools represented at your presentation in Anchorage and Fairbanks.

Thank you for your time and effort.

September 17, 1982

Sincerely,

Chris Christensen, Asbestos Technical Advisor
EPA/Region X
1200 Sixth Avenue
Seattle, Washington 98101

Dear Chris and
A. Smith

The EPA-A00, Juneau would like to express their appreciation for your presentation on the May 27, 1982 Regulation on Friable Asbestos-Containing Materials in Schools conducted in Juneau (9/13), Anchorage (9/14), and Fairbanks (9/15) for all Alaska school district representatives. I think this explanation, and clarification of the relatively new rule will help to promote Alaska schools to comply with the regulation.

As we discussed, you are planning to distribute a letter explaining the new friable-asbestos regulation to each Alaska school district and private school. Hopefully, this will clarify the regulation for those school representatives who were unable to attend your presentation and encourage each school to comply with the regulation in a timely manner. If we can be of any assistance to you in notifying Alaska schools of their responsibility in identifying friable-asbestos materials in their schools, please contact us.

In order to complete our records concerning this project would you please send us a copy of the following material:

- 1) The 1982 cover letter that accompanied the new regulation and Guidance Document distributed to all school districts and private schools.
- 2) The follow-up letter (yellow) and attachments you will be distributing to school districts and private schools.
- 3) Copy of the friable-asbestos results of all Alaska schools that complied with the volunteer program.

- 4) Copy of the friable-asbestos results of any Alaska school that complies with the present regulation.
- 5) List of those schools represented at your presentation in Anchorage and Fairbanks.

September 17, 1982

Thank you for your time and effort.

Sincerely,

Chris Christensen, Assistant Director
 1200 State Avenue
 Anchorage, Alaska 99504

Kathy Paxera
 Environmental Scientist

cc: J. Halterman
 A. Smith

See your presentation of the new friable-asbestos regulation to school districts and private schools. Hopefully, you will clarify the regulations for those school representatives who were unable to attend your presentation and encourage each school to comply with the regulation in a timely manner. I think this regulation will help Alaska schools to comply with the regulation.

As discussed, you are pleased to distribute a letter explaining the new friable-asbestos regulation to each school district and private school. Hopefully, you will clarify the regulations for those school representatives who were unable to attend your presentation and encourage each school to comply with the regulation in a timely manner. I think this regulation will help Alaska schools to comply with the regulation.

In order to complete our records concerning this matter, please send us a copy of the following:

- 1) The 8/23 cover letter that accompanied the regulation and Guidance Document distributed to school districts and private schools.
- 2) The follow-up letter (yellow) and Guidance Document distributed to school districts and private schools.
- 3) Copy of the friable-asbestos results of any Alaska school that complied with the present regulation.

THE PRECEDING DOCUMENT(S) MAY NOT FILM
LEGIBLY BECAUSE OF POOR QUALITY OF THE
ORIGINAL.

ATTENDANCE TO CHRISTMAS 7
presentation in Anchorage 9/14/82

Tom B. Bean, Busk Manager, Anchorage School Dist.

Bob Thornton, MAINT DEPT., Anchorage School Dist.

Bob Ellison, MAINT + OPERATIONS DIR., KODIAK SCHOOL DIST.

Clay R. Sheek, PLANT MANAGER, ADVENT SLOPE BOROUGH SCHOOL DIST.

Ludwig C. Cosulich, Deputy Supervisor, KENAI PENINSULA BOARD

JAMES WM. ELLIOTT, DOE (SEK) ANCHORAGE

Forster A. Day, DEPT. FREIGHTS, WELLES CITY SCHOOLS, WELLES

James C. Hunsicker, DIR. OPERATIONS & MAINTENANCE, MATSU SCHOOL DIST.

JAN D. AFFINITO, ASST. DISTRICT ADMINISTRATOR, KATANUSKA-SUSTINA BOROUGH

Steve Zeake, AK DEPT. OF ENV. CONSERVATION, AK

437 E St., SUITE 200

Anch., AK 99501

PLEASE SEND 10 COPIES OF MATERIAL LISTED ON

2 Aug. 1982 MEMORANDUM. Thank you.

Need copy of model specifications for
development of asbestos removal contracts.

ATTN: JAN AFFINITO

MATANUSKA-SUSITNA BOROUGH

P.O. Box B

PALMER, AK

99645

Please send set of spec ~~to~~ and PCM Lab.

Tom Bibear Asst Manager

Anchorage School Dist.

Phone 6-614

Anchorage, AK 99503

Attendance to Christensen to
presentation in Fairbanks 9/15/82.

List

+ Donna Higdon - S.D. Warehouse,
1300 Munnie St.
FBKS. } P.O. Box. 1250
FBKS. AK 99707

+ * Michael D. Pilon FAIRBANK NSBSD

Dir. Maint + OPS.

+ Nancy R. Napolelli
Dept. of Environmental Conservation
Ranch 1601
Fairbanks, AK 99707

+ Bid B. IRVIN
ALASKA LATEWAY SCHOOL DISTRICT
PO Box 226 TOK ALASKA 99780

+ Ray L. Huntley
DELTA/GRIFFLY SCHOOL DIST.
PO Box 527 DELTA JCT, AK 99737

+ JIM ELLIOTT
DOE 650 W. INTNL AIRPT RD
ANCH 99502

+ Harry Purdy
Eskola City School District

* James Howard

Maint Foreman,

FBKS No. Star Borough School Dist.

PO Box 1250 - 29201

PLEASE NOTE: THE PRECEDING PAGES WERE TREATED
AS A UNIT IN THE ORIGINAL DOCUMENT.