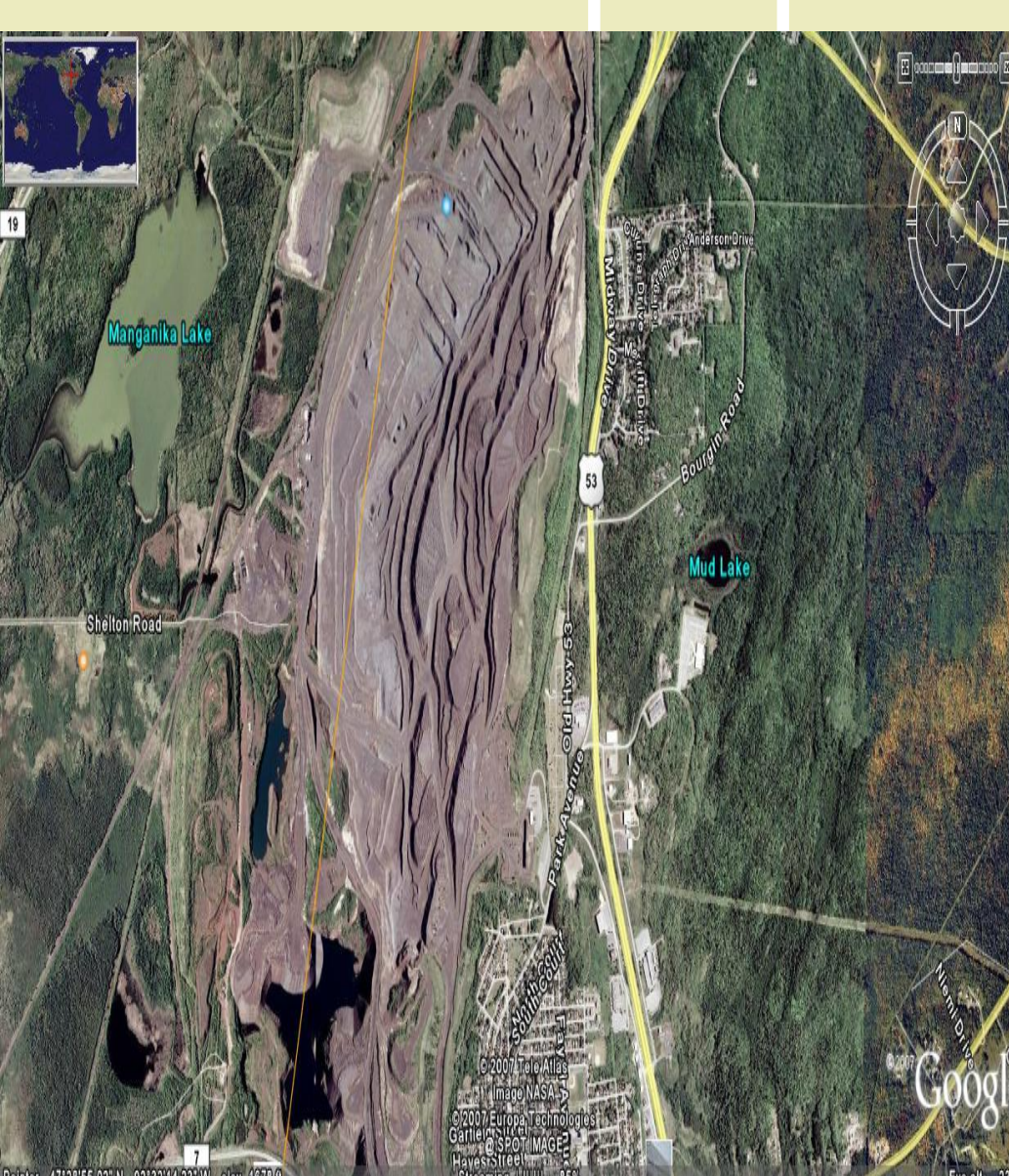




Taconite Worker Health Studies

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Abstract

Minnesota houses one of the world's largest bodies of iron ore, and supplies 65% of the ore needed for North American steel production. Mining has been in place in the state since the early part of the previous century. During that time, thousands of workers have had jobs in this industry. Worker studies in the early 1990s indicated the presence of abnormal chest x-rays, suggestive of silica-related exposures. More recently, a cohort of taconite workers has had an apparent excess of mesothelioma, as determined via the state's cancer surveillance system. Although undoubtedly related to asbestos exposure, the exact cause of this problem and its significance, along with a comprehensive view of the health of this industry is being determined.

Several worker studies are in progress and include:

- cohort mortality study of all causes of death in taconite workers (n=68,000),
- cancer incidence study that focuses on the major cancers associated with asbestos exposure,
- screening survey of occupational lung disease within current and former taconite workers and their spouses,
- workplace exposure assessment that utilizes current and past exposure data and complements the above-mentioned studies.

Industry History

Taconite is igneous rock containing magnetic iron, silica and silicates. It has been mined in northeastern Minnesota since 1952. The mining process is done within a large open pit, measuring several hundred feet deep and 0.5 miles wide. Currently 8 active mines with approximately 6000 workers. Taconite provides 66% of the iron ore needs for steel production in the U.S.

Time Line

- 1985 – Virginia physician reports lung findings
- 1988- Conwed investigation (19% of workers with abnormalities)
- 1989 to 1994 – tracing and notification of former Conwed workers
- 1991 – proposal for occupational surveillance
- 1992 – concern for lung cancer and mesothelioma
- 1994 – taconite worker study proposal
- 1997 – 70% excess mesothelioma in N.E. Minnesota
- 1998 to 2001 – Occupational Respiratory Disease Information System developed
- 2003 – Initial MDH report on mesothelioma in miners

Initial Investigations

Silicosis risk found (Clark *et al.*, 1980)

- Mortality study U. Michigan did not find elevated rates for respiratory diseases after 20+ years of cohort follow-up (Higgins *et al.*, 1981)
- Chest x-ray analysis revealed 7% of films categorized as "1/1" (Higgins *et al.*, 1981)
- Animal toxicology suggests pathogenicity from taconite dust (Cook *et al.*, 1981)

Recent Findings from MDH

- 2003 Report revealed 17 cases of pleural mesothelioma in countries where Taconite industry located from 1988 – 2001
- 2 cases without occupational history
- Commercial asbestos use linked to 14 of 15 of the remaining cases
- 2006 Additional 34 cases identified through 2005 within mining cohort (Cases have addresses on both east and west sides of Iron Range; no exposure assessment conducted)
- 2007 Additional 7 cases identified through May, 2007

Over-Riding Research Questions

What factors are associated with the apparent excess of mesothelioma in miners?

Is there evidence of excess respiratory morbidity within taconite workers and their spouses?

Is there evidence of excess respiratory mortality (or other categories of mortality) within taconite workers?

Exposure Assessment

Comprehensive Exposure Assessment:

- Existing company data
- MSHA data
- On-site measurement using Cascade impactor (including fibers less than 5 microns)
- Bayesian approach to prior exposure measures

The exposure assessment is unique in that it will use size information on particles and fibers ranging from 10 microns and above to 200 nanometers.

Other Studies Being Conducted

A. COHORT MORTALITY STUDY

- Cohort=68,783 individual workers through 1983
- 20,000+ deaths through 2003
- All causes of death compared to expected number in Minnesota, controlled for age, gender, start date, length of employment

B. CASE-COHORT STUDY OF MESOTHELIOMA CASES AND IMPORTANT CANCERS

- Cases (n=58 mesotheliomas) identified in MCSS from 1988 through 2007, within mining cohort
- Controls: mining cohort with other cancer in MCSS, matched by age, gender

C. RESPIRATORY HEALTH SURVEY

Questions:

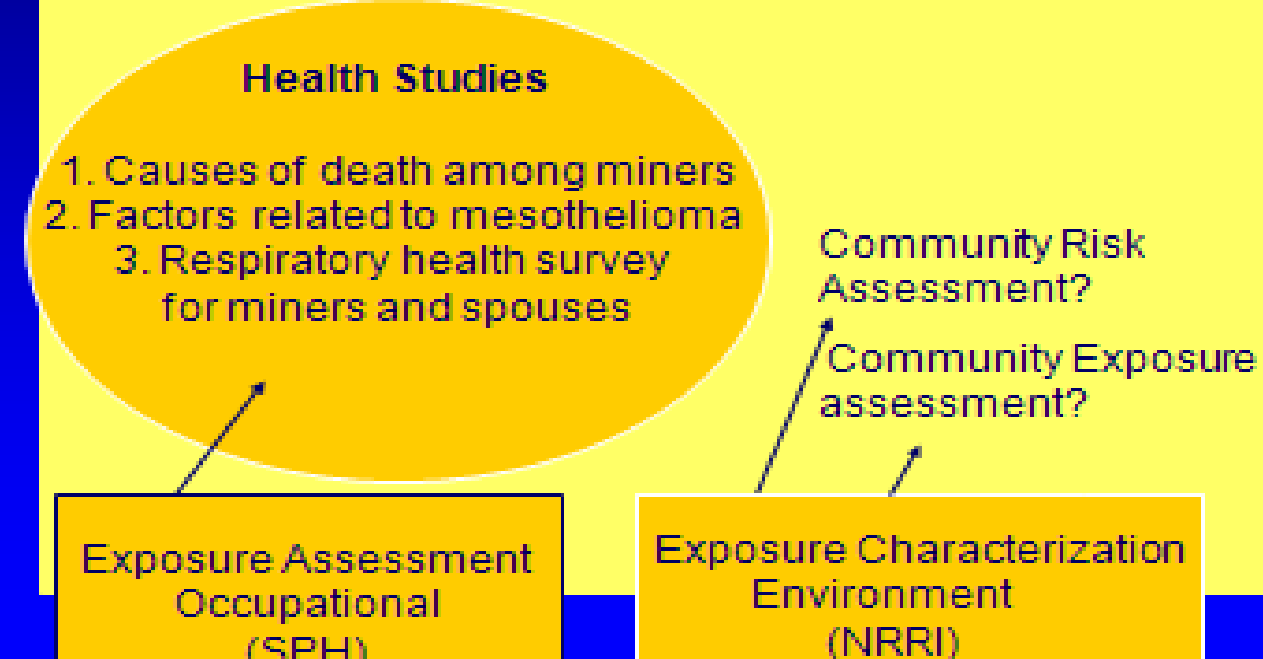
- Is there evidence of radiographic changes c/w pneumoconioses among taconite miners and spouses?
- Prevalence of these changes?
- Changes in PFT and severity?

Screening assessment

- Sampling of current and ? Former workers
- H&P ? (at health care facility)
- Chest x-ray (2 independent B-readers)
- PFT's
- DLCO
- Blood sample (stored)

Taconite Investigations

Scientific Approach



ADMINISTRATIVE STRUCTURE

- Science Advisory Panel
- Study Team (SPH, MDH, Natural Resources Research Institute, Med School)
- Stakeholder Team (Industry, unions, community, politicians)
- Communication Team

Nano Micro Orifice Uniform Deposit Impactor (NanoMOUDI)



Stage	Cut size (µm)
1(Inlet)	>10,000
2	5,600-10,000
3	3,200-5,600
4	1,800-3,200
5	1,000-1,800
6	560-1,000
7	320-560
8	180-320
9	100-180
10	56-100
11	32-56
12	18-32
13	10-18
Filter	0-10

*On these stages the nozzle are specified using pressure drop instead of nozzle diameter (Model 123R NanoMOUDI User Guide, MSP co.)

