

# ASBESTOS - RELATED LUNG CANCER: AN UNRECOGNIZED HEALTH HAZARD

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OEH SEMINAR SERIES

NOVEMBER 23, 2018

# ASBESTOS-RELATED LUNG CANCER: AN UNRECOGNIZED HEALTH HAZARD

- CONFLICT OF INTEREST STATEMENT
- I HAVE TESTIFIED IN MEDICAL-LEGAL PROCEEDINGS ON BEHALF AND AT THE REQUEST OF INDIVIDUALS INJURED BY ASBESTOS EXPOSURE AND THEIR FAMILIES.

# ASBESTOS AND LUNG CANCER: BACKGROUND

- *DE MORBIS ARTIFICUM DIATRIBA* 1713
- PNEUMOCONIOSES
- CANCER



*J.G. Seiller Scaffhurianus sculpsit*

BERNARDINO RAMAZZINI

From the *Opera Omnia*, Geneva, 1717

# ASBESTOS AND LUNG CANCER: BACKGROUND

“WE MAY BE SURE THAT THERE ARE MANY THINGS IN GENERAL USE THAT ARE SUPPOSED TO BE HARMLESS BECAUSE THEY INTRODUCE THEIR POISONS GRADUALLY AND WITH STEALTHY FOOT, UNTIL SOME ACCIDENT PLAINLY SHOWS THEIR HIDDEN HARMNESS.”





# ASBESTOS-RELATED LUNG CANCER

# ASBESTOS

- A MAGNESIUM-IRON SILICATE FIBER
- FIBER TYPES IN COMMERCIAL USE:
  - AMPHIBOLES
    - AMOSITE
    - CROCIDOLITE
    - TREMOLITE
  - SERPENTINE
    - CHRYSOTILE

# ASBESTOS: FIBER TYPES



# ASBESTOS: FIBER TYPES

- CROCIDOLITE



# ASBESTOS: FIBER TYPES

- CHRYSOTILE



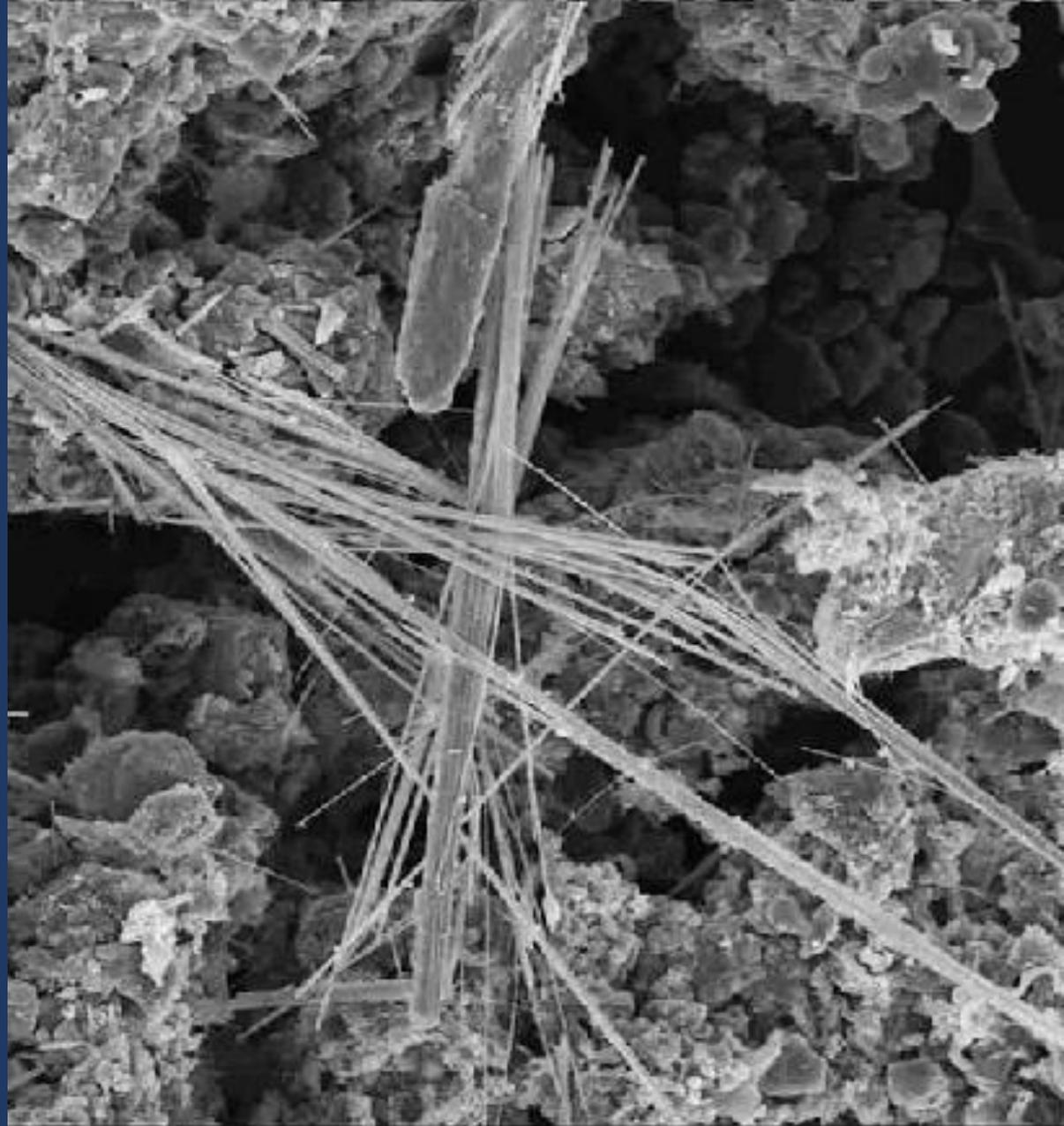


# ASBESTOS FIBER TYPES: SIMILARITIES

- MINED FROM THE EARTH'S SURFACE

# ASBESTOS FIBER TYPES: DIFFERENCES

- AMPHIBOLE:  
AMOSITE



100µm



Detector =

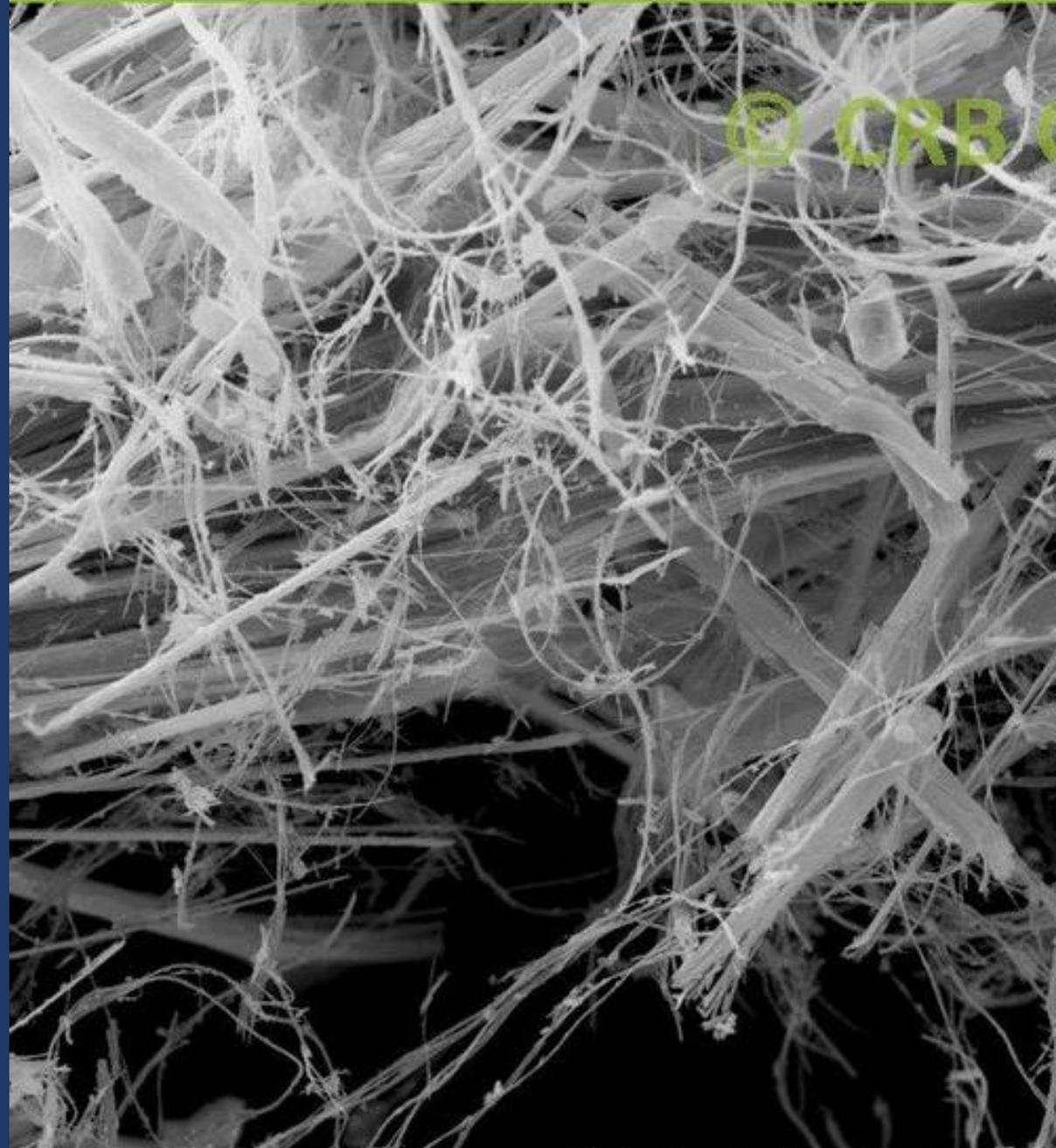
Date :12 M

# ASBESTOS FIBERS: DIFFERENCES



# ASBESTOS FIBERS: DIFFERENCES

- SERPENTINE:  
CHRYBOTILE

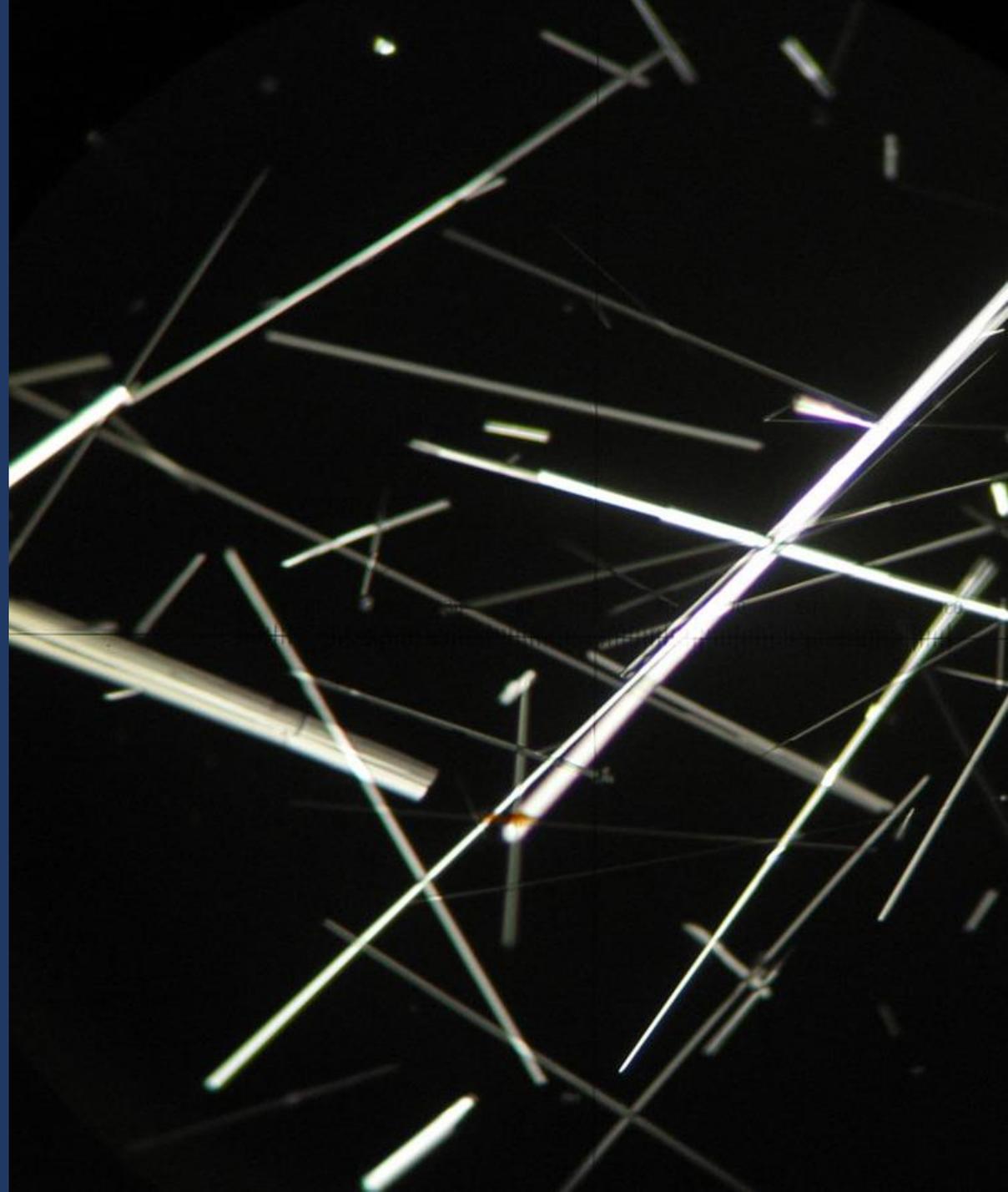


op Beschleunigungsspannung Arbeitsabstand Detektor  
20 kV 9.9 mm SE

# ASBESTOS FIBERS: DIFFERENCES

- TREMOLITE:  
AMPHIBOLE  
CONTAMINANT OF  
CHRYBOTILE

< 1%



# ASBESTOS-RELATED DISEASES

- **MALIGNANT**

- LUNG CANCER
- LARYNGEAL CANCER
- OVARIAN CANCER
- MALIGNANT MESOTHELIOMA

- **NONMALIGNANT**

- FIBROSIS: LUNG TISSUE (ASBESTOSIS)
- FIBROSIS: PLEURA (CIRCUMSCRIBED, DIFFUSE)

# ASBESTOS-RELATED LUNG CANCER: UNRECOGNIZED HEALTH HAZARD

- WHY?
- EARLIER ASSOCIATIONS WITH ASBESTOSIS?
- POOR STEP-SISTER TO MALIGNANT MESOTHELIOMA?
- CIGARETTES?

# ASBESTOS AND LUNG CANCER: BACKGROUND

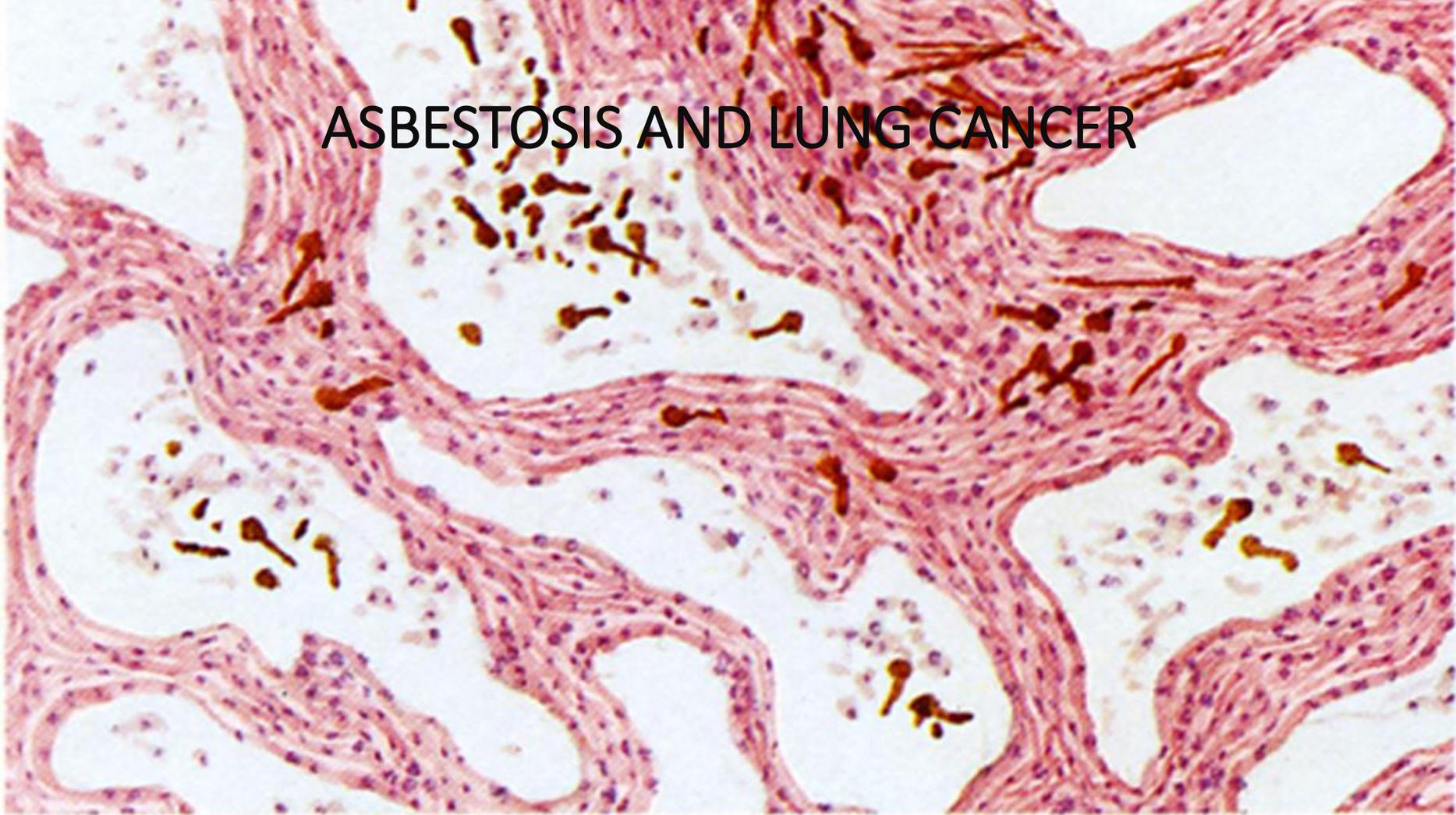
- CASE REPORTS

- 1935: GLOYNE REPORTED 2 CASES SCC IN WOMEN WITH ASBESTOSIS
- 1949: JAMA EDITORIAL – CANCER OF THE LUNG RELATED TO PULMONARY ASBESTOSIS

- EPIDEMIOLOGIC STUDIES

- 1955: DOLL REPORTED EXCESS LUNG CANCER MORTALITY IN ASBESTOS WORKERS WITH > 20 YEARS WORK IN “SCHEDULED” AREAS OF AN ASBESTOS FACTORY.

## ASBESTOSIS AND LUNG CANCER



Section of moderately advanced asbestosis with extensive fibrosis and distorted alveoli. Asbestos bodies (some fragmented) in airspaces and interstitium. Also a few asbestos fibers

# ASBESTOS-RELATED LUNG CANCER: UNRECOGNIZED HEALTH HAZARD

- AM J IND MED 1996;29:183-185.

## Unrecognized Asbestos-Induced Disease

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M.C. Barroeta-Verna, MD, MHS, K. Teschke, PhD, CH, and D.V. Bates, MD, FRCP, FRCPC, FACP, FRSC

*It is being slowly recognized that there is serious under-reporting of cancers that are occupationally related, in the sense that they would not have occurred without the occupational exposure. Data from the Workers' Compensation Boards of New South Wales in Australia and British Columbia in Canada relating to disease attributable to asbestos exposure indicate that in both jurisdictions the ratio of lung cancer cases to mesothelioma cases is much lower than epidemiological studies indicate must be occurring. Over the period from 1980 to 1994, if both jurisdictions are considered together, about 1,207 cases of lung cancer that would not have occurred without asbestos exposure went unrecognized as occupationally related. The data also suggest that it is unlikely that radiological asbestosis should be regarded as a necessary condition for there to be an increased risk of lung cancer following asbestos exposure. © 1995 Wiley-Liss, Inc.*

# UNRECOGNIZED HEALTH HAZARD

YEAR- BRITISH COLUMBIA	ASBESTOSIS	LUNG CANCER W ASBESTOSIS	MESOTHELIOMA
1987	19	5	9
1988	30	1	16
1989	15	2	3
1990	34	1	9
1991	39	5	17
TOTALS	137	14	54

# UNRECOGNIZED HEALTH HAZARD

1980-1994	ASBESTOSIS	LUNG CANCER	MESOTHELI- OMA
BC	309	25	120
NSW	348	88	540
TOTALS	657	113	660

- CONCLUSION: 1,207 CASES OF ASBESTOS-RELATED LUNG CANCER WENT MISSING.
- BARROETAVERNA MC ET AL. AM J IND MED 1995

# UNRECOGNIZED HEALTH HAZARD

- THESE WORKERS' COMPENSATION CLAIMS DATA INDICATE SERIOUS UNDERESTIMATION OF THE EPIDEMIOLOGIC IMPACT OF ASBESTOS EXPOSURE.
- HISTORY OF SMOKING DETERS OCCUPATIONAL HISTORY.
- THAT ASBESTOSIS IS REQUIRED FOR ASBESTOS-RELATED LUNG CANCER DETERS RECOGNITION AND COMPENSATION.

# ASBESTOSIS IS NOT NECESSARY

- PUBLISHED LITERATURE INCLUDES

- ABRAHAM JL. AM J IND MED 1994
- WILKINSON P ET AL. THE LANCET 1995
- EGILMAN D, REINERT A. AM J IND MED 1996
- deKlerk NH ET AL. OCCUP ENVIRON MED 1996
- FINKELSTEIN MM. AM J IND MED 1997
- REID A ET AL. OCCUP ENVIRON MED 2005
- CULLEN MR ET AL. AM J EPIDEMIOLOG 2005

# ASBESTOS-RELATED LUNG CANCER

- FROM A PUBLIC HEALTH PERSPECTIVE
  - LUNG CANCER IS THE MOST COMMON CANCER IN CANADA (OTHER THAN NMSC).
  - LUNG CANCER IS THE MOST COMMON OCCUPATIONAL MALIGNANCY.
  - ASBESTOS IS THE MOST COMMON CAUSE OF OCCUPATIONAL LUNG CANCER.
  - LUNG CANCER IS THE MOST COMMON ASBESTOS-RELATED MALIGNANCY.
- 
- TAKALA J. ELIMINATING OCCUPATIONAL CANCER. EDITORIAL. INDUSTR HEALTH, 2015.

# LUNG CANCER

- **ESTIMATED INCIDENCE 2017:\***
- 76.5/100,000 MALES
- 65.3/100,000 FEMALES
- **ESTIMATED DEATHS 2017:\***
- 59.4/100,000 MALES
- 45.3/100,000 FEMALES

\*AGE-STANDARDIZED

CANADIAN CANCER SOCIETY. 2017.

# LUNG CANCER: RISK FACTORS

- SMOKING TOBACCO (>85%)
- AGE
- SECOND-HAND SMOKE
- OCCUPATIONAL RISK FACTORS
- RADON
- PERSONAL OR FAMILY HISTORY
- COPD
- INDOOR AIR POLLUTION

# LUNG CANCER: OCCUPATIONAL RISK FACTORS

- **OCCUPATIONAL EXPOSURES AND GLOBAL CANCER:**
- 5.3 TO 8.4% OF ALL CANCERS
- 17-29% OF ALL LUNG CANCER DEATHS AMONG MALES

# ASBESTOS AND LUNG CANCER

- **ASBESTOS ACCOUNTS FOR**
- 55-85% OF ALL OCCUPATIONAL LUNG CANCER DEATHS.

FURUYA S ET AL. INT J ENVIRON RESEARCH PUBL HLTH 2018  
DOI:10.3390/IJERPH15051000.

# OCCUPATIONAL CANCER IN ONTARIO

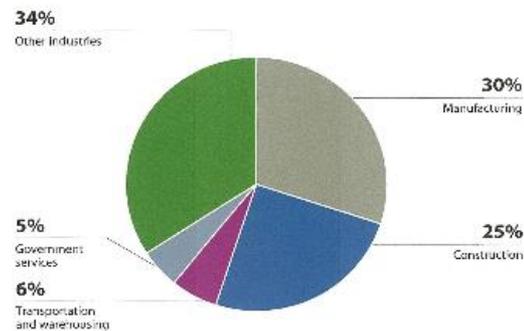
- 2017  
OCRC



# ASBESTOS-RELATED LUNG CANCER

- ONTARIO BURDEN:  
DISTRIBUTION OF RISK  
BY OCCUPATION

**FIGURE 5** Industry breakdown of total lung cancers and mesotheliomas attributed to occupational asbestos exposure



**630**  
Lung cancer (AF = 78%)  
**140**  
Mesothelioma\* (AF = 80.7%)  
**15**  
Laryngeal cancer (AF = 3.8%)  
**<5**  
Ovarian cancer (AF = 0.4%)

NOFES

\* Includes an estimated five cases of mesothelioma attributed to para-occupational asbestos exposure (AF = 3.4%) in this sector.

# LUNG CANCER: CELL TYPES

- 80% NON-SMALL CELL TYPE (NSCLC)\*
- ADENOCARCINOMA, SQUAMOUS CELL CARCINOMA, LARGE CELL CARCINOMA
- IN CANADA, U.S., CHINA, JAPAN: PREVALENCE OF ADENOCARCINOMA > SCC, SCLC
- 20% SMALL-CELL TYPE (SCLC)

\*SPENCER'S PATHOLOGY OF THE LUNG. 2016.

# ASBESTOS AND LUNG CANCER

ASBESTOS HAS BEEN ASSOCIATED CAUSALLY  
WITH ALL CELL TYPES OF LUNG CANCER.

# ASBESTOS-RELATED LUNG CANCER

- RISK FACTORS
  - ASBESTOS DOSE
  - LATENCY
  - CIGARETTE SMOKING
- OTHER
  - AGE
  - COPD
  - FAMILY AND PERSONAL HISTORY

# ASBESTOS-RELATED LUNG CANCER: RISK FACTORS

- ASBESTOS DOSE
  - INTENSITY OF EXPOSURE
  - DURATION
  - FREQUENCY
- 
- ALL ASBESTOS-RELATED DISEASE IS DOSE-RELATED.

# ASBESTOS-RELATED LUNG CANCER

- HOW DO WE ESTIMATE ASBESTOS DOSE?
- TAKE A DETAILED OCCUPATIONAL HISTORY.
- TAKE A DETAILED EXPOSURE HISTORY.
- USE AIR-SAMPLING DATA WHERE AVAILABLE.
- LOOK AT ASBESTOS FIBER BURDEN IN THE LUNG?



# ASBESTOS- RELATED LUNG CANCER: DOSE

IS THERE A DOSE BELOW WHICH  
THERE IS NO RISK FOR ASBESTOS-  
RELATED LUNG CANCER?

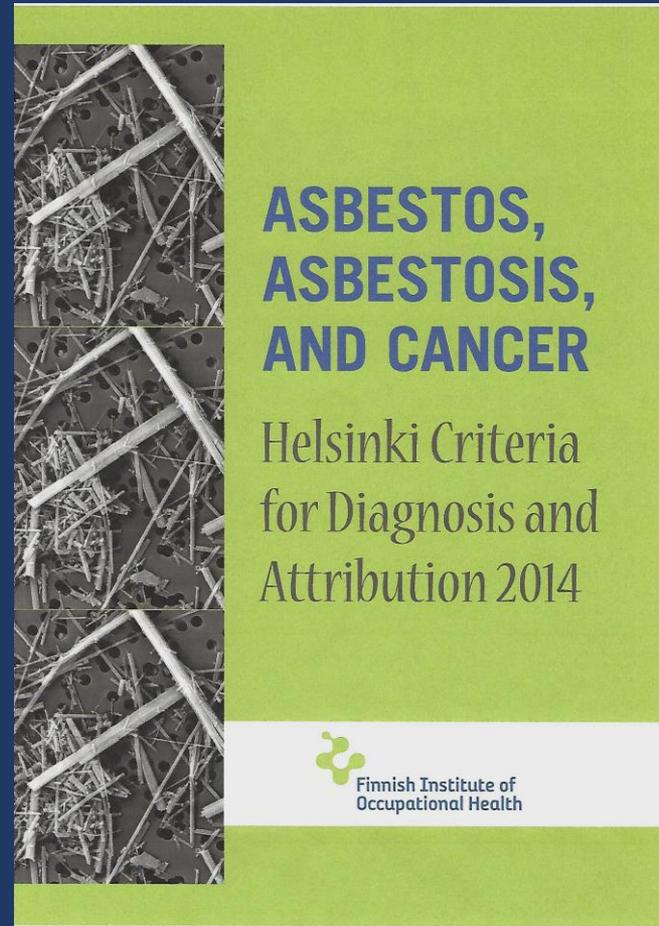
# ASBESTOS-RELATED LUNG CANCER:

HELSINKI CONFERENCE

SCAND J

WORK & ENVIRON HLTH

1997, 2015



# ASBESTOS-RELATED LUNG CANCER: DOSE

- HELSINKI CRITERIA
- 2-FOLD INCREASE IN LUNG CANCER RISK
- CUMULATIVE ASBESTOS DOSE 25 F-YRS/CC
- AND/OR
- 2 MILLION AMPHIBOLE FIBERS  $> 5 \mu\text{M}/\text{GM}$  DRY LUNG
- = 5K-15K AB/GM DRY LUNG

# ASBESTOS-RELATED LUNG CANCER

- THE USE OF EITHER CRITERION IMPLIES A THRESHOLD –
- A DOSE BELOW WHICH THERE IS NO RISK OF DISEASE.

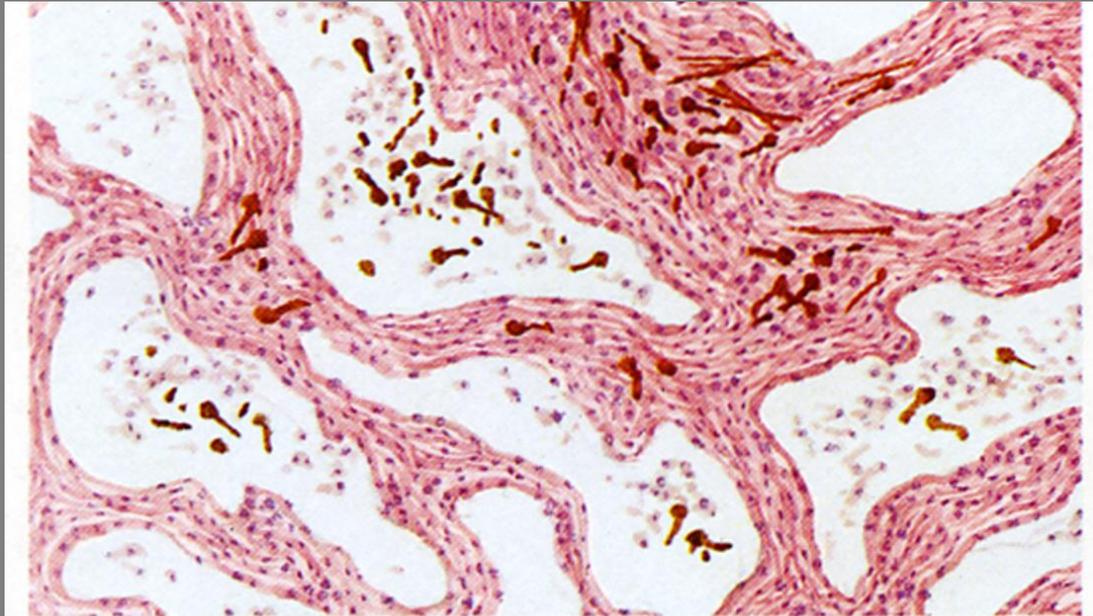


# ASBESTOS- RELATED LUNG CANCER: DOSE

DETERMINED BY FIBER BURDEN

## ASBESTOS-RELATED LUNG CANCER: DOSE

- DETERMINED BY FIBER BURDEN IN THE LUNG



Section of moderately advanced asbestosis with extensive fibrosis and distorted alveoli. Asbestos bodies (some fragmented) in airspaces and interstitium. Also a few asbestos fibers

# ASBESTOS-RELATED LUNG CANCER: DOSE

- COUNTRIES WITH RECOGNITION OF ARLC BASED 25 F-YRS/CC OR HELSINKI CRITERIA:\*
- GERMANY
- AUSTRIA
- BELGIUM
- DENMARK
- SWITZERLAND
- FINLAND
- NORWAY

\*UGUEN, M ET AL. MOLECULAR & CLINICAL ONCOLOGY 2017 DOI:  
*10.3892/MCO.2017.1277*

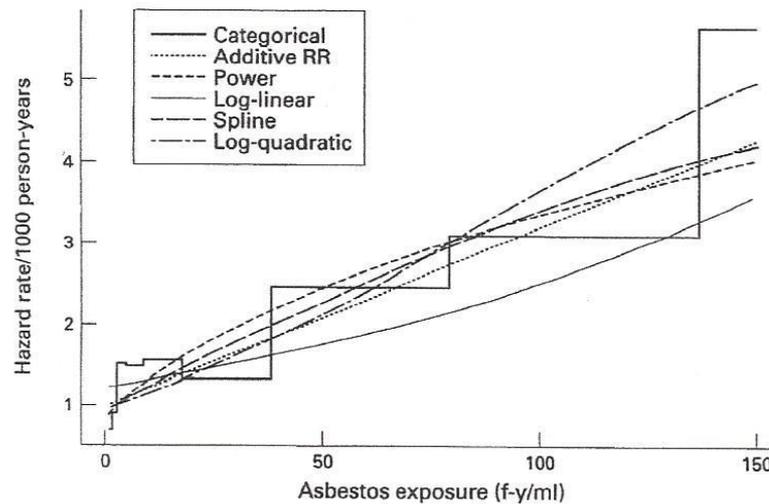
# ASBESTOS-RELATED LUNG CANCER

- DOSE-RESPONSE HAS BEEN EXAMINED USING AIR SAMPLING DATA TO MEASURE DOSE.
- EPIDEMIOLOGIC STUDIES SHOW A DOSE-RESPONSE RELATIONSHIP THAT IS
- LINEAR WITHOUT EVIDENCE OF A THRESHOLD.

# ASBESTOS-RELATED LUNG CANCER: DOSE-RESPONSE RELATIONSHIP

- STAYNER 1997

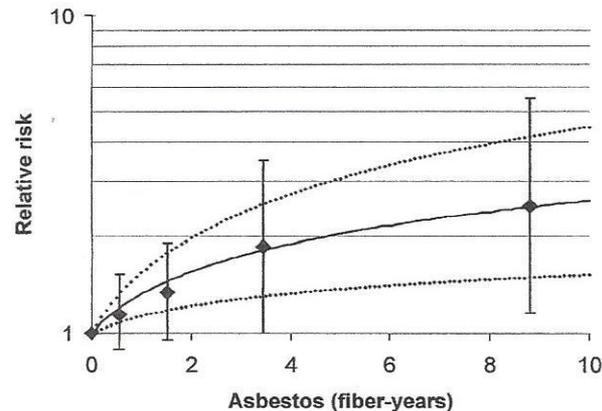
*Occupational exposure-response analysis of risk of respiratory disease and chrysotile asbestos*



*Figure 1 Lung cancer mortalities as a function of cumulative exposure to asbestos predicted by alternative models for white men aged 50 in 1940-69.*

# ASBESTOS-RELATED LUNG CANCER: DOSE-RESPONSE RELATIONSHIP

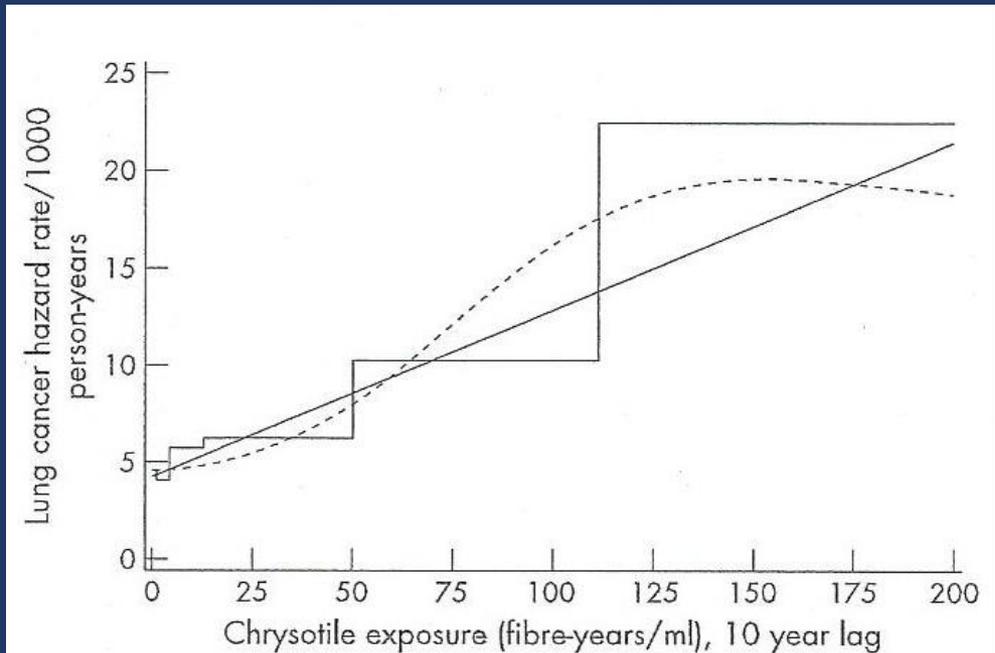
- GUSTAVSSON P.  
AM J EPIDEMIOL  
2002
- POPULATION-BASED  
CASE-CONTROL  
STUDY



**FIGURE 1.** Relative risk of lung cancer and cumulative dose of asbestos for men in Stockholm, Sweden, 1985–1990. Diamonds and error bars indicate point estimates and 95% confidence intervals of the relative risks for categorized cumulative asbestos doses plotted at the position of the arithmetic average dose within each class (refer to table 2 for a definition of classes). The solid line indicates the relative risk and the dotted lines the 95% confidence interval for a continuous dose variable obtained by using the transformation  $\ln(\text{fiber-years} + 1)$ . The relative risk ( $\exp(\beta)$ ) for the transformed dose variable was 1.494 (95% confidence interval: 1.193, 1.871) (refer to the text). Relative risks were adjusted for age group, selection year, residential radon, tobacco smoking, environmental nitrogen dioxide, diesel exhaust, and combustion products.

# ASBESTOS-RELATED LUNG CANCER: DOSE-RESPONSE RELATIONSHIP

- HEIN M ET AL.  
OCCUP ENVIRON  
MED 2007
- SOUTH CAROLINA  
TEXTILE WORKERS



**Figure 1** Estimated lung cancer mortality for white males, 60–64 years of age as a function of cumulative exposure to chrysotile (10-year lag) based on the model described in table 5 (linear relative risk model, solid curve; restricted cubic spline model, dashed curve; categorical model, step function).

# ASBESTOS-RELATED LUNG CANCER: DOSE-RESPONSE RELATIONSHIP

- WHY DOES THIS MATTER?

# ASBESTOS-RELATED LUNG CANCER: DOSE-RESPONSE RELATIONSHIP

- LINEARITY IS INCONSISTENT WITH A THRESHOLD.
- LINEAR DOSE-RESPONSE INDICATES NO “SAFE” LEVEL OF EXPOSURE FOR LUNG CANCER.
- DOSE-RESPONSE RELATIONSHIPS PROVIDE BASIS FOR SOUND PUBLIC HEALTH AND GOVERNMENT POLICY DECISIONS.

# ASBESTOS-RELATED LUNG CANCER: DOSE RESPONSE

- PUBLIC HEALTH AND GOVERNMENT POLICY DECISIONS IMPACT:
- OCCUPATIONAL EXPOSURES
- ENVIRONMENTAL EXPOSURES

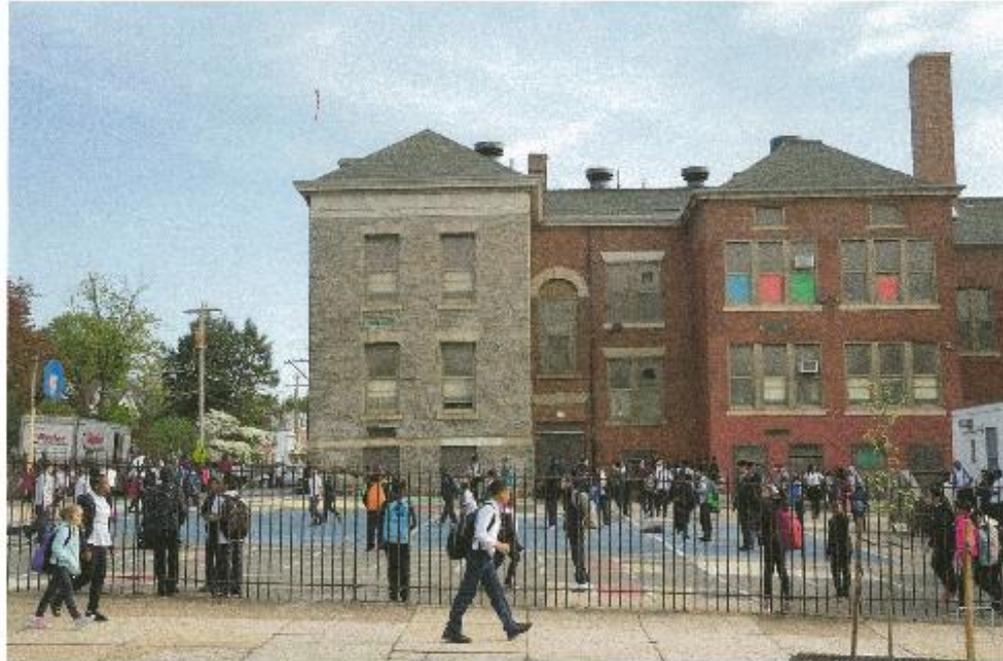
*LEGACY ASBESTOS*

# ASBESTOS-RELATED LUNG CANCER: ENVIRONMENTAL EXPOSURES

NEWS

## New test: 10.7 million asbestos fibers on floor at Philadelphia elementary school

by Wendy Ruderman, Barbara Laker and Dylan Purcell, Posted June 6, 2018

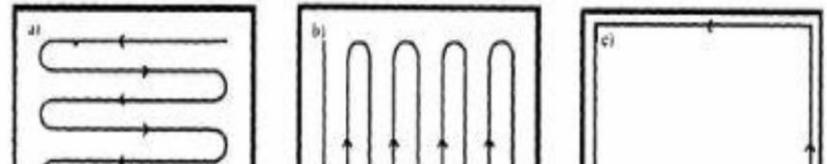


JESSICA CRIVIN

Shortly after the School District of Philadelphia learned of alarming levels of asbestos fibers on the floor of a highly trafficked hallway inside the school on Oct.

Thank you for assisting our research project looking at the potential for asbestos fibers in settled dust. Follow these easy steps to complete this test:

1. Find a place on the floor, a shelf, a desk top, a windowsill, a cubbyhole, or another area that appears to have dust or is located near and deteriorated asbestos and is accessible to small children and teachers. (You're looking for damaged or chipped floor tiles, pipe insulation, ceiling tile, plaster, spackle.) If you can, take a photo of the area prior to wiping.
2. Put on a pair of disposable gloves. Open the dust wipe sample packet and unfold the wipe.
3. In a square area that is about 4 by 4 inches (or 10 by 10 centimeters), make as many S-like motions as needed to wipe the entire sample area, moving from side to side and top to bottom of the 4 by 4-inch square. Apply firm pressure on the wipe.
4. Fold the wipe in half, keeping the dirty side in, and repeat the wiping procedure. (see below). Flip the wipe and repeat.
5. Now fold the wipe into an even smaller square (roughly the size of the wipe packaging) and repeat again, concentrating on collecting dust from the edges and corners of the sample area.
6. Stuff the wipe into the sample tube. Put the cap tightly on the container. On the label, write the school name, time and date, room number and specific area from which the sample was taken (such as Rm. 101, floor tile, under window ledge).



# ASBESTOS AND LUNG CANCER: ENVIRONMENTAL EXPOSURES

# ASBESTOS AND LUNG CANCER: ENVIRONMENTAL EXPOSURES

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**8.5 million  
cancer-causing  
asbestos fibers  
in settled dust**



# ASBESTOS AND LUNG CANCER: ENVIRONMENTAL EXPOSURES



9000 Commerce Parkway Suite B  
Mt. Laurel, New Jersey 08054  
Telephone: 856-231-9449  
Email: customerservice@iatl.com

## CERTIFICATE OF ANALYSIS

Client: Philadelphia Media Network  
801 Market Street, Ste 300  
Philadelphia PA 19107  
Client: PH1001

Report Date: 6/7/2018  
Report No.: 564984 - TEM Dust  
Wipe  
Project: TOXIC CITY: A.S. Jenks  
Project No.:

## TEM WIPE SAMPLE ANALYSIS SUMMARY

Lab No.:6522683 Client No.:1	Location: 106 Closet Floor Near Pipe Area (cm <sup>2</sup> ): 100 Density (s/mm <sup>2</sup> ): 942	Concentration (s/cm <sup>3</sup> ): 4530000 Asbestos Type(s): Chrysotile
Lab No.:6522684 Client No.:2	Location: Floor 106 With Scratch Area (cm <sup>2</sup> ): 100 Density (s/mm <sup>2</sup> ): 3920	Concentration (s/cm <sup>3</sup> ): 1890000 Asbestos Type(s): Chrysotile
Lab No.:6522685 Client No.:3	Location: Closet Tile Near Pipe Area (cm <sup>2</sup> ): 100 Density (s/mm <sup>2</sup> ): 4310	Concentration (s/cm <sup>3</sup> ): 4140000 Asbestos Type(s): Chrysotile Amosite
Lab No.:6522686 Client No.:4	Location: 106 Closet Near Pipe In Front Of Locker Area (cm <sup>2</sup> ): 100 Density (s/mm <sup>2</sup> ): 885	Concentration (s/cm <sup>3</sup> ): 567000 Asbestos Type(s): Chrysotile
Lab No.:6522687 Client No.:5	Location: Missing Tile 106 Closet Near Pipe Area (cm <sup>2</sup> ): 100 Density (s/mm <sup>2</sup> ): 590	Concentration (s/cm <sup>3</sup> ): 2840000 Asbestos Type(s): Chrysotile Amosite
Lab No.:6522688 Client No.:6	Location: Tile Next To Back Pipe Closet 106 Area (cm <sup>2</sup> ): 100 Density (s/mm <sup>2</sup> ): 654	Concentration (s/cm <sup>3</sup> ): 3150000 Asbestos Type(s): Chrysotile
Lab No.:6522689 Client No.:7	Location: Back Tile 106 Closet Near Pipe Area (cm <sup>2</sup> ): 100 Density (s/mm <sup>2</sup> ): 1460	Concentration (s/cm <sup>3</sup> ): 1410000 Asbestos Type(s): Chrysotile
Lab No.:6522690 Client No.:8	Location: Scratch Floor 106 Room (Classroom) Area (cm <sup>2</sup> ): 100 Density (s/mm <sup>2</sup> ): 154	Concentration (s/cm <sup>3</sup> ): 74000 Asbestos Type(s): Chrysotile

Please refer to the Preface of this report for further information regarding your analysis.

Date Received: 6/1/2018  
Date Analyzed: 06/07/2018  
Signature:   
Analyst: Mark Stewart

Approved By:   
Frank E. Ehrenfeld, III  
Laboratory Director

Dated : 6/8/2018 10:16:52

Page 1 of 3

These are asbestos results from an elementary school in South Philly.

Scary amounts of asbestos fibers:

- 4.5 million
- 1.89 million
- 4.1 million
- 567,000
- 2.8 million
- 3.2 million

OVER 100,000 is DANGER LIMIT

# ASBESTOS AND LUNG CANCER: ENVIRONMENTAL EXPOSURES

- CORRECTION: UNITS OF MEASUREMENT USED IN LABORATORY ANALYSES OF WIPE SAMPLES TAKEN IN ELEMENTARY SCHOOLS IN PHILADELPHIA.
- RESULTS SHOWN ON THE PRECEDING SLIDE ARE IN STRUCTURES/CM<sup>2</sup>, AS INDICATED TO THE LEFT, NOT MILLION FIBRES AS INDICATED TO THE RIGHT. THE NUMBERS THEMSELVES ARE CORRECT AND INDICATE EXCESSIVE ASBESTOS CONCENTRATIONS ATTRIBUTABLE TO LEGACY ASBESTOS.



# ASBESTOS AND LUNG CANCER: ONE MORE THING

SYNERGY

# ASBESTOS, CIGARETTE SMOKE, AND LUNG CANCER

- HAMMOND, SELIKOFF, AND SEIDMAN. NYAS 1979
- 17,800 NORTH AMERICAN ASBESTOS INSULATION WORKERS
- 468,688 PARTICIPANTS IN THE CANCER PREVENTION STUDY (CSP) SERVED AS CONTROLS.
- SMOKING HABITS AVAILABLE FOR 12,051 INSULATION WORKERS.
- SUBJECTS AND CONTROLS WERE STRATIFIED BASED ON ASBESTOS EXPOSURE AND SMOKING AND LUNG CANCER DEATH ANALYZED.

# ASBESTOS, CIGARETTE SMOKE, AND LUNG CANCER

- NORTH AMERICAN ASBESTOS INSULATION WORKERS

	MORTALITY	RATIOS	LUNG CA	
EXPOSURE	ASBES +/- CIG -	CIG +/-ASBES -	BOTH	
			1PPD	>1PPD
	5.17 (N=4)	10.85	53.2	87.4

- MULTIPLICATIVE SYNERGISM
- HAMMOND, SELIKOFF, SEIDMAN. NYAS 1979.

# ASBESTOS, CIGARETTE SMOKE, AND LUNG CANCER

- *SARACCI R. INT J CANCER 1977*
- MULTIPLICATIVE SYNERGISTIC RELATIONSHIP BASED ON DATA FROM MINERS/MILLERS, INSULATION WORKERS, AND FACTORY WORKERS.
- *LEE PN. OCCUP ENVIRON MED 2001*
- META-ANALYSIS OF 15 STUDIES REVEALED NO DEPARTURE FROM MULTIPLICATIVE SYNERGISM.

# ASBESTOS, CIGARETTE SMOKE, AND LUNG CANCER

- **OTHER ANALYTICAL STUDIES:**
- *GUSTAVSSON P ET AL. AM J EPIDEMIOL 2002*
- POPULATION-BASE CASE-CONTROL STUDY OF 1,038 INCIDENT LUNG CANCER CASES AND 2,359 REFERENTS IN SWEDEN. THE JOINT EFFECT: 1.15 (95% CI 0.77, 1.72) TIMES THE SUM OF THE TWO AND 0.31 (95% CI 0.11, 0.86) TIMES THE PRODUCT, INDICATING A JOINT EFFECT BETWEEN ADDITIVE AND MULTIPLICATIVE (ADDITIVE SYNERGISM).

# ASBESTOS, CIGARETTE SMOKE, AND LUNG CANCER

- *MARKOWITZ SB ET AL. AM J RESPIR CRIT CARE MED 2013*
- LUNG CANCER MORTALITY STUDY OF 2,377 NA INSULATORS WITH > 30 YEARS SINCE ONSET OF WORK AS INSULATOR WHO UNDERWENT A CLINICAL EXAM BETWEEN 1981 AND 1983.

# ASBESTOS, CIGARETTE SMOKE, AND LUNG CANCER

- MARKOWITZ SB. AM J RESPIR CRIT CARE MED 2013

	LUNG	CANCER	MOR- TALITY	RATE	RATIOS
	CPSII		ASBESTO SIS -	ASBESTO SIS +	ALL
NS	1.0		3.6 (1.7,7.6)	7.4 (4.0, 13.7)	5.2 (3.2, 8.5)
CS	10.3 (8.8, 12.2)		14.4 (10.7, 19.4)	36.8 (30.1, 45.0)	28.4 (23.4, 34.4)

- INTERACTION DEPENDS: ADDITIVE TO ADDITIVE SYNERGISM.

# ASBESTOS, CIGARETTE SMOKE, AND LUNG CANCER

- *NGAMWONG Y ET AL. PLOS ONE AUGUST 14, 2015*
- META-ANALYSIS OF 10 CASE-CONTROL AND 7 COHORT STUDIES COMPARING LUNG CANCER PATIENTS (A-, S-) WITH (A+, S-), (A-, S+), AND (A+, S+) PATIENTS.
- FINDINGS INDICATED *ADDITIVE SYNERGISM BETWEEN ASBESTOS AND CIGARETTE SMOKE FOR LUNG CA – IN BOTH CASE-CONTROL AND COHORT STUDIES.*

# ASBESTOS AND LUNG CANCER

## PUBLIC HEALTH IMPLICATIONS

ASBESTOSIS: NO CURE

MALIGNANT MESOTHELIOMA: NO CURE

LUNG CANCER: THERE'S HOPE FOR SOME

PREVENTION IS THE ONLY WAY ANSWER

# ASBESTOS-RELATED LUNG CANCER

PREVENTION IS THE ONLY WAY FORWARD.



# ASBESTOS- RELATED LUNG CANCER

CANADA BANS ASBESTOS. ALMOST.



# ASBESTOS-RELATED LUNG CANCER

CANADIAN BAN

# ASBESTOS-RELATED LUNG CANCER

- CANADIAN BAN ON ASBESTOS DECEMBER, 30, 2018:
- IMPORT, SALE, AND USE OF PROCESSED ASBESTOS FIBRES AND MANUFACTURE, SALE, AND USE OF PRODUCTS CONTAINING PROCESSED ASBESTOS FIBRES
- EXCEPT
- LABORATORY USE
- USE BY CHLOR-ALKALI FACILITIES
- RE-USE IN ROAD INFRASTRUCTURE

# ASBESTOS AND LUNG CANCER

- FOR THOSE AT INCREASED RISK FOR LUNG CANCER:



# NATIONAL LUNG SCREENING TRIAL

- **MEDICAL SCREENING FOR LUNG CANCER: NATIONAL LUNG SCREENING TRIAL (NLST)**
- NATIONAL RANDOMIZED CONTROLLED TRIAL CONDUCTED BY THE NIH;
- 53,454 CURRENT/FORMER SMOKERS AGE 55-74;
- RANDOMLY ASSIGNED TO LDCT OR CXR SCREENING Q YR FOR 3 YRS;
- FOLLOWED FOR 5 YRS BEYOND FINAL SCREEN.

# NATIONAL LUNG SCREENING TRIAL

- PRINCIPAL CRITERIA FOR ENROLLMENT

- AGE: 55 TO 74 YEARS

- SMOKING HISTORY:

- $\geq$  30 PACK-YEARS

- ABSTINENCE  $\leq$  15 YEARS

# NATIONAL LUNG SCREENING TRIAL

- NLST
- $\geq 20\%$  REDUCTION IN LUNG CANCER MORTALITY  
LDCT VS. CHEST X-RAY SCREENING.
- $> 6\%$  REDUCTION IN DEATH FROM ALL CAUSES

RISK BASED ON SMOKING AND AGE

# CURRENT U.S. LUNG CANCER SCREENING GUIDELINES

- AMERICAN LUNG ASSOCIATION
- AMERICAN CANCER SOCIETY
- AMERICAN ASSOCIATION FOR THORACIC SURGERY
- NATIONAL COMPREHENSIVE CANCER NETWORK
- US PREVENTIVE SERVICES TASK FORCE
- MEDICARE

TANOUE LT, ET AL. CONCISE CLINICAL REVIEW. LUNG CANCER SCREENING. AM J RESPIR CRIT CARE MED 2015;191:19-33.

# U.S. LUNG CANCER SCREENING GUIDELINES

- ALA, ACS:
- ADOPTED NLST GUIDELINES.
- AATS, TIER 2:
- AGE  $\geq$  50 -79 YRS,  $\geq$  20 PK YRS,  $\geq$  ONE ADDITIONAL RISK FACTOR
- NCCN, TIER 2:
- AGE  $\geq$  50-74 YRS,  $\geq$  20 PK YRS,  $\geq$  ONE ADDITIONAL RISK FACTOR (OCCUPATIONAL EXPOSURE).
- AATS, NCCN: NO ABSTINENCE CRITERION

# ASBESTOS-RELATED LUNG CANCER: UNRECOGNIZED HEALTH HAZARD

- AT ISSUE, BASED ON RECOGNITION OF ASBESTOS-RELATED LUNG CANCER:
- PUBLIC HEALTH AND GOVERNMENT POLICY  
PREVENTION AND EDUCATION
- WORKERS' COMPENSATION FOR INJURED  
WORKERS
- DECISIONS REGARDING LDCT SCREENING OF  
EXPOSED WORKERS FOR LUNG CANCER

# IN THE IDEAL WORLD

