

High Impact

A Project from the First 10 Years of NORA



Silica, Lung Cancer, and Respiratory Disease Quantitative Risk

The Challenge:

Although much literature existed about occupational respirable crystalline silica (RCS) exposure, there were few good-quality data sets appropriate for quantitatively evaluating the relationship between RCS exposure and disease. In 1996, IARC evaluated the carcinogenicity of respirable crystalline silica and concluded that inhaled quartz and cristobalite were carcinogenic in occupational settings. Their findings stirred much debate within the scientific community. Few quantitative risk assessments of RCS exposure and lung cancer had been published at that time. In the same year, the prevention and elimination of silicosis and silica-related diseases became priorities of NIOSH, OSHA, MSHA, and the American Lung Association. 📌



Approach:

NIOSH obtained quantitative data from studies of California diatomaceous earth workers, South African underground gold miners, and Chinese tin miners. A variety of exposure-response models were used to estimate the risk of death from lung cancer and nonmalignant respiratory disease mortality and morbidity in RCS-exposed U.S. diatomaceous earth workers. Similar approaches are being used now to conduct a pooled analysis of data from the three cohorts mentioned above.

Results:

The quantitative risk assessments predicted excess lifetime risks of 19/1000 for lung cancer mortality, 54/1000 for lung disease other than cancer (LDOC), and 75/1000 for radiographic silicosis in white male workers exposed for 45 years at the current OSHA standard for respirable cristobalite dust (about 0.05 mg/m³) (with 10-year exposure lag for lung cancer analyses and unlagged for LDOC and radiographic silicosis). These risks are in excess of what is usually considered acceptable by OSHA. (The pooled risk assessment is in progress and results have not yet been published). The published risk assessments were sent to OSHA for their RCS rulemaking activities.

Impact:

The RCS quantitative risk assessments (QRAS) had international impact particularly in the areas of health policy and advancement of knowledge. Between 2001 and 2005, the RCS QRAS were cited in 17 articles in national and international journals, according to the Web of Science database. The QRAS were reported to the World Health Organization's (WHO) Task Force for global elimination of silicosis and are included in a 2003 WHO compendium of activities in occupational health. The lung cancer QRA was cited by the Health and Safety Executive (HSE) in an RCS hazard assessment document. HSE Hazard Assessment documents contribute to the development of health-related regulatory positions in the United Kingdom. The LDOC QRA was a key study used by the California Office of Environmental Health Hazard Assessment to establish a chronic inhalation reference exposure level for RCS (adopted in February 2005). OSHA will review the QRAS during its rulemaking process. ■

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For complete description of this project and others see the CD Rom "A Compendium of NORA Research Projects and Impacts, 1996-2005" located at www.cdc.gov/niosh.

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