

Taconite Workers Health Studies

Respiratory Health Survey of Taconite Workers and Spouses

Jeffrey Mandel, Bruce Alexander, Ian Greaves, David Perlman, Diane Kampa, Cheryl Stibbe, Leslie Studenski, Nancy Tekautz

BACKGROUND

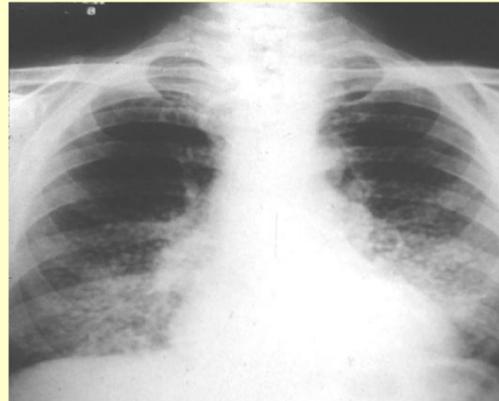
Taconite mining, processing, transportation, and disposal of tailings present two major airborne occupational exposure hazards: (1) several types of elongated mineral particles that satisfy the regulatory definition for respirable mineral fibers; and (2) respirable crystalline silica particles.

Since the 1970s, dust particles from taconite mining operations on the Mesabi Iron Range in N.E. Minnesota have been suspected of causing adverse health effects among taconite workers and the general population. An initial radiographic study (Clark, 1980) identified chest X-ray changes in miners suggesting a pneumoconiotic reaction to silica and possibly other components in the taconite dust.

Mesothelioma was a concern to health officials owing to the presence of mineral fibers in the dust from taconite operations. Since 1997 the Minnesota Cancer Surveillance System has tracked an apparent excess of mesothelioma in the northeastern part of the state. A Minnesota Department of Health (MDH) Report was released in 2003 that showed 17 mesotheliomas had occurred among a cohort of almost 73,000 taconite workers that had been earlier assembled by the University of Minnesota in 1983. Because mesothelioma is a rare tumor and has a high correlation with exposures to asbestos and similar mineral fibers, there was alarm that some of these mesotheliomas were related to fibers present in dust from taconite operations. The MDH report (2003) identified incidental exposures to commercial asbestos that the former taconite workers may have experienced, and it noted that 16/17 workers had at least "potential" exposure to commercial asbestos at some time. However, exposures to dust particles from taconite operations were not assessed (MDH, 2003).

Since 2003, a further 35 mesothelioma cases among taconite workers were identified through June, 2006, and a preliminary count of an additional 6 cases were noted from June, 2006 to June, 2007 (MDH, 2007). Some cases had very brief exposures to taconite processing (less than one year) and cases were identified from across the Iron Range. Possible exposure to commercial asbestos was not assessed in the additional 41 cases. An unnecessary delay by the MDH in releasing the information for the new cases of mesothelioma through June, 2006 led to considerable public outcry. As a result, the Minnesota State Legislature held hearings in June, 2007 and asked the University of Minnesota to conduct further research and identify more accurately any occupational or environmental health risks due to fine particles from taconite operations on the Mesabi Range.

The respiratory health study includes workers with more recent work experience as well as the spouses of the workers, and considers different health outcomes that may not contribute to morbidity or mortality but nevertheless reflect exposure to mineral fibers or silica. Such abnormalities occur more frequently in exposed populations than do tumors, and can be linked with exposure information (work histories and air samples) to explore exposure-response relationships. Furthermore, the inclusion of spouses provides another dimension to assessing the potential effects of dust from taconite operations, extending our evaluation of health effects to exposures occurring in households.



STUDY DESIGN

The respiratory health survey of current and former taconite workers and their spouses is a cross-sectional assessment based on a stratified random sampling of current and former taconite workers. The study instruments are well studied and validated, and include a standardized respiratory questionnaire (based on ATS-DLD-78-A), lung spirometry, the diffusing capacity for carbon monoxide, a poster-anterior (PA) chest X-ray, and a physical examination including a blood sample. A complete list of current and former workers obtained from current and former corporations has been stratified by age. The sampling strategy is weighted toward older subjects with longer periods of employment in the taconite industry because many of the anticipated exposure effects increase with cumulative exposure and latency from first exposure. Random lists of subjects have been created and subjects will be contacted from these random lists until 1200 current and former taconite workers are recruited. Spouses were estimated to be about two-thirds the number of workers or approximately 800.



SPECIFIC AIMS

1. **Among taconite workers, to determine the prevalence of non-malignant respiratory effects associated with breathing respirable, elongated mineral particles ("fibers" as defined by NIOSH) and crystalline silica particles (primarily quartz).**
 - a . To assess the quantitative relationships between respiratory symptoms, X-ray or lung function changes among taconite workers and the corresponding exposure metrics (air levels of particles, duration of exposures, time elapsed since first exposure) for mineral "fibers" and for silica particles, taking into account possible confounding exposures or effect modifiers (e.g., tobacco smoking, home exposures to particles from taconite operations during childhood, age, exposure to other respiratory hazards outside the workplace).
 - b . To identify other possible types of particulate exposures (including commercial asbestos) that might contribute to respiratory effects among these same workers, and assess whether these particles may explain some of the respiratory symptoms, X-ray or lung function changes identified in taconite workers.
 - c . To determine if there is an interaction between mineral "fibers" and silica particles in producing any respiratory symptoms, X-ray or lung function changes in taconite workers, after allowing for possible confounders or effect modifiers.
2. **Among spouses of taconite workers, to determine whether they may be at risk from particles carried home on the clothes of taconite workers.**
 - a . To assess whether any respiratory changes among spouses of taconite workers correspond to measures of exposures to mineral "fibers" and silica particles experienced by the spouse/partner who worked in the taconite industry, taking into account possible confounding exposures or effect modifiers (e.g., tobacco smoking, home exposures to particles from taconite operations during childhood).
 - b . To identify whether any self-reported particulate exposures (including commercial asbestos) other than those brought home on taconite workers' clothing are associated with respiratory symptoms, X-ray or lung function changes among spouses of taconite workers.
 - c . To determine whether qualitative estimates of exposure to dust from workers' clothing correlate with any respiratory symptoms, X-ray or lung function changes identified among the spouses of taconite workers.
 - d . To assess whether spouses, after allowing for possible dust brought home on taconite workers' clothing, may be at different levels of risk depending on where they lived on the Iron Range; in other words, whether living in some areas of the Iron Range may have been more or less hazardous with respect to respiratory symptoms, X-ray or lung function changes.