Fermilab’s Silica Program

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Fermilab Silica Program – 2017 TLV adopted

• In March 2015, the Fermilab Industrial Hygiene Subcommittee notified the DOE Fermi Site Office of annually adopting the current ACGIH TLVs or OSHA 1910.1000 Subpart Z PELs, whichever were more protective. The reasons being:
  − It’s the professional and moral thing to do as industrial hygienists
  − There have been many updates to ACGIH since 2005
  − ACGIH is based off of science and not subjected to the arduous and political updating process of OSHA.
Fermilab Silica Program

• An initial internal program was developed before the effective date of the OSHA silica standard
  – Published as a chapter in the Fermilab Environmental, Safety and Health Manual (FESHM June 2017)
  – Implemented the 2017 TLV and generally followed the requirements of the OSHA standard without any references to it
  – Included a table, Guidance for Silica Work, which was based on a similar table used at Jefferson Lab
  – Follows the same format as Table 1 in the OSHA silica standard and is used in the same manner
  – Revisions were made to the Jefferson Lab table based on data from IH monitoring conducted at Fermilab
  – Continue to tweak the table as additional monitoring data is collected and analyzed
Fermilab Silica Program

- An internal assessment of the silica program is currently underway, with an eye to revising the FESHM chapter to ensure compliance with the elements of the OSHA silica standard
- Will continue to comply with the 2017 TLV
- The FESHM chapter will be considered as the Written Exposure Control Program required by the OSHA silica standard
- The chapter will cover Fermilab employees and subcontractors
Fermilab Silica Program - Subcontractors

• Subcontractors are provided a copy of Section 013100, Environment, Safety and Health Construction Requirements for Subcontractors, that outlines expectations for construction work at Fermilab
  – Clearly states that subcontractors must comply with the 2017 TLVs
  – States that Fermilab expects its contractors to be able to identify silica hazards
  – Includes a copy of the Guidance for Silica Work table from the FESHM silica chapter
  – Subcontractors must document how they determine the effectiveness of the controls being used
  – Tight fitting respirators with P-100 filters must be worn until the effectiveness of the controls are proven through IH sampling
Fermilab Silica Program – IH Monitoring

• Appendix A of the OSHA standard requires that the quantitative limit of detection (LOD) be no higher than 25% of the PEL based on sample air volume

• Fermilab uses the 25% criteria for sampling against the 2017 TLV

• The volume of air that must be sampled is determined:
  – NIOSH 7500 has a LOD of 5µg
  – The equation: \(0.25 \times (\text{TLV µg/M}^3) = (\text{LOD µg}) \div (\text{air volume M}^3)\)
  – Substitute: \(0.25 \times (25 \ \mu\text{g/M}^3) = (5 \ \mu\text{g}) \div (\text{air volume M}^3)\)
  – Air volume = 0.8 M\(^3\) = 800 L
  – Using a 1.7 LPM cyclone requires 470 minutes of sampling time
  – This was a problem because very few activities with potential silica exposure last a full shift at Fermilab
To address the need for collecting an adequate air volume in a much shorter period of time necessitated using a different cyclone

A GK 2.69 cyclone from BGI, Inc. (by Mesa Labs) was identified that provided the respirable fraction at 4.2 LPM

This reduced the sample time to 190 minutes (800 L/4.2 LPM)
Fermilab Silica Program – IH Monitoring Data

• Fermilab IHs monitored its employees and those of Time & Material subcontractors, which are treated as a contract employee (not subcontractor)
• Fixed price subcontractors were monitored by an outside IH consulting firm paid by Fermilab (This was at the time when Fermilab first implemented compliance with the 2017 TLV, and before the construction documents reflected the silica requirements.)
• A total of 48 samples were collected by Fermilab IHs, mostly personal with some area
• A total of nine personal samples were collected for fixed price subcontractors
Fermilab Silica Program – IH Monitoring Data

- Fermilab samples fell into the following categories:
  - Drilling activities – 20
  - Coring – 6
  - Saw cutting – 8 (3 > TLV; 2 personal, 1 area)
  - Grinding – 10 (1 > TLV)
  - Breaking apart – 2
  - Grout mixing – 2

- In all instances of TLV exceedance employees were wearing tight-fitting respirators with P-100 filters as required in the Guidance for Silica Work table, resulting in exposures < TLV
- Wet saw cutting was used in all instances of TLV exceedance
- The grinding operation exceeding the TLV used no controls other than wet concrete
Subcontractor samples (9) were either for drilling or saw cutting.

Three TLV exceedences were the result of less than adequate controls:
- Saw cutting using a hose spraying water on the concrete rather than a saw equipped with direct water control.
- A hollowed out Hilti bit that kept plugging due to the damp conditions of the concrete.
- A makeshift control using a hole drilled through a HEPA vacuum attachment.
- Again in all instances of TLV exceedance employees were wearing tight-fitting respirators with P-100 filters as required by the Guidance for Silica Work table, resulting in exposure < TLV.