CONSULTATION, SAMPLING STRATEGY DEVELOPMENT AND PERFORMANCE OF INDUSTRIAL HYGIENE AIRBORNE EXPOSURE MONITORING FOR RESPIRABLE CRYSTALLINE SILICA RELATED TO CONCRETE CUTTING AND DEMOLITION INVOLVING HEAVY CONSTRUCTION EQUIPMENT AND USE OF REMOTE CONTROL AND MANUAL SAWS WITH OTHER SITE CONTROL MEASURES

Jan Koehn, M.S., CIH; William M. Young, CIH, CSP; Jan Koehn, M.S., CIH, Inc., Houston, Texas

DESCRIPTION/ABSTRACT

Performance of occupational exposure assessment of Respirable Crystalline Silica (RCS) including both qualitative and quantitative evaluation of actual airborne personal workplace exposures during concrete cutting procedures using various types of construction equipment and also project demolition work were observed and recorded on behalf of the Client. Standard activities involved use of several automatic and manual saws employing wet methods and other accepted control measures including ventilation as well as heavy construction equipment for concrete demolition related to the defined project scope of work including remote control operation. Development and implementation of site-specific sampling strategies by a CIH for occupational assessment were requested to document airborne workplace exposure data to determine compliance with the updated OSHA Permissible Exposure Limit (PEL) and published regulatory standards for total Respirable Crystalline Silica (RCS); appropriate recommendations for the construction industry with direct impact to existing Contractor operations for concrete disturbance and removal.

SITUATION/PROBLEM

Professional and technical consulting services were provided for defined workplace exposure assessment during concrete cutting with manual and automatic saws involving use of wet methods and other control measures including ventilation. Based on standard use of various saws and also remote control operation for concrete cutting and/or demolition with heavy construction equipment including enclosed cab, development of representative airborne sampling strategies for RCS was addressed for separate job sites during full work shift and/or partial time periods in intervals from 2019. Direct observations were additionally recorded for construction activities and equipment operation, job positions with noted work practices and procedures, and controls employed including integrated wet methods during saw use as well as remote control operation. Sampling strategy design and implementation were undertaken for RCS involving Contractor personnel and area workplaces with notation of existing controls and current operations, and observed work procedures to assist with subsequent airborne monitoring data interpretation; and site documentation for verification of necessary company health and safety program compliance requirements. Ambient environment work required further record of weather and climate conditions depending on project site locations.

METROLOGY

The project assessment strategy addressed collection of personal airborne RCS breathing zone samples on Operators and area sample locations involving saw cutting, concrete demolition, and material removal. The validated industrial hygiene sampling and analytical methods were: NIOSH 6000 for respirable particulates using 5IC aluminum cassettes, and NIOSH 7500 for crystalline silica laboratory analysis by X-Ray Diffraction (XRD) to determine airborne RCS exposure including cristobalite, quartz, and tridymite forms. Personal pumps were pre- and post-calibrated with a primary standard and adjusted to the flow rate recommended for RCS air sample collection with 5IC cassettes; and, directly observed including adjacent area samples and project site conditions. Fibre cassette media (i.e. pre-weighted 37 mm PVC) was used with processing to a local accredited AIHA laboratory with field blank samples for quality control.

Substantial notation of work site conditions and job-related activities with potential impact on airborne exposures was performed. These parameters included: weather, climate, visibility, cutting and material removal, equipment types and noted use, amounts and locations of disturbance and debris, and other variables including observed saw cutting, frequency, and duration of specific operations and control measures employed at the work sites.

RESULTS/CONCLUSIONS

Occupational exposure assessment including airborne monitoring and job position observations of concrete saw cutting and use of heavy construction equipment for demolition was completed with documentation involving ambient weather and climate conditions, notation of work practices and procedures, and control measures employed. Worker positions and processes for material removal and quantities addressed, and overall project approach and site operation control measures to assist with airborne monitoring data interpretation. Industrial hygiene monitoring results were compared with the OSHA Construction standard for RCS and other published technical guidelines to assess and manage workplace airborne exposures. Personal RCS monitoring results by XRD were documented compared to published OELs for materials addressed and construction projects. Breathing zone monitoring results for crystalline silica were predominantly below the OSHA PEL and/or Action Level for RCS in the Construction industry related to noted concrete operations.

Project observations verified use of integrated wet methods for concrete cutting and drilling operations as well as ventilation to limit airborne RCS exposures for Contractor personnel. Outside environments provided dilution ventilation depending on existing climate and weather conditions and supplemental ventilation was also employed to lower airborne levels. Other variables included: quantity of concrete cutting performed as well as frequency and duration assessed during the work shift; specific construction and demolition equipment used involving types of manual vs. remote control operations for cutting, and heavy equipment for breaking and removal of concrete; and, specific controls implemented including wet methods, vacuum collection of produced slurry, overall dust and debris, and other variables. A company formal written Respiratory Protection Program is enforced and monitoring data incorporated for current update and verification of proper worker protection, and limitation of airborne occupational exposures using further control measures. Specific airborne monitoring procedures involving referenced methods, and CDI data interpretation assisted with evaluation of personal exposures, and specific program needs through data documentation for proper hazard management. Additional investigation of control measures was conducted for limitation of occupational airborne exposures, and increased workplace protection of personnel.