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Respirable Crystalline Silica Industry Perspective

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National Industrial Sand Association (NISA) Silicosis Prevention Program

- NISA is defunct. NSSGA may have some involvement now.
- Contributions and review by medical/industrial hygiene scholars and government (NIOSH).
- Published prior to OSHA silica rule and still quite relevant.
- Addresses only silica hazard. A more comprehensive approach is needed to address other hazards (more on this later).
- Provides mechanisms by which companies can properly and systematically monitor the environmental aspects of dust exposures at their operations and the respiratory health status of employees.
- Ultimately, the manual serves as a guide for adequately protecting the workforce from the effects of respirable crystalline silica.

NISA – Seven Steps to Eliminating Silicosis

1. Management commitment of implementation.
2. Occupational health program implementation. Prescribes baseline and periodic health evaluations for exposed workers.
3. Medical surveillance.
4. Dust exposure assessment.
5. Dust control.
6. Employee involvement in silicosis prevention.
7. Smoking cessation.

Medical Surveillance Objectives

1. Establish a baseline from which to assess changes that may develop in the individual at a future date. Thus, each worker serves as his or her own control, and the ability to recognize early change is greatly enhanced.
2. Detect abnormalities that might be consistent with health effects of silica exposure at an early stage, when intervention can lead to the prevention of disease progression.
3. Prevent the development of silicosis that could produce pulmonary impairment in the worker.
4. Prevent the development of other occupational conditions that might be associated with exposure to silica.
5. Disclose to the worker occupationally and non-occupationally related abnormalities for appropriate medical follow-up.
6. Develop data on which epidemiological studies of crystalline silica can be based.

Dust Exposure Assessment – Standards

Reference	Substance	Guideline or Limit (mg/m ³)
MSHA	Respirable dust containing quartz in underground surface metal and nonmetal mines	PEL = $10 \div \% \text{ quartz} + 2$ (8-hr TWA)
OSHA	Respirable dust containing silica, quartz	PEL = $10 \div \% \text{ quartz} + 2$ (8-hr TWA)
	Respirable dust containing silica, cristobalite	PEL = half of value calculated from the formula for quartz (8-hr TWA)
	Respirable dust containing silica, tridymite	PEL = half of value calculated from the formula for quartz (8-hr TWA)
NIOSH	Respirable crystalline silica	REL = 0.05 (for up to a 10-hr workday during a 40-hr workweek)
ACGIH	Respirable crystalline silica:	
	α-Quartz	TLV = 0.025 (8-hr TWA)
	Cristobalite	TLV = 0.025 (8-hr TWA)

TABLE 2-1—U.S. GUIDELINES AND LIMITS FOR OCCUPATIONAL EXPOSURE TO CRYSTALLINE SILICA AND RESPIRABLE DUST CONTAINING CRYSTALLINE SILICA

American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) in 1978 was the source of the current MSHA (former OSHA) dust equation.

The recent OSHA silica rule uses the NIOSH value of 0.05 mg/m³ as permissible exposure limit (PEL) and the current ACGIH TLV of 0.025 mg/m³ as an “action level.”

Takeaway: following ACGIH’s recommended TLVs is generally the best practice and promotes compliance.

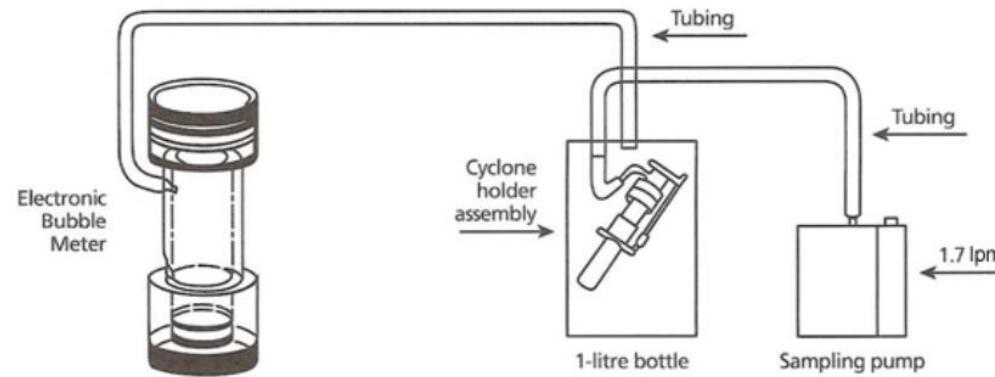
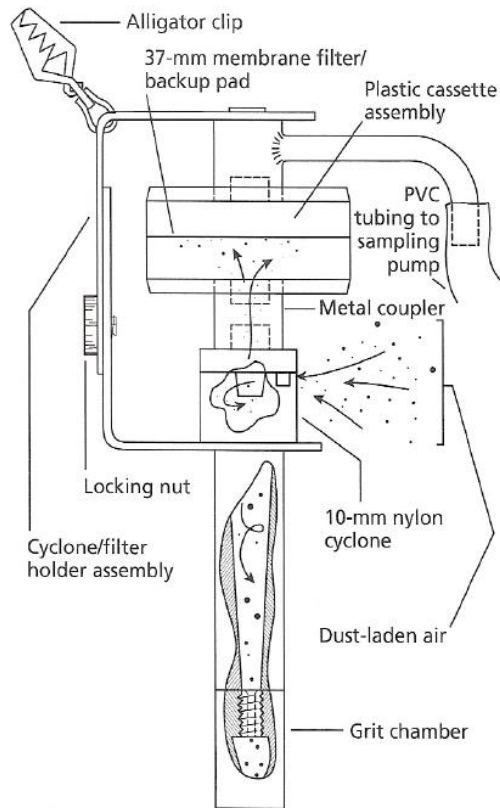
Exposure Assessment

The goal is to collect sufficient personal breathing zone samples from all employees exposed to industrial sand so that cumulative individual exposure assessments can be made. The order of preference for interpreting personal exposures based on air sampling is as follows:

- Employee's personal breathing zone sample.
- Estimates of exposure based on averaging measured exposures of workers engaged in similar activities or similar exposure groups.
- Estimates of exposure based on general area sampling accompanied with appropriate time–motion studies.

Exposure Assessment – Personal

Detailed explanation of equipment, calibration, and use.



Exposure Assessment – Areas

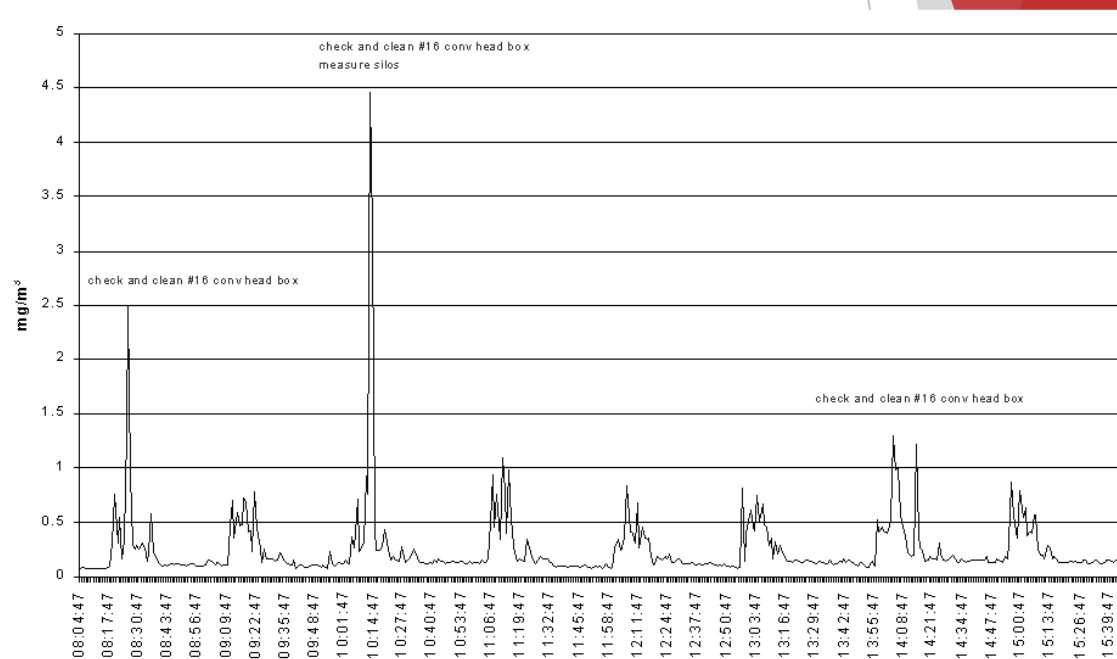
- When impractical to use personal sampling equipment on the worker.
- To determine which of a worker's several job activities contributed most significantly to personal exposure.
- As basis for categorizing various work areas in terms of potential exposure risks.
- Extremely useful in evaluating the performance of engineering controls, the effect of process changes on dust concentrations, and the effectiveness of administrative controls.

Exposure Assessment – Real Time

Spot check dust concentration at various locations over time to develop trend and identify areas or equipment requiring improvement.

Log general area dust.

Log personal dust exposure and combine with activity log to determine what tasks have greatest potential exposures.



Exposure Assessment – Sampling Frequency

It is essential that the exposure for each employee be characterized. If a number of people perform the same function, a representative of the group can be sampled.

Once the initial group of employees has been sampled, the exposure results obtained will be used to determine the frequency of periodic sampling.

Number of Employees Exposed	Number of Time-Weighted Average Determinations
1–20	50% of the total number of workers
>20	10 plus 25% of the excess over 20 workers

Exposure Assessment – Statistics

- Descriptive (min, max, mean, std dev).
- Inferential – calculate confidence limits to quantify uncertainty in the mean and measures central tendency. One method is to calculate a 95th percentile of a dataset for comparison with exposure limit.
- Bayesian – used with small datasets (e.g., less than 10 samples) and incorporates professional judgement or other information.
- American Industrial Hygiene Association (AIHA) has published training and guidance on IH statistics or consider hiring a consultant.
- IHSTAT is a free Excel application from AIHA that calculates statistics.

Exposure Assessment Strategy

Exposure Classification	Time-Weighted Average Exposure	Frequency of Sampling
I	<50%	Every 12 months
II	50–100%	Every 6 months
III	>100%	Every 3 months (minimum)*

**TABLE 3-2—SAMPLING FREQUENCY BASED
ON PERSONAL EXPOSURES**

Exposure Assessment Strategy – What About Everything Else?



This annual publication contains a definitive list of stressors and threshold limit values (TLVs) for each.

TLVs do not carry the weight of government enforcement but do typically reflect the current best science and are equivalent to, or more restrictive than, regulatory standards.

Using this book, one can create a comprehensive exposure assessment strategy knowing that each stressor has been considered.

See www.acgih.org for details. This is not a paid advertisement.

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Exposure Assessment Plan

- Roles and Responsibilities
- Facility Description
- Similar Exposure Groups (SEG)
- Occupational Exposure Limits
 - Inhalation (including respirable crystalline silica)
 - Noise and Hearing Conservation
 - Heat Stress
 - Ergonomics
 - Radiation from Sunlight
 - Others?

Exposure Assessment Plan

- Exposure Profiles (describe the exposure levels to a specific hazard for personnel in a SEG using a scoring system to prioritize hazards).
- Assessment Plan
- Recordkeeping and Re-Evaluation
- Plan Amendment Logs
- Annual Program Review and Exposure Data Summary
- Exposure Assessment Reports (e.g., silica sampling report)

Questions?

