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Dawn Tharr Column Editor

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Exposure to Different Metals During the Demolition of Oil-Fired Boilers

Dawn Tharr, Column Editor

Report by Richard Fairfax

This case study reports on worker exposure to arsenic, beryllium, cobalt, iron oxide, lead, and vanadium pentoxide during oil-fired boiler demolition work. The evaluation was instigated because a formal complaint was received by the Occupational Safety and Health Administration (OSHA) which alleged that workers were exposed to asbestos fibers during a salvage rip-out operation at an old power generation plant. The complaint also alleged that respirators were not available, air monitoring for personal exposure was not conducted, and engineering controls were not in place. The scope of the complaint inspection was initially limited to an evaluation of the complaint items. During the evaluation of the asbestos-related complaints, the inspection scope was expanded to cover the demolition of the boilers.

Background

The power plant had been shut down and out of service for several years. It was being cleared of all salvageable materials prior to its sale at public auction by the electric company. The contractor involved with the complaint had been hired by the electric company to salvage metal, copper wire, old bricks, and the turbines. The electric company did not have any employees on site and was not directly involved in the evaluation.

The power plant consisted of eight brick boilers. Originally, six of the eight boilers were coal-fired; the remaining two used fuel oil. Approximately 50 years prior to the time of this evaluation, the six boilers using coal were converted to fuel oil. It was later determined that the fuel oil used over the years had come from a variety of geo-

graphical sources. The initial evaluation of the complaint items found numerous violations of the OSHA asbestos standard. The evaluation also found that workers were entering the boilers to manually tear down and remove the bricks. Several of the boilers had already been dismantled and the bricks removed. Employees were observed working on the boilers without benefit of respirators, ventilation, eye protection, or skin protection. The workers, on their own initiative, were wetting down the work area for dust suppression.

Interviews with the employees determined that the boiler demolition work was being done daily for various amounts of time. The workers had been hired off the street, no training was provided, hygiene facilities were not available, and medical evaluations were not given. The employees also were not provided with coveralls or work clothing; consequently, the contaminated clothing was worn home. General health-related symptoms and complaints from the employees included headaches, stomach and chest pains, tiredness, inability to sleep, and nausea. A general preinspection literature search indicated that beryllium and vanadium pentoxide were possible exposure hazards associated with boilers.⁽¹⁻³⁾

Sampling Protocol

The purpose of the sampling was to measure employee exposure to airborne metals (including beryllium, vanadium, and lead) and respirable silica to determine compliance with OSHA Permissible Exposure Limits (PELs).⁽⁴⁾ Six employees were working on the site, two of which were involved with the boiler demolition. The two working on the boilers were sampled

for both metals and silica. Sampling time was 130 minutes for one worker and 410 minutes for the other. The variability was a result of the workers being rotated out of the area to assist on other on-site projects. The employees worked 6 to 7 days per week and 10 to 12 hours per day.

Sampling for metals consisted of 0.8-micron, mixed cellulose filters and high flow pumps calibrated at approximately 2.0 L/min. OSHA Analytical Method No. 105 was used for the analysis for arsenic, and OSHA Analytical Method No. 125 was used for the other metals. Sampling pumps were pre- and postcalibrated. Respirable dust samples were collected using 10-mm nylon cyclones, each equipped with a 5-micron, tared low-ash, polyvinyl chloride filter. The sampling pumps were calibrated at 1.7 L/min with precalibration and postcalibrations done. Samples were analyzed for respirable quartz using OSHA Analytical Method No. 142.^(5,6)

Results

The results of the sampling reported as time weighted average (TWA) exposures are presented in Table I. Samples collected for respirable quartz reported nondetected. The metal sample analysis also detected chromium, copper, manganese, molybdenum, nickel, and zinc. Exposure levels of these additional metals were all less than 50 percent of their respective PELs. Employee No. 1 was working outside the boiler placing bricks into a dumpster. Employee No. 2 was working inside the boiler tearing down the brick lining and feeding the bricks out of the boiler to Employee No. 1 or for later loading into the dumpster by himself. The metal exposure for Employee No. 1 exceeded the current OSHA PELs for arsenic, lead, and vana-



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TABLE I. Time-Weighted Average Sampling Results

Analyte	Employee No. 1 (mg/m ³)	Employee No. 2 (mg/m ³)	PEL* (mg/m ³)
Arsenic	0.054	1.3	0.01
Beryllium	0.0004	0.0042	0.002
Cobalt	0.0135	0.123	0.05
Iron oxide	2.5	24.0	10.0
Lead	0.072	0.399	0.05
Vanadium pentoxide	0.06	0.319	0.05

* PEL = permissible exposure limit.

dium pentoxide. The exposures on Employee No. 2 exceeded the current OSHA PELs for arsenic, beryllium, cobalt, iron oxide, lead, and vanadium pentoxide.

Conclusions

The sampling results of this inspection found workers exposed to significant quantities of arsenic, lead, beryllium, cobalt, iron oxide, and vanadium pentoxide. The exposures to vana-

dium pentoxide, lead, and beryllium were expected, although the high levels of some of the exposures were a surprise. Based upon the limited literature search conducted prior to sampling, the exposures to arsenic, cobalt, and iron oxide were not expected. Upon return for additional sampling and documentation, it was found that the remaining boilers had been demolished, and the bricks removed by a bulldozer. The demolition project of the power plant had been rapidly completed, and no employees could be located at the job site or at their given residences.

With the continuing efforts nationwide toward more efficient power generation, it is likely that more and more boilers will be either converted to more efficient units or demolished. This case study brings to light several significant exposures documented during the demolition of oil-fired brick boilers. These exposures should also be considered during maintenance work on existing boilers.

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