Minnesota Taconite Workers Health Study

Minnesota Taconite Workers

Lung Health Partnership

October 17, 2011

UNIVERSITY OF MINNESOTA

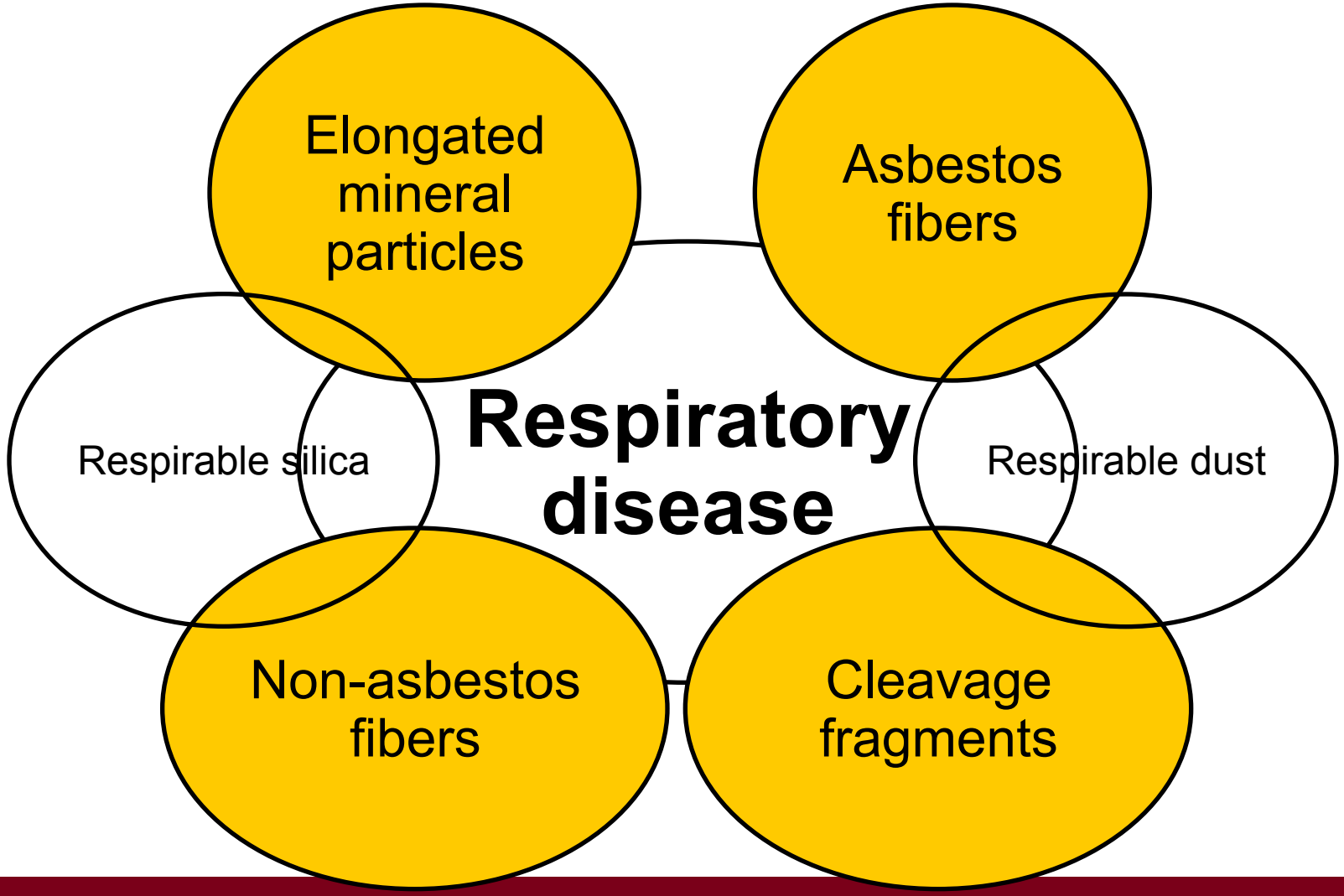
Driven to Discover℠

Agenda

- Welcome - John Finnegan, Ron Dicklich
- Project Updates:
  - Occupational Exposure Assessment:
    G. Ramachandran, Pete Raynor
  - Mortality and Cancer Incidence: Bruce Alexander
  - Respiratory Health Survey: Jeff Mandel
  - NRRI Airborne Particulates: Larry Zanko
- Communication Planning - Jeff Mandel
- Discussion

Occupational Exposure Assessment

Relationships between exposures and diseases



Occupational Exposure Assessment

- The asbestiform type of EMP is a low fraction of the total exposure and nearly all are below the PEL. Total EMP measures have been decreasing through time.
- The respirable dust measures are nearly all under the PEL.

EMP - Elongated Mineral Particle
PEL - Permissible Exposure Limits

Occupational Exposure Assessment

- Silica measures have exceeded the PEL more than the others across the sites. This is similar to MSHA findings for some specific plants.
- All of these exposure areas will be incorporated into the health studies to better understand the relationship of disease categories with the workplace.

Engineering Control Evaluations

- Best measures of control effectiveness are exposure concentrations
- Primary engineering controls are enclosures, ventilation, and particle collectors
- Evaluation methods
  - Toured control systems of six operating mines
  - Measured air velocity into selected enclosures and in selected ducts in four mines
  - Compared findings to ACGIH ventilation guidelines
- Summary of findings
  - Types of installed controls match ACGIH guidelines
  - Velocity into some enclosures is lower than recommended
  - Many collectors are newly installed
  - New collectors are generally filters replacing scrubbers

Respiratory Protection

- Engineering controls are appropriate for normal operations
- Miners may be exposed to elevated dust levels when making repairs or performing maintenance
- Atypical conditions may lead to significant exposures
- Respiratory protection should be used under atypical conditions that contribute to excessive exposures
- Anticipating atypical conditions that require respiratory protection is a challenge

Mortality and Cancer Incidence

Objectives

- Compare rates of death to what is expected in Minnesota
  - Characterize overall health of population
- Detailed analysis for mesothelioma, lung cancer, and nonmalignant respiratory disease (NMRD)
  - Work history
  - Estimated exposure to respirable dust
  - Silica and elongated mineral particles

Taconite Study Population Born After 1920: Status Through 2007

Status	
Alive	30,660
Deceased cause of death known	13,658
Presumed deceased	266
Presumed alive	751
Unknown	197
Total*	45,532

*Subject to change as work histories are reviewed

Taconite Worker Health Study Diseases of Interest From MCSS[a] and Death Certificates

	Mesothelioma	Lung Cancer[b]	NMRD[bc]
MCSS only	28	373	na
Death Certificate only	19	688	645
Both	35	620	na
Total	82[d]	1,681	645

a: MCSS = Minnesota Cancer Surveillance System
b: Born 1920 or later
c: NMRD = Nonmalignant respiratory disease.
d: Includes 4 from Minnesota not pathologically confirmed

Estimating Exposure

- Full work history abstraction: 11,645 workers
- ~90,000 work history entries
- 10,708 unique job titles
- Goal: Reduce the job titles to 29 Similarly Exposed Groups (SEG) for the exposure reconstruction
- Concentrations of respirable dusts for each SEG

Challenges

- Gender information missing for ~23% of cohort
  - Linking to external databases to correct
- Missing work history information
  - Exploring other sources
  - Update records with current companies
- Mapping obscure job titles from work history record

Respiratory Health Survey

Respiratory Health Survey

Results of screening

- Overall participation adequate
- Company participation comparable
- Older participated at higher rates
- Distance from test center affected participation

  - 1188 workers participated
  - 498 spouses participated
  - 134 questionnaire only

Respiratory Health Survey

Spirometry Findings in Workers:

- 17.4% with obstructive (asthma-like) pattern
- 9.2 borderline obstructive
- 4.3% with restrictive (lower air flow) pattern
- 3.0% with mixed (obstruction and restriction) pattern

Respiratory Health Survey

Initial Chest X-ray Findings in Workers*:

Abnormalities:

in tissue of lung (parenchymal)	4-6%
in tissue surrounding lung (pleural)	10-15%

*Independent readers

Respiratory Health Survey

Next Steps

- Compare spirometry with other tests
- Use exposure information in analysis
- Assessment of “non-response” group

NRRI - Airborne Particulates

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Community Sampling – *Now Completed – Analysis in Progress*

Iron Range Communities	Sampling Events	Non-Iron Range Communities	Sampling Events
Silver Bay High School	11 (4W/7S)	Duluth NRRI Rooftop	10 (4W/ 6S)
Virginia Court House	9 (4W/5S)	Ely Fernberg Site	7 (4W/3S)
Hibbing High School	9 (4W/5S)	UMTC-Minneapolis	6 (3W/3S)
Keewatin Elementary School	6 (3W/3S)		
Babbitt Municipal Building	15 (7W/8S)		

In-Plant Sampling – *Now Completed – Analysis in Progress*

Taconite Facility	Sampling Events	Taconite Facility	Sampling Events
United Taconite (Cliffs Natural Resources)	2 active	Keetac (U.S. Steel Corp.)	1 inactive 1 active
Hibtac (Cliffs Natural Resources)	1 inactive 1active	Northshore (Cliffs Natural Resources)	1 inactive 3 active
Minntac (U.S. Steel Corp.)	1 active	Minorca (ArcelorMittal)	3 active

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Sample Analysis – Filters and Substrates

Sample Type	Remaining
TEM Analysis for Mineral Fibers in Air (MDH 852 Method - Braun Intertec Corp.)	~30 in progress
Determination of Asbestos Fibres - Indirect Transfer TEM Analysis (EMSL Analytical, Inc. (ISO 13794))	~60 in progress
Proton-induced X-ray Transmission Analysis (Elemental Analysis, Inc.)	~60 in progress
Modified Elutriator Method (EMS Laboratories)	*Completed – data being evaluated*
Scanning Electron Microscopy / Energy Dispersive Spectroscopy (UMD/NRRI utilizing EDS/EBSD methods)	~75 in progress

Lake Sediment Sampling

- Age dating is now complete for Silver and "North of Snort" Lakes
- Confirmation dating of Silver Lake sediments by ^{137}Cs confirms dependable dates in the upper core to 1907
- Elutriation, particle extraction, and sediment sample analysis is ongoing and will continue during fall and winter

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Plans for Remainder of 2011

- Review of Quality Assurance Project Plan (QAPP) / Standard Operation Procedures / Glossary
- Completion of lake sediment analysis
- Completion of laboratory analysis of samples (TEM, PIXE, Elutriator)
- Continued particle analysis via SEM/EDS/EBSD at the University of Minnesota Duluth
- Completion and review of in-plant gravimetric data reports and community gravimetric data reports
- Continued evaluation and interpretation of laboratory data
- Initiation of final project report

Communication Planning

Communication Planning

- General order of study component reports:
  - Occupational exposure assessment (SPH)
  - Environmental exposure characterization (NRRI)
  - Mortality study (minimal exposure information)
  - Respiratory Health Survey (minimal exposure information)
  - Case-control studies (mesothelioma, lung cancer, non-malignant respiratory disease); detailed exposure information

Communication Planning

- Reporting process
  - External scientific peer review
  - Communication with stakeholders
  - General communication

Communication Planning

- Multiple studies are being done
- Results will be reported
  - As study components are completed
  - As one final report
- Feedback?

Summary

Summary

- The asbestiform type of EMP a low fraction of total exposure
- General dust levels are nearly all under the PEL
- Silica levels exceed the PEL in some cases – similar to MSHA findings
- Engineering controls are appropriate for normal operations

Summary

- Ongoing analysis of lung function tests and chest X-rays from workers and spouses
- Diseases identified will be assessed by exposure categories
  - Mesothelioma
  - Lung cancer
  - Non-malignant lung disease

Summary

- Work that characterizes community dust is in final (analytic) stage
- Reports on each study component expected over next year or so
- One final report to be issued at the end