

ANNUAL REPORT TO THE LEGISLATURE
MINNESOTA TACONITE WORKERS HEALTH STUDY

DATE: February 12, 2010

TO: Sen. John Marty, chairman
Senate Health, Housing and Family Security Committee
328 Capitol

Sen. James P. Metzen, chairman
Senate Business, Industry and Jobs Committee
75 Rev. Dr. Martin Luther King Jr. Blvd.
St. Paul, MN 55155-1606

Rep. Paul Thissen, chairman
House Health Care and Human Services Policy and Oversight Committee
351 State Office Building

Rep. Jim Davnie, chairman
House Labor and Consumer Protection Division
545 State Office Building

Rep. Tom Rukavina
House Higher Education and Workforce Development Finance and Policy Division
477 State Office Building
100 Rev. Dr. Martin Luther King Jr. Blvd.
St. Paul, MN 55155-1206

FROM: John R. Finnegan, Jr., professor and dean, assistant vice president for public health
(E-mail: finne001@umn.edu; Phone: 612 625 1179)

Jeffrey Mandel, associate professor, principal investigator
(E-mail: mand0125@umn.edu; Phone: 612 626 9308)

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Rep. Tom Anzelc
Sen. Tom Bakk
Rep. David Dill
Sen. Tom Saxhaug
Rep. Tony Sertich
Rep. Loren Solberg
Sen. David Tomassoni

Dear Legislators,

Per House File No. 3569 which states that the University of Minnesota must report annually to the committees of the legislature that are responsible for health and workers' safety, we are pleased to present the attached report on our research into the health status of Minnesota taconite mine workers.

In the report, you will find a progress report on the three main human health study areas (occupational exposure assessment, mortality and cancer incidence studies, taconite respiratory health survey) as well as a report from the National Resources Research Institute on its environmental exposure characterization study.

In addition to our scientific research efforts, we continue to make open communication and transparency fundamental objectives of our work. We regularly communicate about our work with the broader Iron Range community through the Minnesota Taconite Workers Lung Health Partnership which continues to meet regularly, via our Web Site (<http://www.taconiteworkers.umn.edu>), in our work with the news media in the Twin Cities that have statewide reach, as well as with media in northeastern Minnesota, and with various stakeholder groups.

We welcome your comments and suggestions, and would be delighted to present this report in person if you wish.

Thank you for the opportunity to advance scientific knowledge on this critical issue facing Minnesota.

John R. Finnegan, Jr.

Jeffrey Mandel

February 12, 2010

TACONITE WORKERS HEALTH STUDY PROGRESS REPORT TO THE MINNESOTA LEGISLATURE

OVERALL SUMMARY

During the past 12 months, considerable progress has been made on each of the component parts of the Taconite Workers Health Study. The occupational exposure assessment, mortality and cancer incidence studies and the respiratory health survey have all made important strides. Those are discussed in more detail within this report, along with a progress report from the Natural Resources Research Institute (NRRI).

We have also had excellent progress on the communications front. The study website has been updated (<http://www.taconiteworkers.umn.edu>) and has had over 1000 visits during the past few months. We have had a variety of meetings with the mining communities, with the unions and with industry representatives.

We have started the process of testing individuals selected to participate in the Taconite Respiratory Health Survey (TRHS). This effort began with locating a testing site (Virginia Regional Medical Center) and with the hiring of five individuals who could conduct the medical testing of current and former miners and their spouses. The five staff persons have undergone extensive preparation for the actual medical testing.

Study participants are selected from electronic lists provided to our study team by industry and by the retiree professional group (SOAR). Cliffs Natural Resources, United States Steel and ArcelorMittal were all involved in assembling these lists of workers, which date back around two decades. These lists have been instrumental in allowing the conduct of this investigation.

The TRHS team has been testing selected individuals for the past 5 months. In the process of doing these evaluations, we have focused on high-quality test results. Variation in testing has dropped significantly. We have had many satisfied participants go through these evaluations. Despite the fact that, for administrative reasons, we started testing several months later than anticipated, we expect to complete the testing process later this year and should be on track with regard to final reports on this portion.

We feel confident that the overall study progress has been satisfactory and that we are on track to issue final reports, as previously estimated.

OCCUPATIONAL EXPOSURE ASSESSMENT

There are three main goals for the exposure assessment component of this research:

1. Assess historical exposures of workers to health-relevant components of dust from taconite operations (asbestos and non-asbestos fibers, respirable dust, and respirable silica) in the taconite industry for the time period 1955-present to evaluate the relationship between exposures and health effects.
2. Assess current exposures of workers to the health-relevant components of dust from taconite operations in relation to current occupational exposure limits.
3. Evaluate existing practices and methods to reduce worker exposures in this industry and, where appropriate, suggest improvements in these methods.

The following tasks have been accomplished to date:

1. We have obtained primary exposure monitoring measurements made in the taconite industry for the time period 1955-present that were abstracted by Dr. John Sheehy in 1986, and data from the Mine Safety and Health Administration.
2. We have obtained data on historical exposure monitoring measurements from Cliffs Natural Resources. Based on this, we have started preliminary analysis to classify the workers into similarly exposed groups (SEGs). The data obtained from US Steel and ArcelorMittal are not as complete as we would like. However, the available information has allowed us to classify the workers into 30 SEGs.
3. We have conducted preliminary surveys through two of the mines (Utac and Hibbtac) owned by Cliffs Natural Resources to prepare for the assessment of current exposures. In these surveys, we conduct a detailed study of the efficacy of existing exposure control measures including engineering controls, work practice and administrative controls, and personal protective equipment. We plan to do the same for all mines owned by all companies that are currently operational. We are negotiating with US Steel and ArcelorMittal to gain access to their workplaces for assessing exposures.
4. The six mines have been divided into two zones (eastern and western) based on their geographical location in the Iron Range. Five of the mines are in the western zone and one in the eastern zone. Each zone's workforce has been divided into 30 SEGs. We have started our assessment of current exposures at Northshore mining in Silver Bay and Babbitt. Two workers from each SEG are being sampled three times each for fibers (NIOSH 7400 method) and respirable dust and silica. At the same time, we are also obtaining area samples for more detailed microscopic analysis by TEM that can be used to adjust the personal samples. Area samples also include real-time monitoring for particle number, surface area, and mass concentrations. We expect that the monitoring of current exposures at the six mines will be concluded by Fall 2010.

MORTALITY AND CANCER INCIDENCE STUDIES

The overall objective of this part of the study is to determine whether employment in the taconite industry, and more specifically exposure to dust from taconite mining and processing, is related to developing certain cancers or dying from specific diseases. In consultation with the study's external Scientific Advisory Board, specific hypotheses for this study have been developed. This study will determine whether employment in the taconite industry and the attendant dust and fiber exposures are associated with; mesothelioma, lung cancer, colon cancer, pharyngeal cancer, esophageal cancer, laryngeal cancer stomach cancer, and non-malignant respiratory disease. These selected conditions are believed to be most relevant to exposure to asbestos, asbestos-like fibers, and silica that would be encountered in taconite mining and processing.

To address these hypotheses, the existing cohort of taconite industry workers will be linked to mortality records and the Minnesota Cancer Surveillance System to identify the cases of cancer and deaths arising from these conditions. The analysis will use a case-cohort design in which detailed work history and exposure information is abstracted from all individuals identified as having died or developed the diseases of interest and from a sample of the entire study population. This approach will yield scientifically valid results but will be less labor intensive and more cost effective.

The following tasks were accomplished in the last year:

- An update to the methods, specifically the sampling plan, was reviewed with the Scientific Advisory Board.
- The historical work history records on microfilm and hard copy have been scanned into an electronically readable format to aide abstraction. This effort established a mechanism to rapidly locate the multiple records for individuals which will facilitate abstracting the data.
- Further review of historical documents to properly classify work history information.
- Protocol established for abstracting the work history records. This includes standardizing process and data collected from records representing the various mines and mining companies.
- Work history records are being abstracted for causes of death of interest.
- Death record information has been obtained for all decedents dying in Minnesota. The majority of the deaths were identified in electronic format. Hard copy or microfilm records were obtained as necessary.
- The cohort was linked to the Social Security Administration service for epidemiologic studies to confirm vital status. Cohort members with a status of unknown or presumed deceased were submitted to the National Death Index to obtain cause of death information.
- The final linkage to the Minnesota Cancer Surveillance is underway to identify the incident cancers for the analysis.

TACONITE RESPIRATORY HEALTH SURVEY

Since we last reported in February 2009, the *Respiratory Health Survey of Taconite Workers and Spouses* has progressed as follows:

Public Meetings: The study team has held several informational meetings regarding the Minnesota Taconite Workers Health Study. Presentations were made to the Tri-County Public Health Board in Duluth, the Range Association of Municipalities and Schools (RAMS) in Virginia, and the Steelworkers Organization of Active Retirees (SOAR) groups in Aurora and Marble. Public meetings have been held in Eveleth at IRR, in Virginia at VRMC in conjunction with the Wellness Program and in Hibbing at the Senior Center. For the United Steelworkers Union locals there have been meetings held in Virginia and in Hibbing, with additional meetings planned in the spring of this year.

Study Protocol Adjustments: The original study protocol was modified by the University of Minnesota Human Subjects' Protection Program, Institutional Review Board (IRB). The original protocol included the ability to place a phone call to the potential research participant shortly after receiving a letter from the study team. The IRB stipulated that no phone calls were to be made to potential participants by the study team unless the research subject responded to us first. Because of the potential for this stipulation to negatively impact recruitment, several attempts to modify the protocol have been made. Just recently, another request to the IRB to be able to contact potential study participants via the telephone in the setting where there is no response after initial communications by letter was approved and will be implemented.

Staff: Dr. Ian Greaves resigned his position with the University of Minnesota in June, 2009 to take a position at Temple University. Other existing study staff members have assumed Dr. Greave's responsibilities on the study. Five individuals from the Iron Range have been hired and trained to coordinate and conduct the participant testing at the research clinic located at the Virginia Regional Medical Center (VRMC). The University clinic staff is working directly with the VRMC staff, particularly the radiology and laboratory departments, to perform the required tests and provide research data per the study protocol.

Recruitment and testing: Employee names have been obtained from Cliffs Natural Resources, United States Steel and ArcelorMittal. Employee names from the closed LTV Mining Company were provided in cooperation with the United Steel Workers local SOAR chapter. Subjects have been and continue to be selected from these lists in a random manner. The research clinic began testing participants in August of 2009. After 22 weeks of operating the clinic, we have tested 615 individuals (421 workers and 194 spouses), following initial mailings. We have contracted with St. Paul Radiology to have their certified B-readers perform the formal interpretation of the chest x-rays using International Labor Organization (ILO) standards. This process will begin in February, 2010.

ENVIRONMENTAL EXPOSURE CHARACTERIZATION STUDY - NRRI

During 2009, the Natural Resources Research Institute Environmental Exposure Characterization Study completed numerous tasks including sampling, sample submission to external laboratories, sample analysis at the NRRI, lake sediment sample analysis, completion of reports, presentations at professional conferences, and training. Several personnel changes also took place. These items are summarized below.

Sampling Events – Communities: Community air sampling took place at seven sites in northeastern Minnesota. These sites are located on the Mesabi Iron Range (MIR) and away from the MIR. Sampling events that took place on the MIR include: 1) Silver Bay High School (eleven sampling events); 2) Virginia Court House (nine sampling events); 3) Hibbing High School (nine sampling events); 4) Keewatin Elementary School (six sampling events); and 5) Babbitt Municipal Building (thirteen sampling events). Sites away from the MIR that were sampled include: 1) Duluth Natural Resources Research Institute (five sampling events); and 2) Ely Fernberg site (two sampling events).

Sampling Events – Mining Operations: Sampling events took place at four taconite plants during 2009. At each plant, four locations were sampled, including; 1) crusher; 2) magnetic separator; 3) agglomerator / ball drums; and 4) kiln pellet discharge area. The four plants sampled in 2009 included: 1) Forbes (United Taconite, Cliffs Erie LLC – one sampling event during active processing); 2) Hibtac (Hibbing Taconite, Cliffs Erie LLC – one sampling event while the plant was inactive); 3) Keetac (U.S. Steel Corporation – one sampling event while the plant was inactive); and 4) Northshore Mining (Cliffs Erie LLC – one sampling event while the plant was inactive, one sampling event during active taconite processing).

Samples Submitted for Analysis (External Laboratories): One hundred twenty samples were submitted for various analyses at external laboratories during 2009. These included: 1) twenty-nine samples submitted to Braun Intertec Corporation (Bloomington, Minnesota) for Minnesota Department of Health transmission electron microscopy (TEM) analysis for mineral fibers in air (MDH 852 Method); 2) thirty-nine samples submitted to EMSL Laboratories (Minneapolis, Minnesota) for indirect TEM analysis; 3) forty-two samples submitted to Elemental Analysis, Inc. (Lexington, Kentucky) for proton-induced X-ray emission (PIXE) analyses; and 4) ten samples submitted to EMS Laboratories, Inc. (Pasadena, California) for evaluation utilizing the modified elutriator method.

Samples Submitted for Analysis (Natural Resources Research Institute): Sample analyses performed by Natural Resources Research Institute personnel included: 1) gravimetric analyses were completed on all particulate samples collected to date; and 2) scanning electron microscopy (SEM) with energy dispersive spectrometry (EDS) was performed on eleven samples from the crusher at Northshore Mining (collected during active processing).

Lake Sediment Samples (Natural Resources Research Institute): Lake sediment core samples have been collected at two sites and are currently being processed. These include: 1) samples from the Northshore/Dunka Pit area on the eastern side of the MIR which have been dated and are ready for follow-up analyses; and 2) samples from Silver Lake (Virginia area of the MIR) are currently undergoing follow-up Pb²¹⁴ dating.

Technical Reports: Two technical reports were completed during 2009. These reports have been submitted to the University of Minnesota-School of Public Health for review and release to the general public.

- Diedrich, T. R., Brecke, D. M., and Zanko, L. M., 2009, Glossary of Selected Terminology for the Environmental Exposure Characterization Study for Minnesota Taconite Workers Lung Health Partnership: Natural Resources Research Institute Technical Summary Report NRRI/TSR-2009/04, 18 p.
- Brecke, D. M., 2009, 2008 Mesothelioma Air Particulate Project Review: Developing Procedures for Particle Collection and Gravimetric Analysis: Natural Resources Research Institute Report of Investigations NRRI/RI-2009/02, 28p.

In addition, the Quality Assurance Project Plan (QAPP) for the Environmental Exposure Characterization Study of Mineral Dust Particles Produced by Mining Taconite on Mesabi Iron Range, Northeast Minnesota is nearly completed.

- Diedrich, T. R., Brecke, D. M., Zanko, L. M., Schreiber, M., Monson-Geerts, S., and Hudak, G. J., (in review), Environmental Exposure Characterization Study of Mineral Dust Particles Produced by Mining Taconite on Mesabi Iron Range, Northeast Minnesota – Quality Assurance Project Plan and Work Plan for Characterization of Mineral Dust Particles on the Mesabi Iron Range: Natural Resources Research Institute Report of Investigation.

Conference Presentations: Poster presentations were made at two professional conferences in 2009. These presentations are available on the NRRI website (<http://www.nrri.umn.edu/egg/presentations.html>).

- Diedrich, T., Brecke, D., Schreiber, M., Zanko, L., Marple, V., and Olson, B., 2009, Environmental study of mineral dust in population centers on Mesabi Iron Range – progress report: NRRI Poster 2009-02, Annual Meeting of Society of Mining Engineers, Minnesota Chapter, Duluth, Minnesota, April 14-15, 2009.
- Diedrich, T., Brecke, D., Schreiber, M., and Zanko, L., 2009, Taconite-derived mineral dusts in population centers on Mesabi Iron Range: tracking mineral fibers from ore to air: NRRI Poster 2009-05, Institute on Lake Superior Geology, Ely, Minnesota, May 7-8, 2009.

Training: Training completed by all NRRI project personnel during 2009 included: 1) Mine Safety and Health Administration (MSHA) training; and 2) respirator fit-tests and training.

Personnel Changes: Several personnel changes took place during 2009. These included: Devon Brecke (resigned), Tamara Diedrich (Leave of Absence), Stephen Monson Geerts (hired as Research Fellow), George Hudak (hired as Senior Research Associate).