

# SILICA - CRYSTALLINE

## “AN OVERVIEW”

PRESENTED BY:



## BACKGROUND INFORMATION

- ONE OF MANY POTENTIAL HEALTH HAZARDS IN THE WORKING ENVIRONMENT
- CRYSTALLINE SILICA - REFERRED TO AS “FREE SILICA”
- COMPOSED OF SILICON DIOXIDE (SiO<sub>2</sub>)

## BACKGROUND INFORMATION

- CRYSTALLINE versus AMORPHOUS
- MOST COMMON FORMS
  - Quartz
  - Tridymite
  - Cristobalite

## BACKGROUND INFORMATION

- USED IN GENERAL INDUSTRY AND CONSTRUCTION FOR DECADES (1880s)
- POTENTIAL AREAS OF EXPOSURE
  - Abrasive/Sand blasting
  - Rock drilling
  - Foundry work
  - Stone/Concrete/Brick cutting
  - Jack hammering
  - Concrete mixing

## BACKGROUND INFORMATION

- POTENTIAL AREAS OF EXPOSURE (continued)
  - Ceramics, clay and pottery, stone and glass industries
  - Manufacture of abrasives
  - Manufacture of soaps and detergents
  - Manufacture of Portland Cement
  - Tuckpointing

## ENTRY INTO BODY

- INHALATION (Major route)
- INGESTION
- ABSORPTION
- INJECTION

## ENTRY INTO BODY

- RESPIRABLE PARTICLES
  - Less than 10 micrometers in diameter
  - Major concern
- DOSE
  - Dust concentration (quantity)
  - Duration of exposure (time)

## POTENTIAL HEALTH EFFECTS

- SILICOSIS
- COPD
- BRONCHITIS
- TUBERCULOSIS
- LUNG CANCER
- RENAL DISEASE
- STOMACH AND OTHER CANCERS

## POTENTIAL HEALTH EFFECTS

- SILICOSIS
  - Chronic / Classic Silicosis (15-20 years)
  - Accelerated Silicosis (5-10 years)
  - Acute Silicosis (months-2 years)

## POSSIBLE SYMPTOMS OF EXPOSURE

- SHORTNESS OF BREATH/LABORED BREATHING
- FEVER
- INCREASED FATIGUE
- OCCASIONAL BLUISH SKIN (ear lobes or lips)
- INCREASED COUGHING
- LOSS OF APPETITE
- CHEST PAIN
- INFECTION

## EXPOSURE STANDARDS & GUIDELINES

- OSHA – Occupational Safety and Health Administration
- NIOSH – National Institute for Occupational Safety and Health
- ACGIH – American Conference of Governmental Industrial Hygienists

## EXPOSURE STANDARDS & GUIDELINES

- OSHA General Industry Permissible Exposure Limit (PEL) for an 8-hour Time-Weighted Average (TWA)
  - Respirable Quartz per 29 CFR 1910.1000, Table Z-3
$$\frac{10 \text{ mg/m}^3}{\% \text{SiO}_2 + 2}$$
  - Cristobalite: Use ½ the value calculated from the count or mass formulae for quartz.
  - Tridymite: Use ½ the value calculated from the formulae for quartz.

## EXPOSURE STANDARDS & GUIDELINES

- OSHA General Industry PEL for an 8-hour TWA
  - Mixture

$$\frac{10 \text{ mg/m}^3}{\% \text{Quartz} + 2(\% \text{cristobalite}) + 2(\% \text{tridymite}) + 2}$$

## EXPOSURE STANDARDS & GUIDELINES

- OSHA Construction PEL for an 8-hour TWA
  - Respirable Crystalline Silica per 29 CFR 1926.55, Appendix A - 1970 TLVs

$$\frac{250 \text{ mg/m}^3}{\% \text{SiO}_2 + 5}$$

## EXPOSURE STANDARDS & GUIDELINES

- NIOSH Recommended Exposure Limit (REL) for an 8-hour TWA
  - Respirable Quartz, Cristobalite, and Tridymite

0.05 milligrams per cubic meter (mg/m<sup>3</sup>)

## EXPOSURE STANDARDS & GUIDELINES

- ACGIH Threshold Limit Value (TLV) for an 8-hour TWA
  - Respirable Quartz and Cristobalite

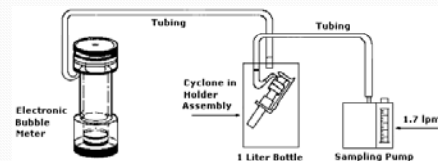
0.025 mg/m<sup>3</sup>

## EXPOSURE EVALUATION

- AIR MONITORING
- OBZ
- 8-HOUR TWA
- LABORATORY ANALYSIS (AIHA accredited)

## EXPOSURE EVALUATION

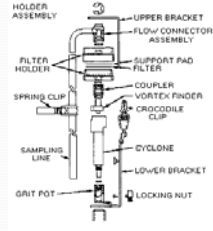
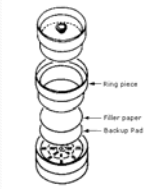
- CALIBRATION OF SAMPLING TRAIN (PUMP, TUBING, FILTER AND CYCLONE)



## EXPOSURE EVALUATION

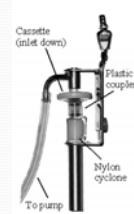
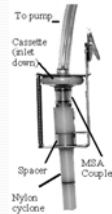
- FILTER AND CYCLONE

FIGURE II-1-14. EXPLODED VIEW OF THREE-PIECE CASSETTE SHOWS PLACEMENT OF BACK-UP PAD.



## EXPOSURE EVALUATION

- CYCLONES



## CONTROL OPTIONS

- SUBSTITUTION
  - Olivene
- ENGINEERING CONTROLS
  - Enclosure (equipment)
  - Isolation (person)
  - Ventilation (area and/or equipment)
- ADMINISTRATIVE CONTROLS

## CONTROL OPTIONS

- WORK PRACTICES
  - Minimize dust generated
- HOUSEKEEPING
- PERSONAL PROTECTIVE EQUIPMENT (PPE)
  - 29 CFR 1910, SUBPART I and 29 CFR 1926, SUBPART E
  - Respirators (effective program) 1910.134 & 1926.103
  - Clothing

## CONTROL OPTIONS

- HYGIENE PRACTICES (depends on setting)
  - No eating, drinking or using tobacco products
  - Proper washing before eating, drinking or using tobacco products
  - Shower at end of day
  - Follow policy on contaminated clothing

## CONTROL OPTIONS

- MEDICAL SURVEILLANCE
- TRAINING

## REGULATORY OVERVIEW

- OSH ACT – GENERAL DUTY CLAUSE
  - Section 5(a)(1) requires employers to "furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees".
  - Section 5(a)(2) requires employers to "comply with occupational safety and health standards promulgated under this Act".

## REGULATORY OVERVIEW

- OSHA GENERAL INDUSTRY STANDARDS
  - 29 CFR 1910.1000, Table Z-1, Limits for Air Contaminants
  - 29 CFR 1910.1000, Table Z-3, Mineral Dusts
- OSHA CONSTRUCTION STANDARDS
  - 29 CFR 1926.55, Appendix A – 1970 TLVs

## REGULATORY OVERVIEW

- SPECIAL EMPHASIS PROGRAM (SEP) FOR SILICOSIS (1996)
  - "Provides inspection targeting guidance for implementing an OSHA-wide SEP to reduce and eliminate the workplace incidence of silicosis from exposure to crystalline silica"
  - CSHO may expand inspection scope if other hazards or violations are observed
  - Includes General Industry settings and Construction activities

## REGULATORY OVERVIEW

- NATIONAL EMPHASIS PROGRAM (NEP) – CRYSTALLINE SILICA (2008), CPL 03-00-007
  - "Describes policies and procedures for implementing a NEP to identify and reduce or eliminate the health hazards associated with occupational exposure to crystalline silica"
  - All related Local Emphasis Programs (LEPs) may remain in effect
  - Applies to General Industry and Construction workplaces

## REGULATORY OVERVIEW

- NEP – CPL 03-00-007 (continued)
  - LEP Development
    - Industry selection (Appendix B)
    - Master list of targeted establishments
    - Inspection schedule
    - CSHO, expand scope of inspection

## REGULATORY OVERVIEW

- NEP – CPL 03-00-007 (continued)
  - Inspection Procedures
    - Conduct employee exposure monitoring
    - Evaluate engineering and work practice controls
    - Evaluate respiratory protection (CPL 2-0.120)
    - Evaluate hazard communication (CPL 2-2.38D)
    - Evaluate housekeeping and hygiene practices
    - Conduct specific evaluation for abrasive blasting operations

## REGULATORY OVERVIEW

- CPL 02-02-007 – CRYSTALLINE SILICA (1978)
  - “Provides guidelines to be followed in inspections, and where necessary, the issuance of citations, regarding exposure to crystalline silica”
  - Includes:
    - Opening conference

## REGULATORY OVERVIEW

- CPL 02-02-007 – CRYSTALLINE SILICA (continued)
  - Review of air monitoring program
  - Review of medical program
  - Review of record keeping program
  - Review of employee training and information program
  - Review of personal hygiene program
  - Review of housekeeping program
  - Review of PPE program
  - Review of engineering controls and related PM program

## REGULATORY OVERVIEW

- CPL 02-02-007 – CRYSTALLINE SILICA (continued)
  - Walkthrough inspection
  - Air monitoring
  - Closing conference
  - Report
  - Citation(s)

## REGULATORY OVERVIEW

- NIOSH CRITERIA DOCUMENT
  - Criteria for a Recommended Standard: Occupational Exposure to Crystalline Silica (1974)  
DHHS (NIOSH) Publication No. 75-120
  - NIOSH recommends that employee exposure to crystalline silica be controlled by adherence to the following sections.....

## SUMMARY

- BACKGROUND INFORMATION
- ROUTES OF ENTRY
- POTENTIAL HEALTH EFFECTS
- SYMPTOMS OF EXPOSURE
- EXPOSURE STANDARDS AND GUIDELINES
- EXPOSURE EVALUATION
- CONTROL OPTIONS
- REGULATORY OVERVIEW

## ? QUESTIONS ?

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