FIBERS AND CLEAVAGE FRAGMENTS

COMMENTS PERTINENT TO THE NIOSH DOCUMENT
"ASBESTOS AND OTHER MINERAL FIBERS:A ROADMAP FOR SCIENTIFIC RESEARCH"

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OCCUPATIONAL HYGIENE AND EPIDEMIOLOGY

RESEARCH

- ASBESTOS
- FIBERS
- OCCUPATIONAL CANCER
- OCCUPATIONAL DISEASES

PURPOSE OF PRESENTATION

1. Share results of the study:

   "An evaluation of the Risks of Lung Cancer and Mesothelioma from Exposure to Amphibole Cleavage Fragments"

   by John F Gamble (IERF) and Graham W Gibbs (SHEI). (The paper is currently in press).

2. Comment on the mesothelioma in Minnesota.

APPROACH

- Compare the lung cancer and mesothelioma experience of workers exposed to cleavage fragments with experience of workers exposed to asbestiform equivalents.

Workers exposed to amphibole cleavage fragments.

Epidemiological studies have been conducted:

- Gold mine South Dakota (Grunerite-cummingtonite exposure)

- Taconite mines in Minnesota (Grunerite and other non-asbestiform amphiboles)

Workers exposed to amphibole cleavage fragments.

- Talc mine in St Lawrence County, New York State (transition minerals, non-asbestiform anthophyllite and tremolite).

Workers exposed to asbestiform amphiboles

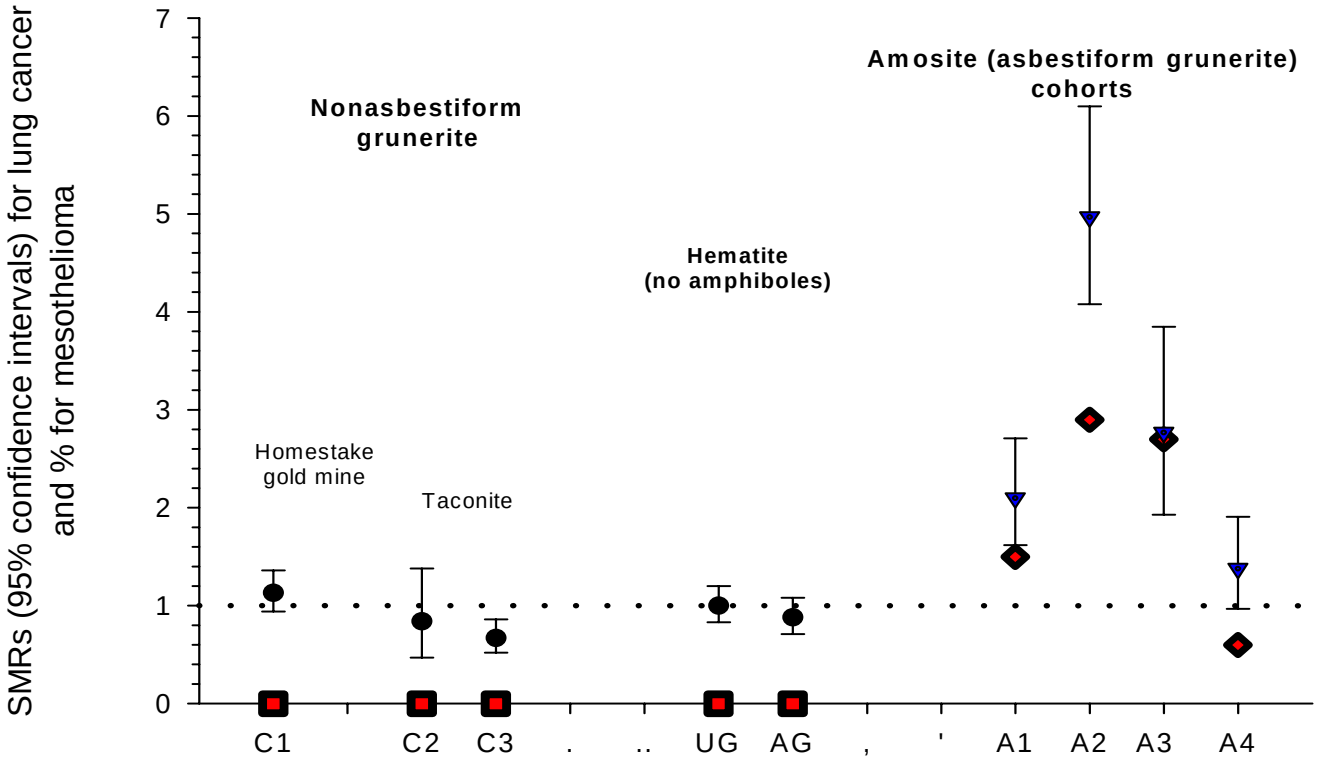
- Amosite asbestos mines, mills and manufacturing facilities

Workers exposed to asbestiform amphiboles

- Anthophyllite asbestos mines and mills
- Asbestiform Tremolite* in vermiculite mines

*Tremolite term is used as this term has been used in medical literature concerning this facility to describe amphibole fiber exposures. Amphiboles in the mine appear to include tremolite, winchite and richterite.

RESULTS-GRUNERITE

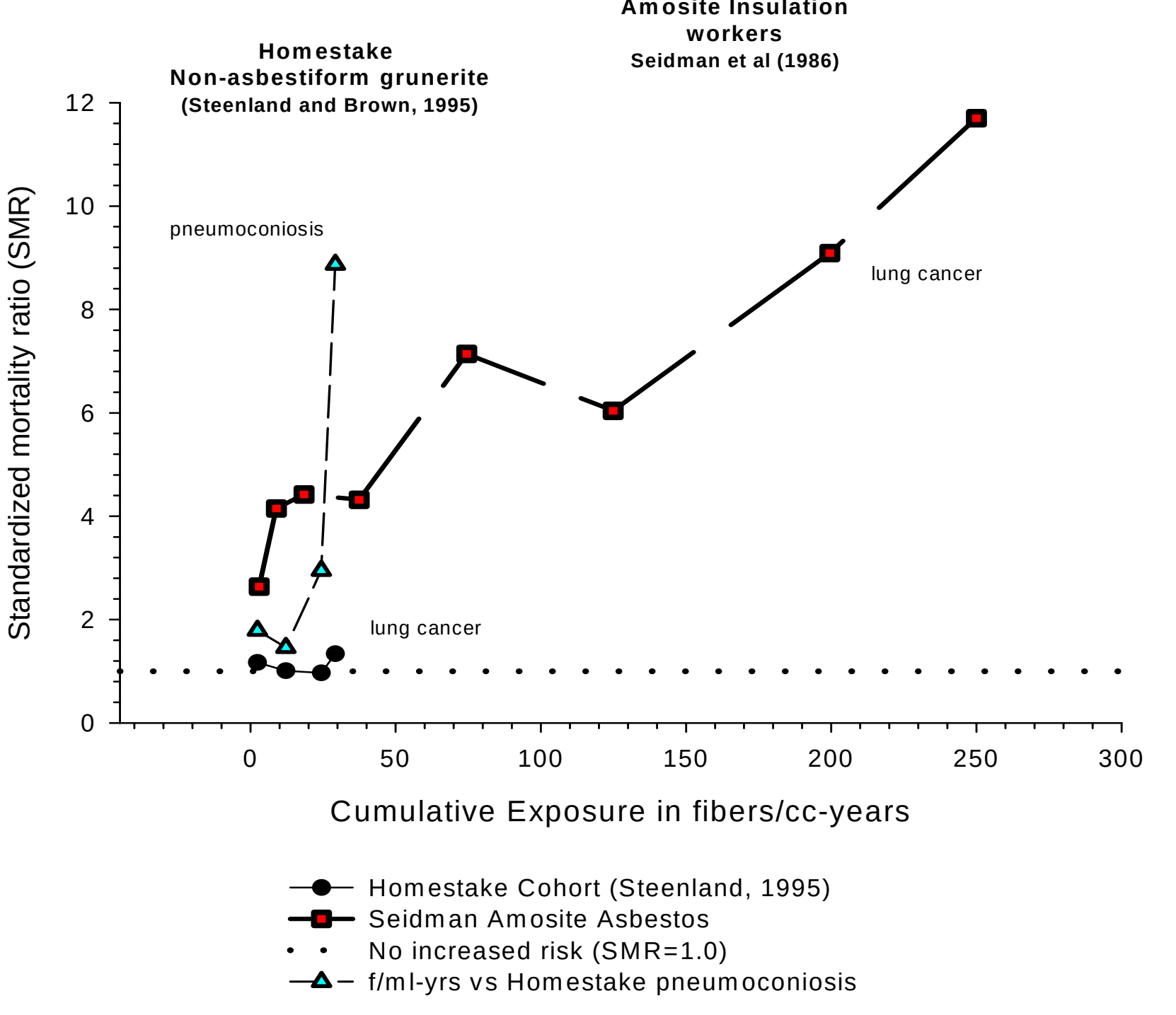


C1 = Steenland and Brown (1996)
C2 = Higgins et al (1983)
C3 = Cooper et al (1992)

UG, AG = underground and aboveground Hematite (Lawler et al (1985)

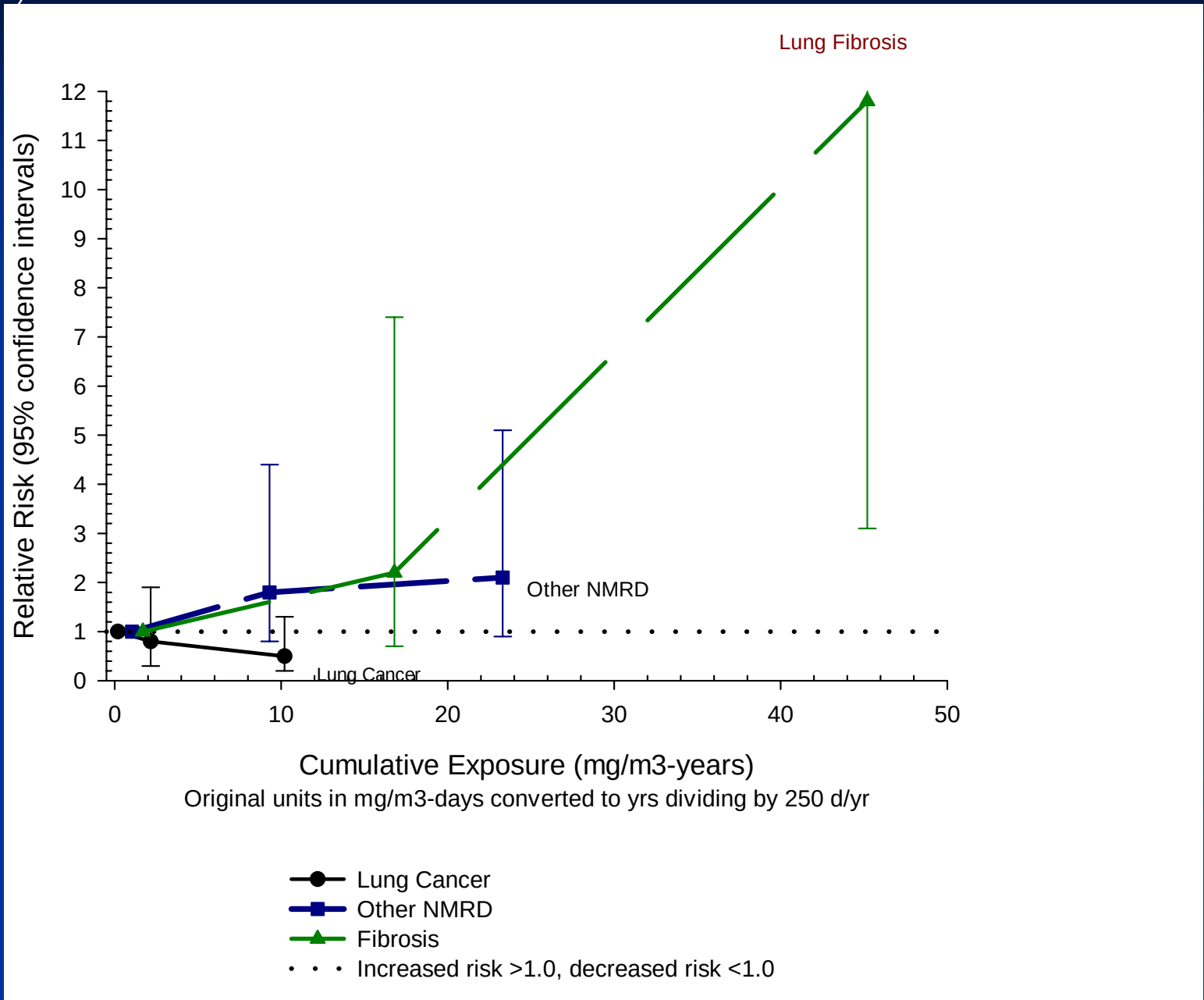
A1 = Acheson et al (1984, amosite insulation mfg
A2 = Seidman et al (1986) amosite insulation factory
A3 = Levin et al (1998) amosite insulation pipe mfg plant
A4 = Sluis-Cremer et al (1992) chrysotile/amosite insulation

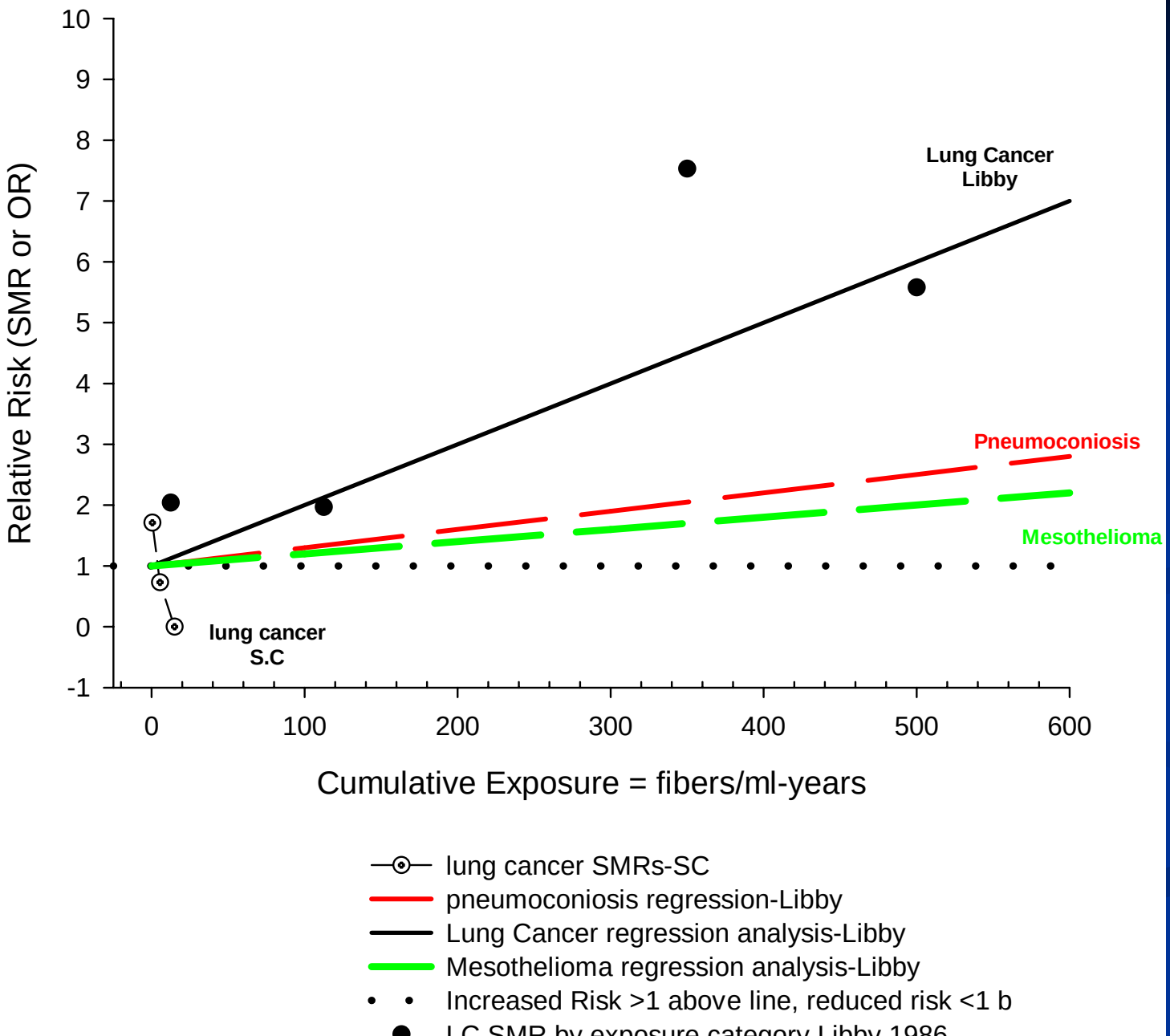
- lung cancer SMRs
- % meso (n cases/total deaths = PMR)
- No effect level for lung cancer (SMR=1)
- % mesothelioma, asbestos cohorts
- lung cancer SMRs, Asbestos cohorts


Amosite Insulation workers
Seidman et al (1986)
Homestake
Non-asbestiform grunerite
(Steenland and Brown, 1995)
pneumoconiosis
lung cancer
lung cancer
Standardized mortality ratio (SMR)
0
2
4
6
8
10
12
0
50
100
150
200
250
300
Cumulative Exposure in fibers/cc-years
Homestake Cohort (Steenland, 1995)
Seidman Amosite Asbestos
No increased risk (SMR=1.0)
f/ml-yrs vs Homestake pneumoconiosis

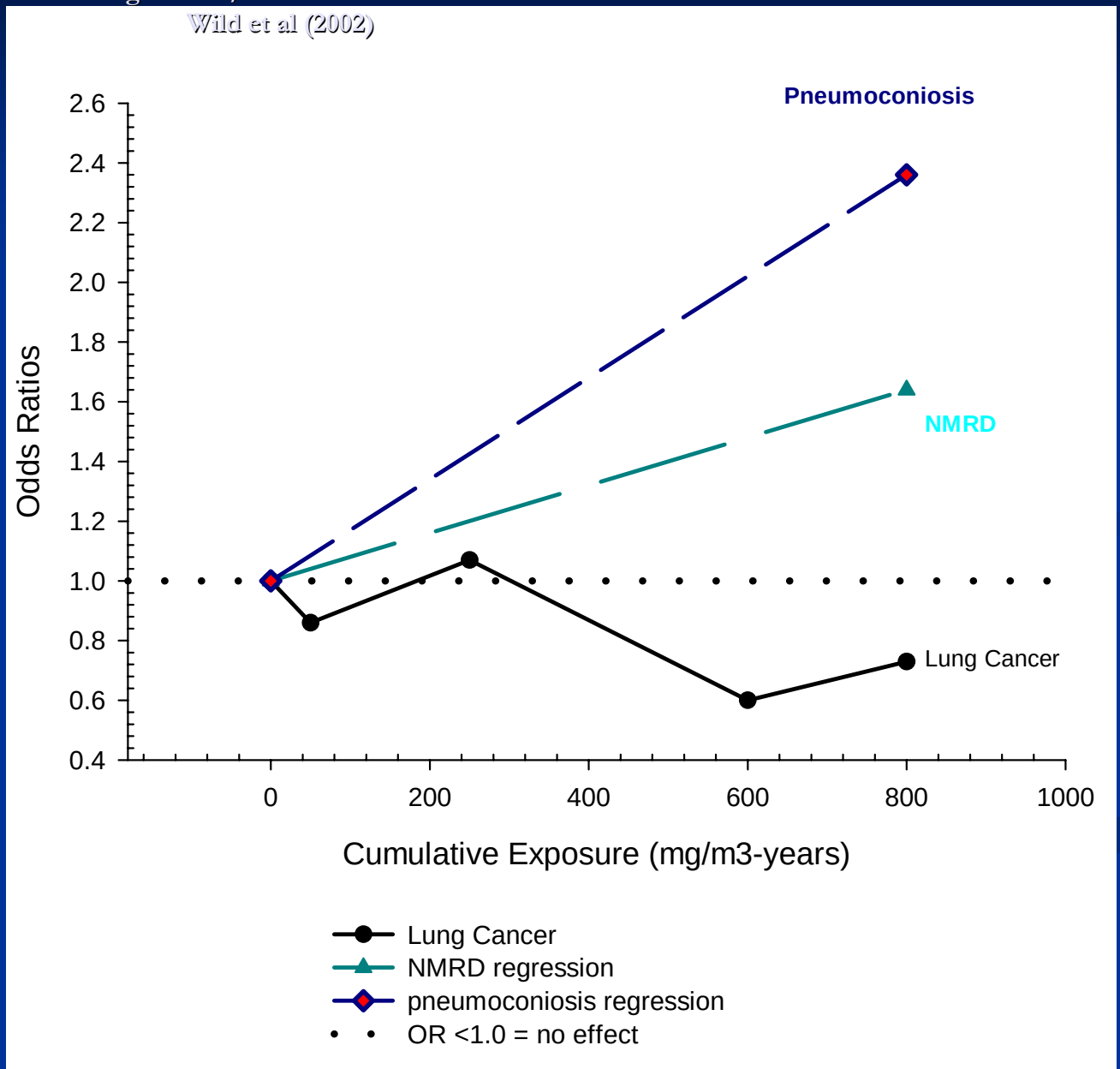
RESULTS
TREMOLITE/ANTHOPHYLLITE

FIGURE 3
Exposure-response of lung cancer, other non-malignant respiratory disease (other NMRD) and lung fibrosis by cumulative exposure (mg/m3-years)
Honda et al (2002)

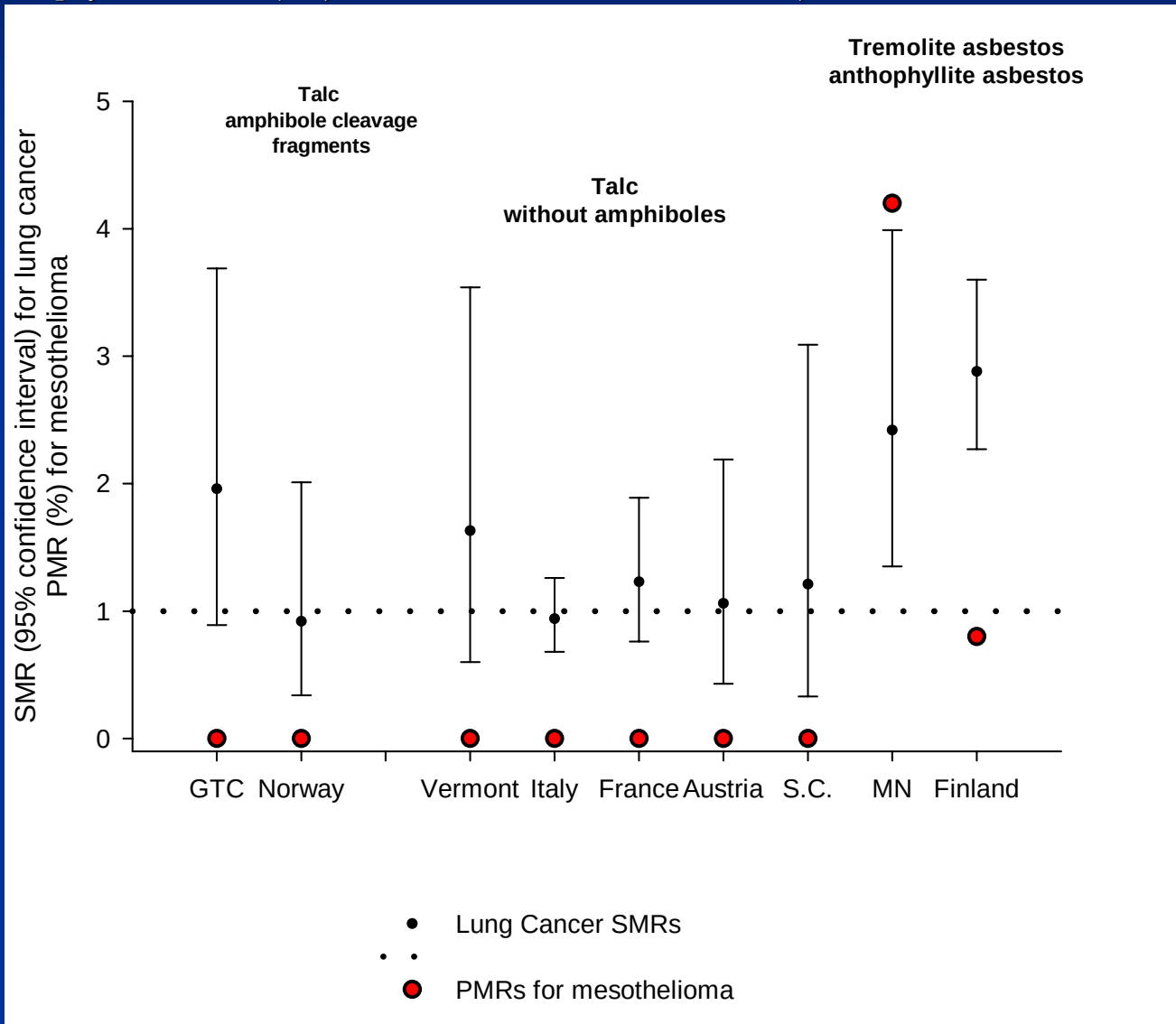



Relative Risk (SMR or OR)
10
9
8
7
6
5
4
3
2
1
0
-1
0
100
200
300
400
500
600
Cumulative Exposure = fibers/ml-years
Lung Cancer
Libby
Pneumoconiosis
Mesothelioma
lung cancer
S.C
lung cancer SMRs-SC
pneumoconiosis regression-Libby
Lung Cancer regression analysis-Libby
Mesothelioma regression analysis-Libby
Increased Risk >1 above line, reduced risk <1 b
LC SMR by exposure category Libby 1986

Exposure-response trends for lung cancer
Non-malignant respiratory disease (NMRD) and
Pneumoconiosis by cumulative exposure (mg/m3-years)
To Talc not containing amphiboles
Among French/Austrian Talc Workers
Wild et al (2002)



Lung cancer and mesothelioma mortality in workers exposed to
Talc containing nonasbestiform amphiboles in New York and Norway
(Honda et al, 2002; Wergeland et al (1990)
Talc without amphiboles (Vermont, Italy, France/Austria)
Selevan et al (1979), Coggiola et al (2003), Wild et al, (2002)
and
Vermiculite containing tremolite asbestos (McDonald et al (1986
Anthophyllite Asbestos (Karjalainen et al, 1994;Meurman et al, 1994)



COMPARISON GRUNERITE (ASBESTOS) (Mining SA, Manufacturing UK, US, US)VS NON-ASBESTIFORM EXPERIENCE. (Homestake, Reserve, Erie)

Population	No in cohort % Dead	No. Meso %	SMR-LUNG CANCER
Asbestiform grunerite (Amosite)	9607 (18.7%)	21/1796=1.2%	224/81=2.77
Non-Asbestiform grunerite	12510 (23.2%)	0 /2907 = 0	192/2119=0.91

Comparison Non-Asbestiform Grunerite (Steenland & Brown 1995) – Asbestiform Grunerite (Seidman et al 1986) (Assumes 1 MPPCF= 0.146 f/ml

f/ml-yrs	<4.8 <6	4.8-19.5 6-11.9	19.5-29.2 12-24.9	>29. 25-44.9	50-99.9	100-149.9	150-249.0	250+
SMRNonAsb	1.17	1.01	0.97	1.31				
SMRAsb	2.64	4.15	4.42	4.42	7.14	6.04	9.09	11.7

MINNESOTA -TACONITE

EXCESS OF MESOTHELIOMA
LINKED TO MINING?

NEEDS: WELL CONDUCTED
EPIDEMIOLOGICAL STUDY OF
MESOTHELIOMA WITH APPROPRIATE
CONTROLS AND TISSUE
ANALYSES.

COMMENTS & THOUGHTS

- Thoracic fraction?
  - Caution-Epidemiology-Conversion?
  - Already the current fibre counting ignores effect of diameters (Eg: more amosite fibers; Fewer crocidolite fibers seen). Validity of fiber exposure and risk comparisons?

- Need method to distinguish cleavage fragments from real fibers.
  - Consider Aerosol spectrometer - Timbrell
  - Consider magnetic alignment – Timbrell
  - Horizontal eleutriation – separates diameters
  - Nano-technology surface expertise?

GENERAL COMMENT/SUGGESTION

- Workshops and think tanks on specific topics.

- What has changed? – levels of exposure and technology.