62 Reducing silica exposure to miners at surface operations in the United States

A.B. CECALA, J.A. ORGANISCAK, R.J. TIMKO*, J.F. COLINET*, E.D. THIMONS**, W.A. HEITBRINK***
Mining Engineer
* Section Chief
** Branch Chief, All previous authors with National Institute for Occupational Safety and Health, Pittsburgh Research Laboratory, Pittsburgh, PA, USA
***Associate Professor, University of Iowa, Iowa City, IA, USA

Workers at surface mining operations in the United States are often exposed to high levels of silica and other harmful respirable dusts. In an effort to lower respirable dust exposures, the National Institute of Occupational Safety and Health (NIOSH) has been conducting research to address this problem in a practical and economically viable manner. This article will discuss two research projects addressing areas of high silica exposure in surface mining operations today. The first deals with enclosed cabs. Many types of heavy equipment, including drills, dozers, loaders, and scrapers, as well as a vast array of different haulage vehicles and trucks, have enclosed cabs to protect equipment operators from health and safety hazards. If cabs are not properly designed or fabricated, or if components significantly deteriorate over time, the protection provided can be seriously jeopardized, potentially causing an overexposure to silica and other respirable dusts. NIOSH has been involved in an extensive research effort investigating how to improve the protection of workers in enclosed cabs, including a number of cooperative studies with mining companies, heating and air conditioning companies, and cab filtration manufacturers. The majority of this work has investigated retrofitting older cabs with new filtration and pressurization systems and these studies have shown very cost-effective reductions. Retrofits to older cabs have resulted in respirable dust reductions in the 80 to 90 percent range for enclosed cabs on drills and loaders. For an enclosed cab to be effective in controlling respirable dust, two key components are necessary: 1) effective filtration, and 2) cab integrity. An effective filtration system should be composed of both a re-circulation and a clean outside-air system. Cab integrity is necessary in order to achieve some level of pressurization, a critical component for an effective clean cab system. To prevent dust laden air from infiltrating the cab, the static pressure within the cab must be higher than the velocity pressure of the prevailing wind. The second major research area involves reducing the respirable dust exposures of bag operators and bag stackers at mineral processing operations. For the past 20 years, dust exposure records for mineral processing plants have shown that both of these job functions normally have the highest respirable dust exposures. NIOSH=s research effort focused on engineering controls that were adapted to existing facilities to reduce the dust generated by these two job processes. This control technology was successful in lowering the respirable dust exposures of the bag operators and bag stackers by 80 to 90 pct. This research also examined various controls for secondary dust exposure, including general ventilation requirements for mill buildings, the effects of background dust sources, and personal work practices. The majority of this research was performed in the silica sand industry and was highly successful in reducing workers=respirable dust exposures.

63 Blasting abrasives: health hazard comparison

M. GRESKEVITCH, P. MIDDENDORF, F. HEARL, V. CASTRANOVA, H. AHLERS
NIOSH, Morgantown, WV and Cincinnati, OH, USA

Historically the most common form of abrasive blasting, sand blasting, has generated respirable quartz dust, which can lead to the development of silicosis, a deadly lung disease that continues to occur in abrasive blasters. Several substitutes for silica sand have been suggested, but little data exist which compare the respiratory health hazards of substitute abrasives to silica sand. This study compares the dust generation characteristics and *in vivo* toxicity of several blasting abrasives (table 1). Studies were conducted in controlled environments to compare concentrations of respirable quartz, respirable dust, and various toxic contaminants for each of the substitute abrasives relative to silica sand. Abrasive blasting with silica sand generated respirable quartz concentrations much greater than the NIOSH recommended exposure limit of 0.05 mg/m^3, while the concentrations of respirable quartz were much lower when using substitute abrasives (table 2). However, some substitute abrasives generated concentrations of potentially toxic components more than 10 times the NIOSH REL (table 3). Steel grit was the only substitute abrasive that generated significantly less respirable dust than silica sand. NIOSH investigators reported the relative short-term *in vivo* toxicity of these substitutes by using intratracheal instillation of equal respirable dust concentrations of each abrasive in male rats. Short-term *in vivo* evidence indicates that, compared to silica sand, steel grit and specular hematite have less potential to cause lung disease. The potential long-term toxicity of steel grit requires further studies because it contains arsenic and nickel and some forms of arsenic and nickel can cause cancer. Each of the other substitute blasting abrasives caused *in vivo* lung toxicity similar to or greater than silica sand. Regardless of the choice of abrasive, effective engineering controls, work practices, and respiratory protection (i.e., Type CE abrasive-blasting supplied-air respirators for abrasive blasters) should be used to reduce the hazards associated with blasting abrasives and substrates.

Table 1 - *Short-term animal lung toxicity relative to silica sand (1.0)*

Type of abrasive	Inflammation	Damage	Fibrosis
Steel Grit*	0.0*	0.1*	0.0*
Sp. Hematite*	0.0*	0.2*	0.2*
Nickel slag	0.2**	0.5**	0.7
Copper slag	0.6**	0.5	1.0
Staurolite	0.9	0.7	0.7
Garnet	0.9	1.1	0.5
Cr. Glass	1.3	1.1	0.5
Coal slag	1.9	1.9	0.7
Olivine	4.2	3.8	0.9

* Significantly less than sand and similar to control
** Significantly less than sand and greater than control

Table 2 - *Average respirable quartz concentrations when using various abrasives* (mg/m³)*

Type of abrasive	Laboratory study	Field study
Silica sand	8.82**	28.0**
Garnet	0.23	2.6***
Staurolite	0.15	2.3***
Coal slag	ND·	0.1
Copper slag	0.15	ND·

* Respirable quartz was not detected in specular hematite, crushed glass, olivine, steel grit and nickel slag
** Significantly greater than substitute abrasives
*** Significantly greater than other substitute abrasives
· ND = Quartz was not detected

Table 3 - *Selected components exceeding ten times the recommended exposure limit*

Type of abrasive	Potentially toxic component
Olivine	Nickel
Copper slag	Arsenic
Garnet	Quartz
Nickel slag	Nickel
Staurolite	Quartz
Steel grit	Arsenic and nickel

64 Occupational exposure to silica in Italy: assessing the extent of workers using administrative data

A. SCARSELLI, A. MARINACCIO, M. NESTI, M. MARCONI*
ISPESL – National Institute of Occupational Prevention and Safety - Occupational Medicine Department, Rome, Italy
* ISPESL – National Institute of Occupational Prevention and Safety - Documentation, Information and Education Department, Roma, Italy

Objective: The primary aim of this study is to recognise the industries at risk of exposure to silica and to estimate the number of exposed workers in order to promote a nationwide plan of action for preventing silica risk. In addition, a graphical picture of results will be performed.
Methods: The identification of industrial sectors at risk of silica is based on the distribution of cases of silicosis compensated by the Italian National Institute for Insurance of Occupational Accidents (INAIL) in the period between 1984 and 1999. Industrial sectors with at least 500 cases of compensation have been selected. The industries and the number of workers have been retrieved from the ISPESL database created in 1999. The database has been set up merging administrative files from the Chambers of Commerce (UNION CAMERE) and the National Institute of Social Security (INPS), validated by the National Statistic Institute (ISTAT) census data.
Results: The major industrial sectors involved are: construction with 246,609 workers in 74,524 sites; manufacture of basis metals and fabricated metal products with 90,361 workers in 4,750 sites; mining and quarrying with 21,257 workers in 4,659 sites; manufacture of other non-metal mineral products (including glass, stone, ceramics, bricks and other building materials) with 111,837 workers in 15,716 sites. The Italian provinces which have the highest number of workers are: Milan (21,892 blue collars), Brescia (21,688 blue collars), Turin (17,516 blue collars) and Bergamo (17,092 blue collars).
Conclusions: The database of industries at risk of silica is useful for assessing the distribution and the consistence of the silica exposure problem in Italy. The identification and the geographic localization of all industries involved are the basis for planning prevention programs and for improving the environmental quality in the work-place.

65 Prevention of silicosis in sandblasters. Conduct and outcomes of a program in Québec, Canada

R. SIMARD, R. ARCAND*, J. TURCOT**, P. PELLETIER***
Occupational Health, Montreal Department of Public Health
* Montreal Department of Public Health
** Prevention-inspection, CSST, Québec
*** Department of Public Health, Mauricie-Centre du Québec

Objectives: Following the identification of several cases of accelerated silicosis among sandblasters in the early 90's by the Montreal Department of Public Health, public health authorities in the province of Quebec focused on the development of a prevention program aimed at eliminating acute and accelerated silicosis by year 2002. Implementation by occupational health teams from Local Community Health Centers (CLSC) started in 1997.
Methods: The program adopted a multifaceted approach. Firstly, a steering committee was set up and included specialists from the Quebec Workers Health and Safety Board, occupational medicine, hygienists and organizations providing education in occupational health and safety. Three industrials sectors were targeted for the intervention: car painting and auto body repair, construction sites and boat repairs. The program comprised the following aspects. 1) Education: educational material, including printed material about the health effects of silica, proper handling of silica and the use of protective equipment. Group sessions covering the same themes were also offered. 2) Use of safer substitutes. The program emphasized product substitution when feasible. Technical guides about substitutes were developed and handed out to key abrasive material distributors and various industries. 3) Hygiene surveys. Industrial hygienists completed field surveys of current sand blasting practices in auto body shops, boat yards and construction sites. The efficacy of process isolation and ventilation was assessed, as well as the use of air supplied respirators and hoods. 4) Medical surveillance. Guidelines for medical surveillance were developped and workers potentially exposed tp silica were invited to participate in a periodic screening program. All pulmonary X-rays were interpreted and classified by certified B-readers according to ILO standards. 5) Enforcement of regulations. Compliance with permissible exposure levels, ventilation requirements and respiratory protection were stressed to industrial settings. The results of the program were closely monitored using standardized protocols, on a yearly basis. The data gathered was transferred to a computerized database and analysed by one of us.

Volume 93 **Supplemento 2002**

Rivista fondata nel 1901
da Luigi Devoto

Issn 0025 - 7818

La Medicina del Lavoro

RIVISTA BIMESTRALE DI MEDICINA DEL LAVORO E IGIENE INDUSTRIALE
ITALIAN JOURNAL OF OCCUPATIONAL HEALTH AND INDUSTRIAL HYGIENE

INTERNET http://www.lamedicinadellavoro.it

E-MAIL redazione@lamedicinadellavoro.it

REDAZIONE La Medicina del Lavoro
Clinica del Lavoro «L. Devoto»
Via San Barnaba, 8 - 20122 Milano (Italy)
Tel. 02/50320125 - Fax 02/50320126

CASA EDITRICE Mattioli 1885 spa - Casa Editrice
Via Coduro, 1/b - 43036 Fidenza (PR)
Tel. 0524/84547 - Fax 0524/84751
e-mail: edit@mattioli1885.com
www.mattioli1885.com (CCP N. 11.286.432)

Pubblicazione bimestrale
Direttore Responsabile Prof. Vito Foà
Autorizzazione del Presidente
del Tribunale di Milano 10/5/1948 - Reg. al N. 47

La Medicina del Lavoro è recensita su:
Index Medicus/MEDLINE; Embase/Excerpta Medica; Abstracts on Hygiene; Industrial Hygiene Digest; Securité et Santé au Travail Bit-CIS