

THE NEW SILICA STANDARD: ASSESSING EXPOSURE IN HIGH HAZARD WORK ENVIRONMENTS

29 CFR 1910.1053

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NEW CHEMICAL-SPECIFIC STANDARD

- 29 CFR 1910.1053 / 1926.1153 - RESPIRABLE CRYSTALLINE SILICA ("RCS")
 - QUARTZ, CRISTOBALITE, TRIDYMIT
 - "RESPIRABLE" = MEAN PARTICLE SIZE MEAN OF 0.4 MICRONS
- REDUCES PERMISSIBLE EXPOSURE LIMIT ("PEL")
 - 8 HOUR TIME-WEIGHTED AVERAGE ("TWA") EXPOSURE
 - OLD PEL = 100-5000UG/M3 (%SiO2)
 - NEW PEL = 50UG/M3
- INCORPORATES MEDICAL SURVEILLANCE FOR EXPOSED WORKERS
- REQUIRES "OBJECTIVE DATA" TO DEMONSTRATE COMPLIANCE



5 YEAR COMPLIANCE TIMELINE

- JUNE 23, 2016 - EFFECTIVE DATE
- JUNE 23, 2018 - FULL COMPLIANCE DATE
 - EXCEPT FOR HYDRAULIC FRACTURING OPERATIONS
- JUNE 23, 2020 - MEDICAL SURVEILLANCE FOR WORKERS \geq ACTION LIMIT
- JUNE 23, 2021 - ENGINEERING CONTROLS FOR FRAC'ING OPERATIONS



WHY? APPENDIX B.

- SILICOSIS: PROGRESSIVE & IRREVERSIBLE FIBROTIC LUNG DISEASE
- INCREASED RISK FOR TUBERCULOSIS, KIDNEY DISEASE, LUNG CANCER
- REDUCTION IN QUALITY OF LIFE
 - SHORTNESS OF BREATH
 - CHRONIC COUGH
 - FATIGUE
- OLD PEL BASED ON RESEARCH CONDUCTED BEFORE 1968

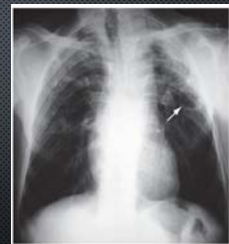


Figure 1 - Chest X-ray of a patient with silicosis and pulmonary tuberculosis. The patient was a well driller. Note the thick-walled cavity in the left middle lung field (arrow).



IMPORTANT DEFINITIONS

- **EXPOSURE** = AIRBORNE RCS IN PERSONAL BREATHING ZONE WITHOUT BENEFIT OF A RESPIRATOR
- **OBJECTIVE DATA** = AIR MONITORING DATA FROM SIMILAR EXPOSURES OR CALCULATIONS BASED ON SUBSTANCE COMPOSITION
 - REPRESENTATIVE OF WORST-CASE SIMILAR EXPOSURE CONDITIONS
- **ACTION LEVEL** = 8 HOUR TWA EXPOSURE TO HALF THE PEL (25UG/M3) OR MORE, BUT LESS THAN THE PEL (50UG/M3)



1910.1053 APPLICABILITY EXCEPTIONS

- CONSTRUCTION OR AGRICULTURAL WORK
- WORK INVOLVING ABSORBANT CLAYS (BARITE, BENTONITE)
- UNUSUAL TASKS OCCURRING IN VARYING CONDITIONS
- NO "FORESEEABLE" WAY TO EXCEED THE ACTION LIMIT
 - USING OBJECTIVE DATA



EXPOSURE ASSESSMENT

- **PERFORMANCE OPTION** – COMBINATION OF AIR SAMPLING, AND OBJECTIVE DATA (COMPOSITION, MANUFACTURER'S DATA)
 - DATA FOR EACH EMPLOYEE
 - TABLE 1 OF 1926.1153?

Equipment/task	Engineering and work practice control methods	Required respiratory protection and minimum assigned protection factor (APF)
		≤ 4 hours/shift
		> 4 hours/shift

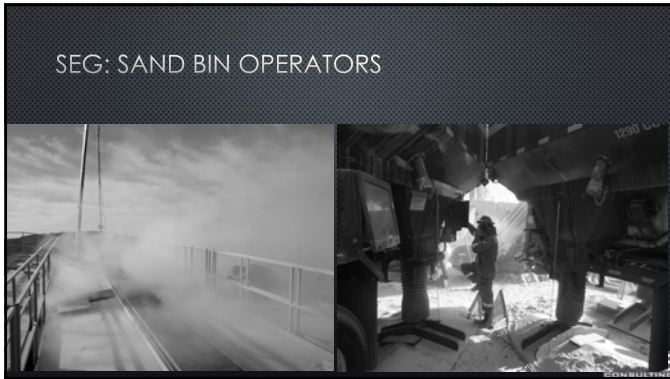
- **SCHEDULED MONITORING OPTION** – WORST CASE PBZ SAMPLING FOR EACH GROUP OF EMPLOYEES HAVING SIMILAR EXPOSURE PROFILES
 - REPRESENTATIVE GROUPS OF EMPLOYEES
- **REASSESSMENT** – UPON A CHANGE IN WORK ENVIRONMENT WHERE EXPOSURES MAY INCREASE ABOVE ACTION LEVEL (AL)



SCHEDULED MONITORING

- **ONGOING**
 - REPEAT EVERY 6 MONTHS FOR GROUPS ≥ AL, BUT < PEL
 - REPEAT EVERY 3 MONTHS FOR GROUPS ≥ PEL
- **DISCONTINUE**
 - FOR GROUPS FOUND BELOW AL DURING INITIAL MONITORING REGIMEN
 - NEGATIVE EXPOSURE ASSESSMENT
 - CONFIRMATORY – GROUPS FOUND WITH REDUCED EXPOSURES < AL (AFTER INITIAL) – REPEAT WITHIN 6 MONTHS UNTIL 2 PBZ SAMPLES AT LEAST 7 DAYS APART ARE < AL





PBZ SAMPLE ANALYSIS

- APPENDIX A
- ANALYTICAL METHODS LISTED (NIOSH 7500)
- ISO 17025 ACCREDITED LAB (NVLAP, AIHA)
 - INTERNAL & EXTERNAL QUALITY CONTROL PROGRAM
- EXPECT VARIABILITY IN SAMPLE RESULTS

Courtesy: Department of Chemistry, University of South Carolina

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EXAMPLE – EXPOSURE ASSESSMENT

- 6 PBZ SAMPLES
- WORST CASE = 1220UG/M3 (TWA 12)
- EXTENDED SHIFT (12H)
- PROPPANT IS BATCH PROCESSED (BY "STAGE")
- WHAT IS THE 8H TWA EXPOSURE?

EXPOSURE CONTROL

- PRIMARY DISEASE PREVENTION
- SUBSTITUTION: CHANGE PROPPANT (SAND COATINGS, CERAMIC)
- ENGINEERING: DUST CAPTURE
- ADMINISTRATIVE: ACCESS CONTROL, WORK ROTATION
- PPE: RESPIRATORS
- "FEASIBILITY"

Courtesy: Hazard

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ENGINEERING CONTROLS: ACTIVE DUST CAPTURE (1)

PROS:

- SCALABLE TO SITE
- RETROFITS TO EXISTING EQUIPMENT
- COMPREHENSIVE
- VALIDATED BY SUPPLIER

CONS:

- REQUIRES ENERGY SUPPLY TO OPERATE
- REQUIRES DISPOSAL OF FINES
- EXPENSE
- ADDS TO SITE FOOTPRINT



ENGINEERING CONTROLS: ACTIVE DUST CAPTURE (2)

- PERSONAL DECONTAMINATION UNIT (PDU)



ENGINEERING CONTROLS: PASSIVE DUST CAPTURE

PROS:

- RETROFITS TO EXISTING EQUIPMENT
- UTILIZES ENERGY PROVIDED BY MATERIAL TRANSFER
- LITTLE IMPACT ON SITE FOOTPRINT
- VALIDATED BY NIOSH

CONS:

- FINES STAY IN SYSTEM
- CONTROL IS LIMITED TO SAND BIN EMISSIONS



ENGINEERING CONTROLS: WORKSTATION FILTRATION

PROS

- EFFECTIVE PROTECTION FOR EQUIPMENT OPERATOR

CONS

- ADDITIONAL EXPOSURES TO NEARBY WORKERS NOT CONTROLLED



ENGINEERING CONTROLS: MACHINE-SPECIFIC



WATER MIST



VACUUM DUST COLLECTORS



Benefit







REGULATED AREA


- AREA(S) OF WORK ENVIRONMENT WHERE SILICA CONCENTRATION EXCEEDS THE PEL
 - DETERMINE THROUGH AREA SAMPLING
- BARRICADE / DEMARCATATE PERIMETER
 - SIGNAGE AT ENTRANCE(S)
- CONTROL ACCESS
 - LIMITED TO ASSIGNED WORKERS OR OTHERS WITH "BUSINESS" IN THE AREA
 - ADMINISTRATIVE CONTROL
- PROVIDE RESPIRATORS TO ENTRANTS
 - IN ACCORDANCE WITH RESPIRATORY PROTECTION PROGRAM







EXPOSURE CONTROL PLAN (ECP)

- WRITTEN DOCUMENT THAT DEFINES EXPOSURES & CONTROL STRATEGIES BY
 - SITE, FACILITY, ORGANIZATION?
- HOUSEKEEPING
 - GHOST WORKER
 - HEPA VACUUM OR DUST CAPTURE
- ANNUAL EVALUATION
- AVAILABLE FOR REVIEW

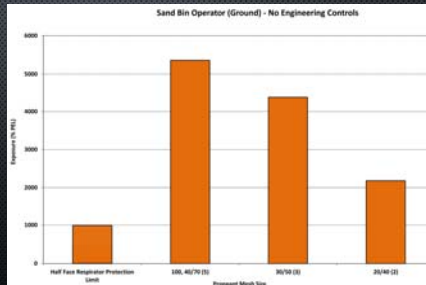


Courtesy Occupational Safety & Health Administration



EXAMPLE – EXPOSURE PROFILE VARIABILITY

- PROPPANT SIZE
- SITE ARRANGEMENT
- ENGINEERING CONTROLS DEPLOYED



RESPIRATORY PROTECTION

- WHEN EXPOSURES EXCEED THE PEL
- WHEN FEASIBLE ENGINEERING & ADMINISTRATIVE CONTROLS ARE NOT COMPLETELY PROTECTIVE (>PEL REMAINS)
- MAXIMUM USE CONCENTRATION (MUC)
 - 500UG/M3 FOR HALF MASK WITH HEPA
 - 2500UG/M3 FOR FULL FACEPIECE WITH HEPA




Courtesy 3M




TRAINING

- INTEGRATE WITH HAZARD COMMUNICATION PROGRAM
- TRAINING MUST INCLUDE RCS HEALTH HAZARDS:
 - CARCINOGENS
 - LUNG EFFECTS (RESPIRATORY IRRITANTS)
 - IMMUNE SYSTEM EFFECTS
 - NEPHROTOXINS
- TASKS INVOLVING EXPOSURE TO RCS AND EMPLOYER CONTROL METHODS
- COPY OF THE STANDARD AVAILABLE




MEDICAL SURVEILLANCE

- REQUIRED FOR WORKERS EXPOSED TO RCS \geq AL FOR 30 DAYS / YEAR OR MORE
- CONSISTS OF: MEDICAL / WORK HISTORY, PHYSICAL EXAM, CHEST X-RAY, PULMONARY FUNCTION TEST (APPENDIX B)
- REPEATED AT LEAST EVERY 3 YEARS
- MANAGING EMPLOYEE MEDICAL RECORDS (PLHCP WRITTEN OPINION)



RECORDKEEPING

- AIR MONITORING (PBZ SAMPLING) DATA
 - EMPLOYEE EXPOSURE RECORD SUBJECT 1910.1020 (30 YEAR RETENTION)
- OBJECTIVE DATA
 - MATERIAL (RCS) COMPOSITION, DATA SOURCE
 - TESTING PROTOCOL & RESULTS
 - DESCRIPTION OF TASK/PROCESS/ACTIVITY
 - SAME RETENTION AS ABOVE
- MEDICAL SURVEILLANCE
 - RETAIN AS EMPLOYEE MEDICAL RECORD



Courtesy Microsoft

