

ALASKA LEGISLATURE COMMITTEE FILES 1983-1984 86/2

2357 SHESS SB 372 - SB 373 > 37



Employment and Training
Center of Alaska

A Rehabilitation Industry

30 Nichols
Anchorage, Alaska 99504
(907) 279-6617

CLYDE FARRINGTON
Executive Director

February 14, 1984

Senator Don Gilman
Pouch V
Juneau, Alaska 99811

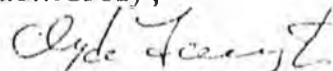
Senator Gilman,

This is to support Senate Bill 372 which calls for the development of a sheltered workshop in the Kenai Peninsula. The staff of the Employment and Training Center of Alaska has advocated for such a program and remain available to you and the people of the Kenai/Soldotna area.

As I am sure you are aware, both the Administration and the Department of Health and Social Services are examining possible mechanisms by which the operational costs of such a program might be identified. It is my sincere hope that these operational funds might be coordinated with the capital funds of this Bill to provide a comprehensive vocational training program for the disabled people of the Kenai Peninsula area.

Please feel free to contact the Employment and Training Center of Alaska if we can be of any assistance.

Sincerely,


Clyde Farrington
Executive Director

cc: Mr. Harold Reynolds
Dr. Robert Gregovich
Senate HESS Committee
House HESS Committee
Senate Finance Committee
House Finance Committee

CF/pr



Employment and Training
Center of Alaska

A Rehabilitation Industry

2330 Nichols
Anchorage, Alaska 99504
(907) 279-6617

CLYDE FARRINGTON
Executive Director

February 14, 1984

Senator Paul Fisher
Pouch V
Juneau, Alaska 99811

Senator Fisher,

This is to support Senate Bill 372 which calls for the development of a sheltered workshop in the Kenai Peninsula. The staff of the Employment and Training Center of Alaska has advocated for such a program and remain available to you and the people of the Kenai/Soldotna area.

As I am sure you are aware, both the Administration and the Department of Health and Social Services are examining possible mechanisms by which the operational costs of such a program might be identified. It is my sincere hope that these operational funds might be coordinated with the capital funds of this Bill to provide a comprehensive vocational training program for the disabled people of the Kenai Peninsula area.

Please feel free to contact the Employment and Training Center of Alaska if we can be of any assistance.

Sincerely,

Clyde Farrington
Executive Director

cc: Mr. Harold Raynolds
Dr. Robert Gregovich
Senate HESS Committee
House HESS Committee
Senate Finance Committee
House Finance Committee

CF/pr

Soldotna, Alaska

Feb. 16, 1984

Dear Mr. Josephson,

I am writing in reference to Senate Bill No. 372 for a Sheltered Workshop and Group Home in Soldotna for the Mentally & Physical Handicapped.

I am so in hopes you will support this bill. We are so in need of a facility in this area. The peninsula is growing at such a rapid pace that we will have more adults than we have now. At this time there is nothing here, as you must know, and no place without a waiting list in the state. We have had our daughter on the waiting list at Hope Cottage for almost three years and still no openings. We really don't want her to move out of the area so are in hopes we will be able to get a workshop here. Please consider this very closely.

Sincerely

Mrs Adelaide Moore

Jack E. Brown
Executive Director
283-4099 Office

People Count Inc.

P.O. Box 7073 NRB
Kenai, AK 99611

Judith Walgenbach
Operations Director
776-8510 Message

February 15, 1984

The Honorable Don Gilman
Alaska State Senate
Pouch V
Juneau, AK 99811

RE: Sheltered Workshop

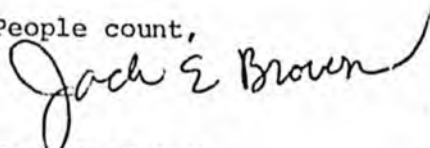
Dear Senator Gilman:

Enclosed please find two packets of additional information on the Sheltered Workshop/Residential Care Facility. This includes:

- 1) Kenai Peninsula Borough Resolution 84-43;
- 2) Construction and operational costs;
- 3) Architectural drawings of Sheltered Workshop/Residential Care Facility;
- 4) Revised list of Sheltered Workshop Steering Committee.

We hope this information is helpful. Could you please see that Senator Fischer gets a copy of the packets? Please let us know if there is anything else we can provide for you. Thank you.

People count,



Jack E. Brown
Executive Director

KENAI PENINSULA BOROUGH

RESOLUTION 84-43

AUTHORIZING THE BOROUGH MAYOR TO ENTER INTO A LEASE/PURCHASE CONTRACT FOR FIVE (5) ACRES OF LAND TO BE USED EXCLUSIVELY FOR A SHELTERED WORKSHOP/RESIDENTIAL CARE FACILITY.

WHEREAS, the Kenai Peninsula Borough Assembly passed Resolution 83-76 on March 1, 1983 in support of a sheltered workshop/residential care facility; and

WHEREAS, such facilities are needed on the peninsula; and

WHEREAS, the Kenai Peninsula Borough Planning Commission considered the proposed development at the meeting of January 23, 1984 and February 6, 1984; and

WHEREAS, the commission found, by unanimous decision, that this was an acceptable use for the land and recommended the Borough Assembly authorize the Borough Mayor enter into a lease/purchase contract with certain restrictions;

NOW THEREFORE, BE IT RESOLVED BY THE ASSEMBLY OF THE KENAI PENINSULA BOROUGH:

Section 1. That the Borough Mayor is authorized to enter into a lease/purchase contract with People Count, Inc. for no more than five (5) acres described as:

A 5 acre tract located within the SW $\frac{1}{2}$, NE $\frac{1}{2}$, Section 1, T4N, R11W, S.M. Alaska subject to a survey and plat.

Section 2. That such lease/purchase is subject to the following conditions:

1. The property is to be used exclusively for a sheltered workshop/residential care facility or it reverts back to the Borough.

2. Construction has to be started within three (3) years or it reverts back to the Borough.

3. The property is paid off over a ten (10) year period at 10% per year.

4. An additional five (5) acres immediately adjacent to the designated parcel is to be set aside for exercise of an option to purchase by People Count, Inc, under the same conditions as contained herein. Such option must be exercised withing fifteen (15) years or whenever the land is proposed for

conveyance whichever is first. The price will be at the current borough appraisal in effect at the time of exercising the option. The purchase must be completed within sixty (60) days of notification by People Count, Inc.

5. The purchase price is to be at current borough appraisal. However, if the lease/purchase is still in effect at the end of five (5) years, the property shall be reappraised and the lease/purchase shall be adjusted to the new appraisal.

Section 3. That the lease/purchase agreement shall contain such provisions as are deemed necessary to ensure that the conditions specified herein are met.

Section 4. That this resolution takes effect immediately upon its adoption.

ADOPTED BY THE ASSEMBLY OF THE KENAI PENINSULA BOROUGH ON THIS _____ DAY OF _____, 1984.

Joseph C. Arness, Assembly President

ATTEST:

Borough Clerk

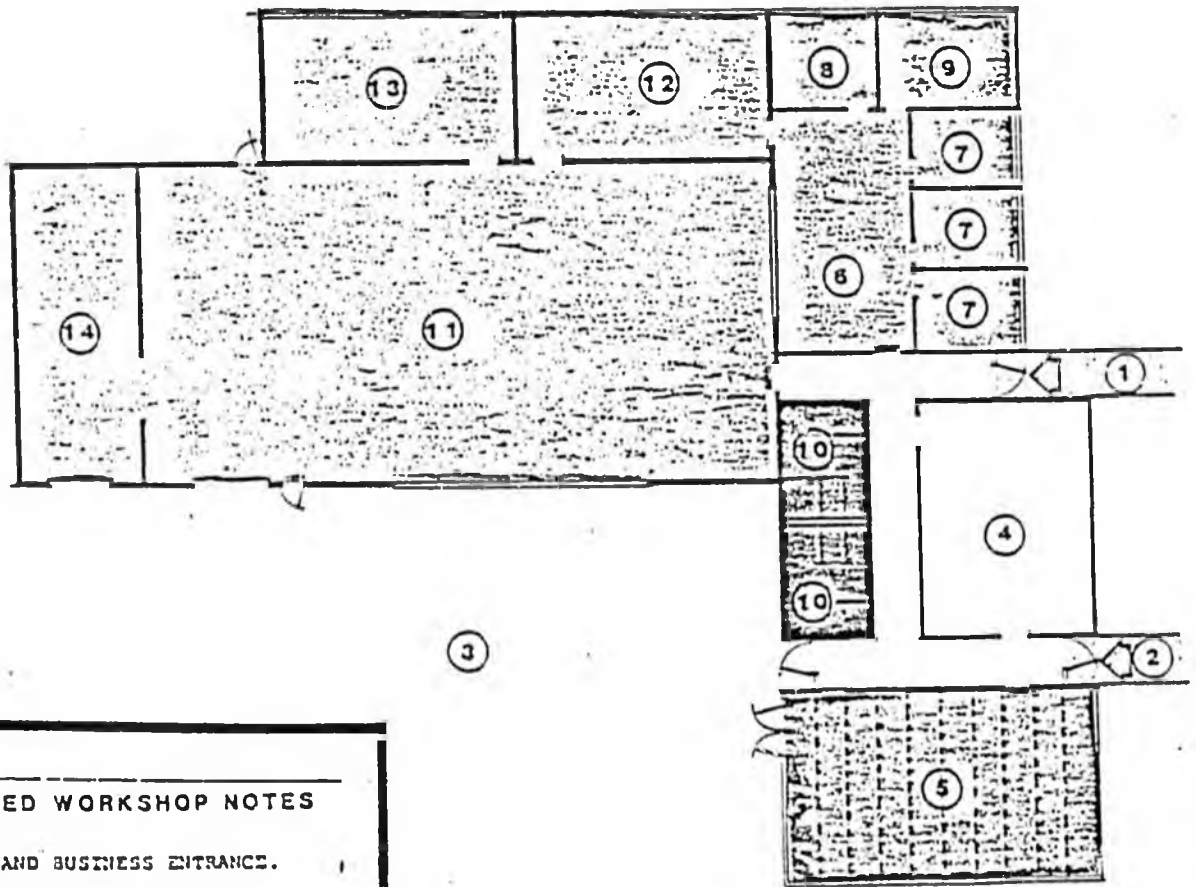
CONSTRUCTION AND OPERATIONAL COSTS

PHASE I

- A. Construction of Sheltered Workshop \$925,000
 7,000 square ft. building
 Capital expenditure will be approx. 10% of this figure.
 Architect
 Civil Engineer
 Septic system
 Well
 Utilities
- B. Operating costs \$175,000
 These costs will be supplemented by
 in-kind and community match donations...
 they are based on operating within the
 the proposed sheltered workshop.

PHASE II

- A. Construction of a Residential Care Facility \$600,000



SHELTERED WORKSHOP NOTES

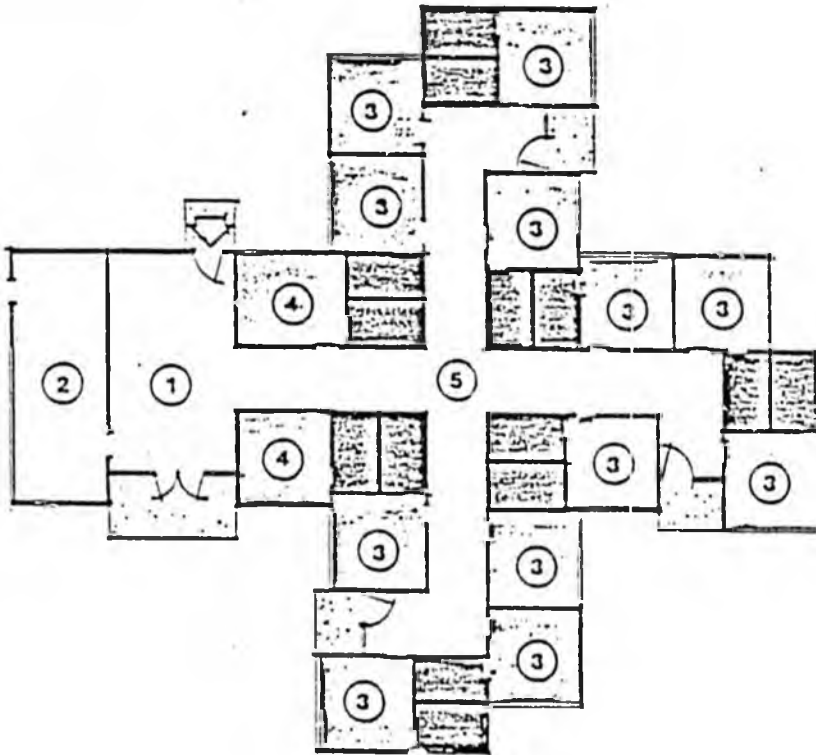
1. STAFF AND BUSINESS ENTRANCE.
2. PUBLIC AND SALES ENTRANCE.
3. SERVICE YARD.
4. CRAFT SALES.
5. GREENHOUSE.
6. RECEPTION AND OPEN OFFICE.
7. SMALLER OFFICE, 120 SF.
8. LARGER OFFICE, 150 SF.
9. CONFERENCE ROOM.
10. RESTROOMS (HANDICAP).
11. WORKSHOP 40' X 80'.
12. THERAPY AND EXERCISE ROOM.
13. LUNCH ROOM, LOUNGE, MULTIPURPOSE.
14. STORAGE AND MATERIALS.

SHELTERED WORKSHOP

AREA 7000 sq. ft.

RESIDENTIAL CARE FACILITY NOTES

1. LIVING ROOM WITH DINING AREA.
2. KITCHEN AND SERVICE.
3. TYPICAL SINGLE QUARTERS WITH BATH (12).
4. STAFF QUARTERS.
5. WIDE CORRIDOR.



RESIDENTIAL CARE FACILITY

PEOPLE COUNT, INC.

Sheltered Workshop Steering Committee

Revised 2/14/84

*Betty Glick, Chm.

Box 528

Kenai, AK 99611 283-7644

*Jack Brown

Box 7073

Nikishka, AK 99635 283-4099

LaVern Davidhizar, D.O.

Box 2949

Soldotna, AK 99669 262-7566

Joan Davis

Rt 2 Box 159

Soldotna, AK 99669 262-7320

*Kevin Dee

**Box 4267

Soldotna, AK 99669 776-8533

John Douglas

Box 4500

Kenai, AK 99611 283-3096

Fran Jones

Rt 2 Box 778

Soldotna, AK 99669 283-4196

**Sally Kishbaugh

Box 4151

Soldotna, AK 99669 776-8533

Arlene Larson

Box 4958

Kenai, AK 99611 283-3893

*Todd Nelson

**11355 Spur Hwy.

Benco Bldg. Room 208

Kenai, AK 99611 283-3133

**Libby Strandlie

Box 1200

Soldotna, AK 99669 262-4478

**Janie White

Rt 1 Box 1290

Kenai, AK 99611 776-8438

*Executive Committee

**Technical Support Advisory Committee

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: *MR Jim Robinson* Jim Robinson

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					
4	Type of Expenditure			Amount	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.			
	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				Range/Step 19A	Barg. Unit GGU	Form 12 Page/Line	GOV.	A	DISAPP.			
2	Type of Position SEAS	Staff Months 10	RP Number	PCN Number	BRIJ 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

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 Typist 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
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

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 DB 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:

OLD HIGH SCHOOL
PIPE CRAWL WAY

CHRYSOCTILE-45%

CELLULOSE -45%

SILICATES -10%

OLD GYM
HOT WATER TANK

CHRYSOCTILE-60%

NONE SEEN

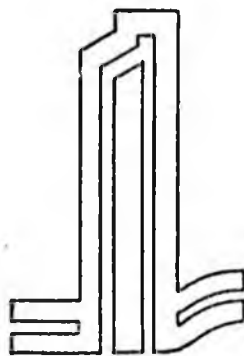
SILICATES - 5%
UNKNOWN BINDER-35%

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:

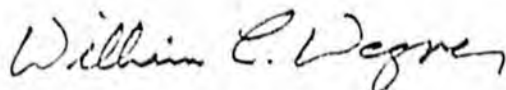
Enclosed is the cost estimate for the asbestos abatement of the spray-applied material in Kodiak High School. We have included our recommendation for abatement, approximate cost and time figures, and phasing possibilities to allow for portions of the building to remain in use during the abatement.

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
			<u>\$ 600,814.50</u>
Replacement			
New Fireproofing	42,785 S.F.	6.15	263,127.75
Dropped Ceiling Replacemt.	24,855 S.F.	4.38	<u>108,864.90</u>
			\$ 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		2		3					
PERSONAL SERVICES									
5	Salary	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								
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 _____									

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 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 - APERA

concerned that pub. facilities are eliminated from bill. Great need for other buildings. APERA 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.

2/23/84

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.

2400 - 2500 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.

dy. 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 COM, INC.

PHONE: 908-5306

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

CHRYCOTILE-
10%

CELLULOSE &
SYNTHETIC FIBER- 1%

CEMENT 90

Ceiling Tiles in Classrooms

NONE SEEN

FIBROUSGLASS- 90%

SILICATES 10

Wrapped pipes in shop

CHRYCOTILE-
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 data are from prospective studies (1-8) and other (19-22).

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 (104, 23)	56	761 (615, 67)
All causes (1950-1970)	0.2			1.41	2.26	0.61	1.10	1.11	1.46		1.20
Cancer-all sites (140-210) or (140-210)	24 (50.2)	23	68	172 (56, 24)	66	13 (17, 41)	50 (51, 32)	50 (42, 77)	55 (30, 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 (150, 154)	0										
Cancer-digestive system (150-154)			20								55 (19, 91)
Cancer-G.I. tract (150-154)	13 (19.9)	5 (1.79)		24 (10, 57)	13	4 (3, 82)			15 (7, 99)	1	
Respiratory disease (490-514)											61 (19, 31)
Non-infectious respiratory disease (410-514)											6, 71
Asbestosis (515, 2)	0	2	30	26	18	2			15	2	19
Pulmonary tuberculosis (510-511)	0	4, 15	10, 0	5, 0	15, 0	3, 0			12, 0	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	23.4	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 with asbestos filter pans	Asbestos company, U.S.A.
Observation period	1916-1977	1945-1965	1940-1964	1967-1971	1940-1975	1945-1974	1931-1974	1931-1974	1959-1975	1940-1975	1941-1974
Years exposed	20.5	215	varies	not reported	varies	91	97	910	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	1000-10000 ft ³ /year	1 to 15 ft ³ /year (1936-72)	not reported	light exposure	yes
Asbestos type	Chrysotile + Crocidolite + amphibole	not reported	not reported	chrysotile, amosite	not reported	chrysotile only	chrysotile, crocidolite	chrysotile, crocidolite	not reported	bestic, crocidolite, not chrysotile	chrysotile, bestic, crocidolite

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1) International Classification of Diseases, 10th Revision (ICD-10)
 2) From the United States, the mortality attributable to asbestos exposure accounted for 1.5% of all deaths in 1970. This is a significant increase from 0.5% in 1950.

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

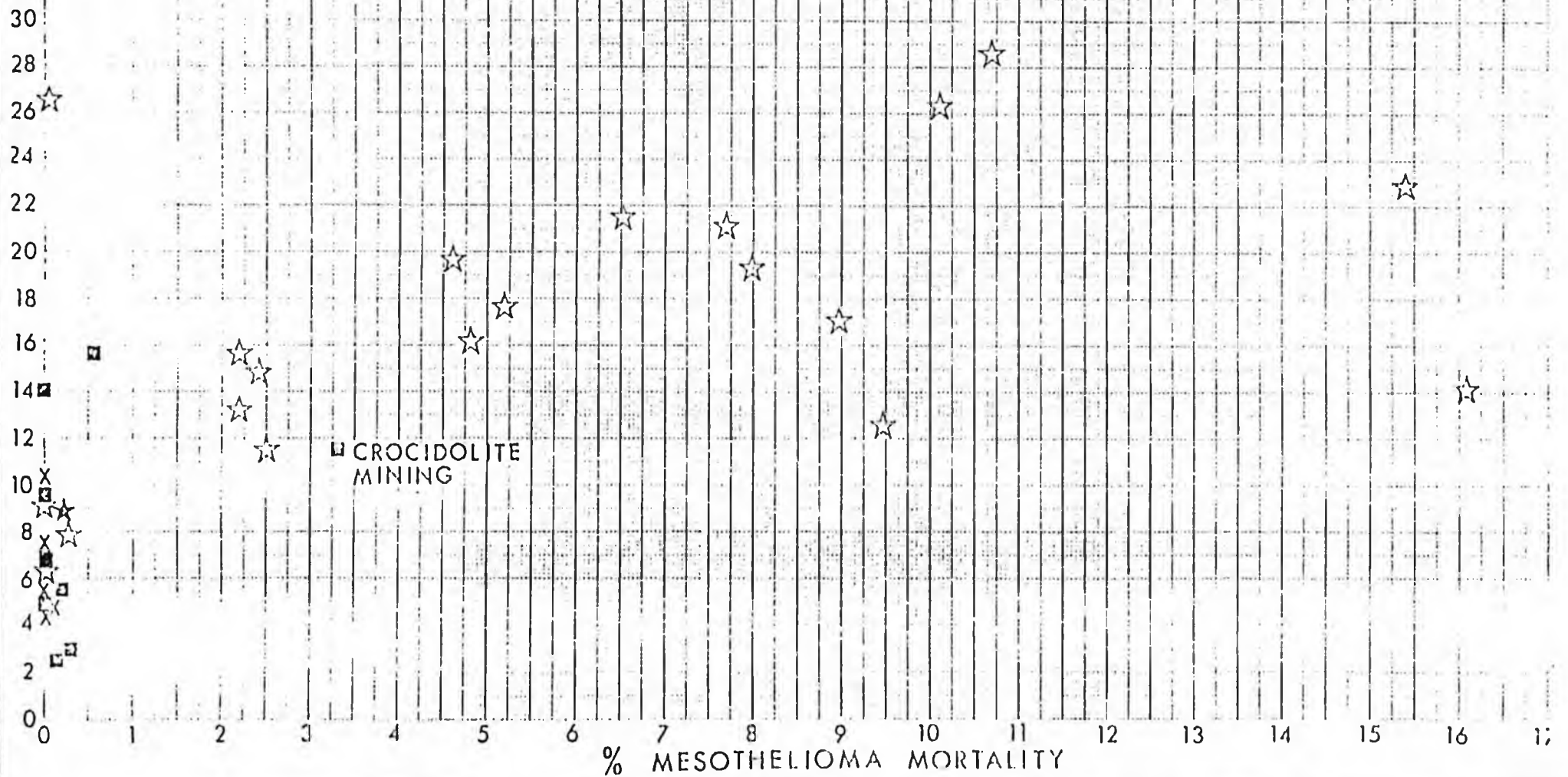
Study		III	IIII	IV	V	VI	VII	VIII	IX	X	XI	XII
Case of cancer	Number of deaths	Perout et al., 1974	Newhouse and Reilly, 1977	Neill et al., 1979	Seltoff et al., 1979 ¹	Seltoff et al., 1979 ²	Seltoff et al., 1979a	Seltoff et al., 1979b ²	Seltoff et al., 1979c	Seltoff et al., 1979d	Cherniack and Anderson, 1981	Neill et al., 1981
All cancer (100-104)	Obs./Exp.	120(1.42)	745(556.0)	601(690.1)	475(170.9)	87(63.8)	2271(1654.4)	79(25.7)	104(150.4)		Not given	14
	% all deaths	1.56	1.14	0.68	1.45	0.76	1.37	1.05	1.97			
Lung cancer (110-114)	Obs./Exp.	8(3.14)	175(119.41)	120(156.6)	210(57.0)	23(10.1)	925(104.7)	10(16.2)	116(11.4)		167(111.13)	7
	% all deaths	1.40	2.15	0.77	3.55	1.98	1.11	2.41	1.47		1.11	
	% all deaths	1.5	43.6	29.0	43.7	12.1	41.8	49.4	36.2			53.8
Cancer lung, trachea, bronchus (167)	Obs./Exp.	510(74)	135(46.41)	51(49.2)	91(11.1)	16(2.6)	446(105.6)	21(5.7)	69(10.1)		44(27.31) ³	110(70)
	% all deaths	5.12	2.80	1.04	6.96	3.45	4.60	3.68	5.34		1.61	14.7
	% all deaths	26.3	17.4	8.49	12.5	14.1	21.4	25.6	19.7			31.3
Mesothelioma peritoneum, pleura (104,162)	Obs./Exp.	None reported	67	0	18	3	125	4	14		1	2
	% all deaths		8.99	0	2.95	0.83	2.41	10.1	4.61			14.2
Cancer digestive system (155-156)	Obs./Exp.		60(44.2)	25(50.1)								
	% all deaths		1.36	0.50								
	% all deaths		8.05	4.16								
Cancer colon, rectum (157-158)	Obs./Exp.				43(15.1)	3(1.5)	94(51.4)	1(1.1)	16(6.0)		0(24.4)	1
	% all deaths				2.05	2.61	1.67	0.97	2.90		1.01	1
	% all deaths				3.01	4.41	4.36	3.80	5.26			1.6
Respiratory disease (169-174)	Obs./Exp.	101(1.24)	102(76.0)									
	% all deaths	0.76	1.31									
	% all deaths	52.6	11.7									
Noninfectious respiratory disease (176-181)	Obs./Exp.				45(1.1)	7(1.4)	212(5.0)	14(1.7)	24(4.7)			
	% all deaths				4.41	6.15	3.59	4.18	5.11			
	% all deaths				9.41	11.1	3.14	12.7	2.66			
Asthenosis (185,2)	Obs./Exp.				41	5	168	11	14			
	% all deaths				9.15	9.56	3.40	16.4	5.92			
Number in cohort		41	5527	5035	632	631	17,400	410	682		568	
Number of entry (females)		41(0)	4600(67)	5645(0)	632(0)	631(0)	12,600(0)	103(0)	58(0)		568(0)	568(0)
% lost		15.1	11.5	13.6	15.2	7.14	12.4	15.0	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 workers	Asbestos workers	Asbestos workers		Asbestos workers	Asbestos workers
Observation period		1960-1975	1931-1975	to 1974	1945-1976 (10 yr employment)	1944-1976 (first employment)	1960-1976	1962-1976	1960-1975		1960-1975	1960-1975
Years reported		varies	310	varies	varies	varies	varies	varies	varies		varies	varies
Years since first exposure		varies	310	320	most 30	most 30	varies	varies	varies		varies	varies
Controls		male rates, Genoa	not given	death rates, Ins, Imbion, matched controls	0% death rates	0% death rates	0% death rates	0% death rates	0% death rates		death rates, first 20 industrial sites	death rates, Genoa
Smoking data		Not reported	yes	None	Not reported	Not reported	Not reported	Not reported	Not reported		Yes	Not reported
Exposure data		Not reported	yes	0 to 3000 mg/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		Asbestos, some crocidolite	Thrysotile, amosite, crocidolite

1 International Classification of Diseases, ICD Revision (1974)
 2 Within the United States mesothelioma mortality correlated to asbestos exposure reported for approximately one death in 10,000 in 1977 (estimated from data given by R. Gould and B. Hays).
 3 Reported to include 1000 cases of mesothelioma other than commercial asbestos.

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☆ 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).



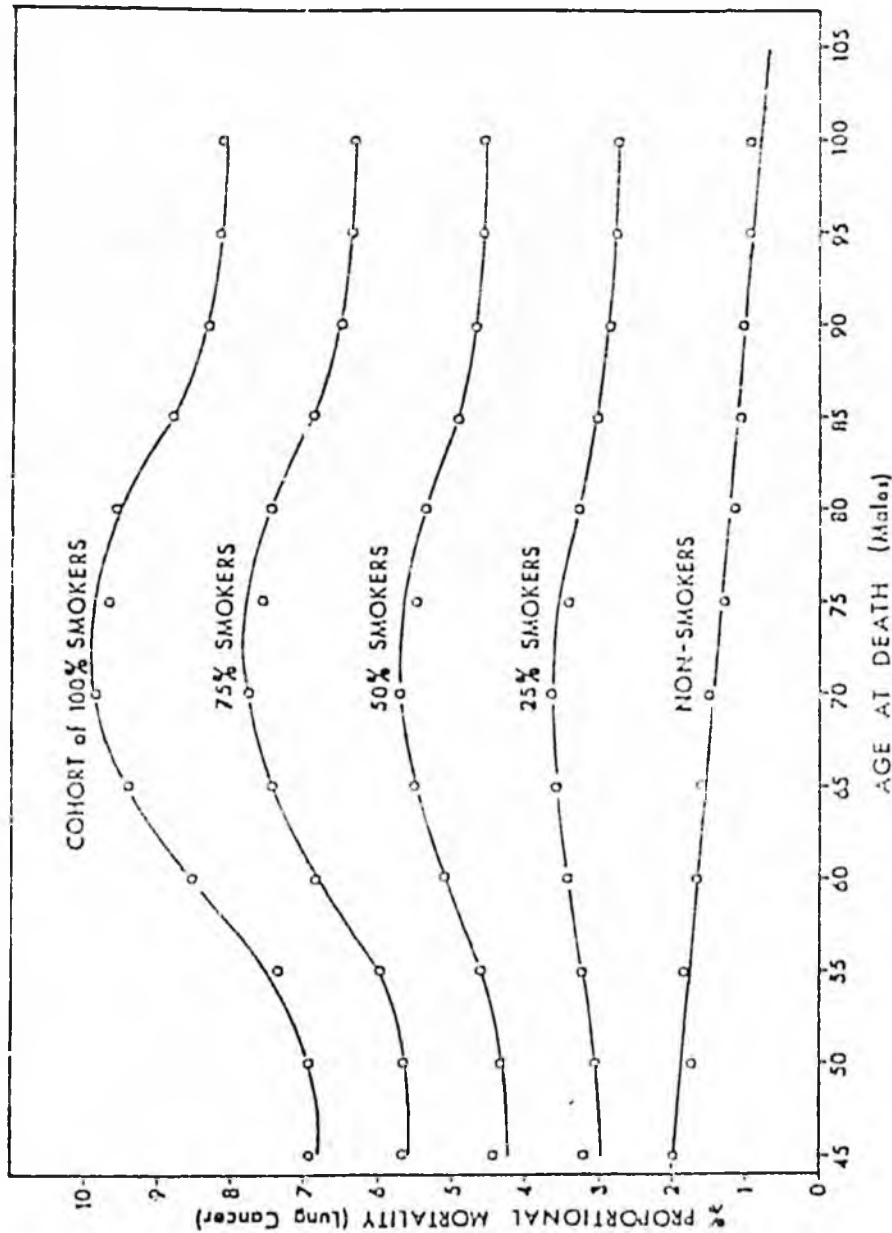


Figure 2. Percent of lung cancer deaths in males relative to deaths by all causes (proportional mortality - lung cancer) plotted with respect to age for four groups (cohorts) having different cigarette-smoking characteristics and for a cohort of non-smokers. For example, for a cohort of 70-year old males 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	10 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	banfel ironstone	serpentine	serpentine	serpentine	
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., 1974	Nicholson et al., 1974	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.