



OSHA Compliance Issues

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Reported by Ken Linch

Introduction

In August 1996 the Occupational Safety and Health Administration (OSHA) began enforcement of its special emphasis program (SEP) for workplace exposure to crystalline silica.⁽¹⁾ The crystalline silica SEP targets workplaces in general industry, construction, and maritime where overexposures to silica and cases of silicosis are documented or expected to be found. The program utilizes a variety of local and national data sources to target these inspections.^(1,2) During the spring and summer months, much of the OSHA inspection activity under this SEP will be directed at the construction industry, which is most active during these months. This month's column focuses on OSHA activity in the construction industry, with regard to crystalline silica, prior to OSHA's SEP.

Background

Worker exposure to crystalline silica and other air contaminants often goes unchecked because some small construction firms lack any organized respiratory protection program or employee training. Some may not have heard of crystalline silica and its associated hazards. In fact, many managers as well as workers have regarded crystalline silica dust exposure as part of the job, or in other words, as "just being dust." Some construction activities during which dust containing respirable crystalline silica may be produced include:

- Abrasive blasting. Exposures to crystalline silica can be very high when abrasive blasting is performed. This is particularly true when silica sand is used as the abrasive (sandblasting), although blasting of concrete or stone surfaces may produce crystalline silica exposures regardless of the blasting agent. Abrasive blasting often occurs prior to bridge and tank

painting, as well as other steel structure work (either new construction or maintenance).

- Masonry, bricklaying, block laying, and/or stone setting. Masonry contains crystalline silica in varying amounts. If any of these materials are sawed, hammered, or ground without dust control, there will be very high dust concentrations. Mixing of sand for mortar may add to the exposure.
- Demolition and repair of concrete or masonry structures. Demolition of buildings, highways, and bridges, and repair of roads and highways can generate ample quantities of dust containing crystalline silica. Whenever a concrete or masonry structure such as a highway is sawed, drilled, or jack-hammered, there is potential for high exposures.
- Concrete finishing work. After a concrete foundation, wall, or floor has been poured, workers sometimes grind, drill, or saw the surface of the concrete. These operations often smooth or shape the concrete prior to the application of a finish surface or finish appliances. Sometimes this work is done with hand-held grinders, drills, or saws that are used without dust collection or water spray. Concrete grinding, drilling, or sawing for any purpose can produce high crystalline silica exposure levels.
- Rock drilling. Drilling in rock prior to blasting for highway construction, or for other reasons such as site preparation, water well drilling, or pipeline installation, is basically the same in the construction industry as in past surface mining. Recently the Mine Safety and Health Administration (MSHA) enacted strict regulations concerning the control of dust from rock drilling machines at surface coal mines. As a result, many of the older drill rigs that lack the required dust control systems may

have been shifted from mostly mine properties to construction jobs under OSHA jurisdiction. If not well controlled, very high crystalline silica exposures may result.

Methods and Results

Construction site data, collected by OSHA industrial hygienists prior to the implementation of the SEP for crystalline silica, were obtained from the OSHA Integrated Management Information System (IMIS).⁽³⁾ IMIS data contain the standard industrial classification (SIC) for each inspection. Table 1 presents a breakdown of the construction industries grouped under the respective SICs.⁽⁴⁾ Table 2 presents a breakdown of the construction data for all federal OSHA silica sampling from 1980 through 1995. The data include only information from federal OSHA enforcement states and do not include sampling data from the state plan enforcement states (those states that implement and enforce their own OSHA programs). The data show that OSHA found exposures to crystalline silica in excess of the OSHA permissible exposure limit (PEL) for crystalline silica primarily in SICs 1542, 1622, 1629, 1721, 1741, and 1799. The summary for all of the SICs indicates that approximately 35 percent of samples obtained by federal OSHA inspections exceeded the PEL.

The following provides additional information about the four-digit SICs for which the OSHA IMIS data indicate that at least 50 samples were obtained for all ten OSHA regions and in which at least 30 percent were over the PEL for the years 1980 through 1995.

SIC 1542: General Building Contractors—Nonresidential Buildings Other Than Industrial Buildings and Warehouses

The OSHA IMIS data indicate that 41 percent of samples in SIC 1542 were over the PEL. SIC 1542 includes general contractors primarily engaged in the con-

TABLE 1. Definitions for SIC Codes

SIC Codes	Construction Work Associated with the SIC
1522	General contractors, residential buildings other than single family
1541	General contractors, industrial buildings and warehouses
1542	General contractors, nonresidential other than industrial buildings and warehouses
1611	Highway and street construction, except elevated highways
1622	Bridge, tunnel, and elevated highway construction
1623	Water, sewer, pipeline, and commercial and power line construction
1629	Heavy construction
1711	Plumbing, heating, and air conditioning
1721	Painting and paper hanging
1731	Electrical work
1741	Masonry, stone setting, and other stone work
1742	Plastering, drywall, acoustical, and insulation work
1743	Terrazzo, tile, marble, and mosaic
1751	Carpentry
1752	Floor laying and other floor work
1761	Roofing, siding, and sheetmetal work
1771	Concrete work
1791	Structural steel erection
1793	Glass and glazing work
1794	Excavation work
1795	Wrecking and demolition work
1796	Installation or erection of building equipment
1799	Special trades not elsewhere classified

struction (including new work, additions, alterations, remodeling, and repair) of nonresidential buildings other than industrial buildings and warehouses. Included are nonresidential buildings such as commercial, institutional, religious, and amusement and recreational buildings. General contractors primarily engaged in the construction of industrial buildings and warehouses are classified in SIC 1541. For the three-digit SIC 154, which comprises these two SICs (1541 and 1542), the 1993 Bureau of Labor Statistics (BLS) data estimate that there are 520,758 workers employed at 39,564 establishments.⁽⁵⁾

SIC 1622: Bridge, Tunnel, and Elevated Highway

The OSHA IMIS data indicate that 53 percent of samples in SIC 1622 were over the PEL. This SIC includes general contractors primarily engaged in the construction of bridges; viaducts; elevated highways; and highway, pedestrian, and railway tunnels. General contractors engaged in subway construction are classified in SIC 1629. Special trade contractors primarily engaged in guardrail construction or installation of highway

signs are classified in SIC 1611. According to the 1993 BLS data, there are 48,400 workers employed at 1797 establishments in SIC 1622. Illinois is the fifth largest employment state for this SIC, behind California, Texas, Florida, and New York. Illinois has 2495 workers employed at 101 establishments under this SIC, which is 5.2 percent of the total for the country.

SIC 1629: Heavy Construction, Not Elsewhere Classified

The OSHA IMIS data indicate that 39 percent of samples in SIC 1629 were over the PEL. Trades covered by SIC 1629 involve general and special trade contractors primarily engaged in the construction of heavy projects not elsewhere classified, such as canal, dam, chemical plant, and hydroelectric plant construction. According to the 1993 BLS data, there are 239,413 workers employed at 16,968 establishments in this SIC. Texas has more workers in this SIC than any other state, employing 59,970 at 1355 establishments.

SIC 1721: Painting and Paper Hanging

The OSHA IMIS data indicate that 52 percent of samples in SIC 1721 were over the PEL. The data also show that of the 54 samples in this SIC, 29 or 54 percent were from sandblasting operations. The description of SIC 1721 includes contractors primarily engaged in painting and paper hanging. Contractors primarily engaged in roof painting are classified in SIC 1761. According to the 1993 BLS data, 160,664 workers are employed at 34,977 establishments in this SIC. Illinois is the fourth largest employer of construction workers in this SIC behind California, Texas, Florida, and New York. Illinois has 7104 construction workers employed at 1553 establishments (which is 4.4% of the employment in this SIC for the United States).

SIC 1741: Masonry, Stone Setting, and Other Stone Work

The OSHA IMIS data indicate that 39 percent of samples in SIC 1741 were over the PEL. The description of work under SIC 1741 includes special trade contractors primarily engaged in masonry work, stone setting, and other related stone work. Special trade contractors primarily engaged in concrete work are classified in SIC 1771; those engaged in digging foundations are classified in SIC 1794; and those engaged in the construction of streets, highways, and alleys are classified in SIC 1611. According to the 1993 BLS data, there are 136,139 workers employed at 24,362 establishments. Illinois is second in employment in this SIC behind Pennsylvania. Illinois employs 7662 workers at 1192 establishments, which is 5.6 percent of the total for the United States.

SIC 1799: Special Trade Contractors, Not Elsewhere Classified

The OSHA IMIS data indicate that 31 percent of the samples in SIC 1799 were over the PEL. In addition to SIC 1721, sandblasting also occurs in SIC 1799. The description of this SIC includes contractors primarily engaged in construction work not elsewhere classified, such as construction of swimming pools and fences, erection and installation of ornamental metal work, house moving, shoring work, waterproofing, damp proofing, fireproofing, sandblasting, and steam cleaning of building exteriors. According

TABLE 2. OSHA IMIS Sampling Data for Crystalline Silica 1980 Through 1995 by Four-Digit Construction SIC Codes for All Ten OSHA Regions

SIC	Total Number of Inspections	Number of Silica Inspections	Number of Silica Samples	Percent of Samples Over PEL
1522	122	3	5	60
1541	282	6	10	30
1542	619	26	73	41
1611	244	18	29	34
1622	144	26	81	53
1623	150	7	12	58
1629	254	31	94	39
1711	578	8	13	23
1721	455	33	54	52
1731	331	9	14	14
1741	108	28	76	39
1742	333	11	22	0
1743	33	1	1	100
1751	85	2	10	20
1752	56	5	7	29
1761	177	1	1	0
1771	103	15	60	20
1791	98	3	3	0
1793	14	1	1	0
1794	90	7	13	0
1795	580	13	26	19
1796	82	4	7	14
1799	968	52	116	31
Total	5987	310	728	35

SIC codes with at least 50 crystalline silica samples in the database and in which 30 percent or more were over the PEL are in bold type.

to the 1993 BLS data, there are 206,405 workers employed at 29,117 establishments in this SIC. Illinois is the fifth largest employer with 8486 workers at 1058 establishments.

OSHA Region 5 Review

A portion of this review focused on the construction inspection activity in OSHA region 5. Region 5 was selected for this review for a number of reasons, including the following:

- Region 5 includes a concentration of states participating in a special National Institute for Occupational Safety and Health (NIOSH) program for surveillance of occupational disease including silicosis—the Sentinel Event Notification System for Occupational Risk (SENSOR).⁽⁶⁾ Four out of a total of seven NIOSH SENSOR silicosis states are located in the region (Illinois, Michigan, Ohio, and Wisconsin).
- Based on the BLS 1993 Employ-

ment and Wages Annual Averages, region 5 is the second largest construction employment OSHA region in the country (second only to region 4), employing more than

800,000 construction workers. Note that this employment figure does not include self-employed or currently unemployed construction workers. This region has the fifth largest construction employment state (Illinois) and the seventh largest construction employment state (Ohio). Employment levels in region 5 by state are: Illinois, 200,319; Ohio, 187,775; Indiana, 118,065; Michigan, 131,833; Wisconsin, 93,139; and Minnesota, 78,478.⁽⁵⁾ Indiana and Michigan are state plan enforcement states.

Table 3 presents a summary of the OSHA crystalline silica sampling data for region 5. The summary for the region shows that 38 percent of the samples collected in the federal OSHA states in region 5 were over the PEL.

Discussion

Considering the level of construction employment and the large amount of construction which occurred in region 5 from 1980 through 1995, the number of crystalline silica samples found within the IMIS appears to be rather small. The summary data for region 5 indicate that between one and two crystalline silica samples per year, on average, were collected and entered into the database for each of the three federal OSHA states in region 5.

The reason for the small number of silica samples within the construction

TABLE 3. OSHA IMIS Sampling Data for Crystalline Silica in Region 5 from 1980 Through 1995 for All Construction SIC Codes with at Least One Inspection

SIC	Total Number of Inspections	Number of Silica Inspections	Number of Silica Samples	Percent of Samples Over PEL
1542	112	2	5	20
1611	7	2	5	20
1629	26	2	5	60
1711	151	1	1	0
1721	97	4	6	50
1731	67	1	1	0
1741	25	7	18	67
1742	41	1	1	0
1752	9	1	1	0
1771	24	2	6	17
1795	112	1	1	0
1799	208	8	15	27
Total	1126	32	65	38

Federal enforcement states for region 5 include Illinois, Ohio, and Wisconsin.

SICs may be due in part to the terminology of the OSHA PEL. According to the OSHA SEP for crystalline silica, the OSHA PEL within the construction industry is still based upon impinger collection and particle counting, with the results expressed in millions of particles per cubic foot. However, the impinger methodology has not been in use for years.⁽¹⁾ As a result, OSHA compliance personnel may have been uncertain of the method to use for sampling and analyzing crystalline silica in the construction industry. Therefore, many of the potential exposures encountered by compliance personnel in the construction industry either were evaluated using the general industry exposure limit or were unevaluated.

Within the SEP, the sampling and analytical procedures for OSHA inspections in the construction industry were changed to follow those for respirable dust containing crystalline silica in general industry. Thus, the PEL is based on the 1968 threshold limit value from the American Conference of Governmental Industrial Hygienists, as follows:⁽⁷⁾

$$\text{PEL} = \frac{10 \text{ mg/m}^3}{(\% \text{ quartz} + 2)}$$

The procedure for determining the PEL for respirable dust containing crystalline silica is to obtain a respirable dust sample, have it analyzed to determine the percentage of crystalline silica in the sample, and use this percentage in the formula. A measured respirable dust concentration is then compared with the calculated respirable dust PEL.

Recommendations

Awareness and planning are important in silicosis prevention. The key to preventing silicosis is keeping dust out of the air. Construction managers and industrial hygienists must recognize when silica dust may be generated and plan ahead to eliminate or control the dust at the source. Dust controls can be as simple as a water hose to wet the dust before it becomes airborne. Air monitoring is needed to measure worker exposures to respirable crystalline silica, to select appropriate engineering controls and respiratory protection, and to measure the effectiveness of controls. Air samples should be collected and analyzed according to NIOSH Methods 7500 and 7602 or their equivalent. Respirators should not be used as the primary means of preventing or minimizing exposures to airborne contaminants. When respirators are used, the employer must establish a comprehensive respiratory protection program as outlined in the *NIOSH Guide to Industrial Respiratory Protection*⁽⁸⁾ and as required in the OSHA respiratory protection standard (29 CFR 1910.134 and 1926.103).⁽⁹⁾ A silicosis prevention information packet developed by NIOSH, OSHA, and MSHA is available by calling NIOSH at 1-800-35-NIOSH.

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