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Spiral Wound Gasket Removal

Work Practice Study

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Spiral Wound Gasket Removal

Work Practice Study

Spiral Wound Gasket Removal Work Practice Study

This study was designed and conducted by Richard Hatfield, William Longo, Ph.D., and Larry R. Newton, CIH, CSP.

Study Design and Methodology

The study was performed in the exposure characterization lab (ECL). The size of the ECL is approximately 20 ft x 15 ft x 8 ft and the walls and ceiling is constructed of a painted plastic laminate. The ECL is constructed with two viewing windows for video taping purposes and has a ventilation rate of approximately 200 cubic feet per minute with two primary inlet sources and a negative air machine that produces a constant airflow during the study.

During video taping of the work practice study, lighting is utilized inside the ECL to increase the possible observations of dust release during the work practice. Previous studies have shown that the use of, what is commonly referred to as the "Tyndall light phenomena", is an effective method of displaying respirable airborne dust generated from workplace activities.[1,2,3,4] To minimize light reflection, the walls, floor and ceiling inside the ECL are painted black.

MAS received a number of flanges and valves from Dr. Robert Gay. Dr. Gay had harvested these flanges and valves from a wood products mill powerhouse located in Oregon. Three of these valve and flange assemblies which contained spiral wound gaskets were selected. A fourth valve and flange assembly was provided by Patton, Warnom, & Watkins. The four flange assemblies were identified as containing spiral wound gaskets and were partially opened to confirm the presence of these asbestos containing gaskets prior to the work practice study. The flanges were reassembled and the outside surfaces were cleaned. After cleaning, the flange assemblies were sand blasted and painted. The cleaning and painting measures were performed to eliminate any contribution of asbestos from previous thermal insulation, which may have been present. Four flange assemblies were slated for use in this study. Each assembly contained two flanges; therefore, eight spiral wound gaskets were to be removed in this study.

During the study, air samples were collected using 25 mm cassettes containing 0.8-micron pore size mixed cellulose ester (MCE) filter on a 5.0 micron backing pad. The air sampling pumps were calibrated both before and after the sample collection. High volume pumps were used for area air samples during the simulation. The pumps were located outside the ECL and connected to the air samples cassettes by Tygon® tubing through the walls of the ECL.

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[1] Surgen Commander P.G. Harris, "The Effects and Control of Disease Associated with Exposure in Devonport Dockyard," Doctoral Dissertation.
[2] C. Dernchl & K.S. Lane, "Asbestos Toxicology Report," Union Carbide Corporation.
[3] D.T. ECL's "Dust Control Development" (S. Chissick & R. Derricott), in Asbestos, Volume 2, Properties, Applications and Hazards, 6, 193, 1983.
[4] I. J. Selikoff, "Insulation Hygiene Progress Report," Volume 3, No. 4, Winter, 1971.

The four area air samples were located around the work site. The area air sampling cassettes were placed approximately five feet from the floor and 6 to 7 feet from the work activity. The high volume pumps were calibrated to a flow rate of 10 liters per minute for both background and area samples collected during the study. The two investigators performing the work practice were each fitted with two personnel air sampling pumps with connecting tubing and 25 mm MCE air sampling cassettes. The air sampling cassettes were attached to each shoulder and within the breathing zone of each investigator. The personnel air sampling pumps were calibrated to a flow rate of 2 liters per minute. Before working on the flanges, background samples were run inside and outside the ECL. The air samples were collected in general accordance with NIOSH Method 7400 for measuring airborne asbestos fibers.

The individuals working inside the ECL wore Tyvek® suits under cotton/polyester (35% / 65%) work clothes, and were supplied air through full-face pressure demand respirators equipped with an escape HEPA filter system. The ECL design included a decontamination area for clothing removal and a shower to remove residual asbestos contamination before the individuals left the ECL area.

Gasket Removal and Electric Wire Brushing

Four flange assemblies were used for this study for a total of eight spiral wound gaskets to be removed. During the study, the flange face was opened and the spiral wound gasket was removed. In most cases, the spiral wound gasket assembly was easily removed from the flange face; however, it was observed that the spiral wound gasket assembly would generally leave a small amount of gasket residue on the flange surface. This residue was removed by using an electric wire brush as described by former machinist and maintenance personnel.

Analytical Methods

All air sample cassette filters were analyzed by NIOSH Method 7400 PCM method using A counting rules. A portion of the filter material from the air samples was analyzed by TEM using the indirect method after preparation by the ASTM D5755-95 analytical protocol.

The spiral wound gaskets were collected from the four flange assemblies that were removed during the study. These eight samples were analyzed by PLM to determine the asbestos content. Additionally, an effort was made to identify the manufacturer of the spiral wound gaskets.

Results

During the work practice, the worker was exposed to levels of airborne asbestos fibers between 1.1 to 1.4 fibers/cc as measured by PCM and between 76.5 to 402.2 structures/cc as measured by TEM. The helper/assistant's exposure level ranged from 1.0 to 1.2 fibers/cc as measured by PCM and between 7.7 to 50.1 structures/cc as measured by TEM. The

clothing worn by the worker was contaminated with respirable asbestos fibers. The one fabric sample tested, resulted in a level of 131.7 million asbestos structures per square foot.

The PLM analysis showed that each of the spiral wound gaskets contained approximately 60% chrysotile asbestos. Four of the gaskets were identified to be manufacturered by Flexitallic and four were manufactured by Parker.

Conclusion

MAS conducted a study to determine if there were any asbestos exposures to asbestos fibers generated by removing and electric wire brushing of spiral wound asbestos containing gasket material from flanges. Typically, a maintenance operation will first remove the spiral wound gasket from the flange, and then polish the flange face with either a pneumatic or electric rotary drill brush equipped with a wire wheel.

These results show that employees should wear at a minimum, powered air purified respirators (PAPR) to conduct this operation. In addition, an employee standing near the work activity will also be exposed to significant levels of asbestos fibers. This employee will require the same level of respiratory protection. The results show that both the employee and the helper brushing the gasket exceeded OSHA's current asbestos excursion limit of 1 fiber/cc throughout the study. This work should also be performed in an enclosed room or glove bagged to prevent asbestos fibers from migrating and exposing other personnel.

On examination of the PCM filters, it was observed that all filters taken during the study were overloaded with non-asbestos particulate. This type of overloading, will bias the fiber counts to lower concentrations. Therefore, the PCM fiber counts can only be considered as a minimum exposure. The evidence that the PCM counts should have been higher lies in the TEM data. Based on the fibers >5µm in length and greater than 0.25µm in diameter counted in the TEM analyses, the PCM counts should have been as much as four to five times higher.

SPIRAL WOUND GASKET REMOVAL

Work Practice Simulation
June 2, 2000

Protocol

Richard Hatfield, William E. Longo, Ph.D., Larry Newton, CIH, CSP

I. ECL SET-UP

A. Study is to be performed in the exposure characterization lab (ECL) constructed using negative airflow asbestos abatement technology. The size of the ECL is approximately 15' x 20' x 8'.

B. Air exchange inside the ECL will be approximately 200 cubic feet per minute as measured (Extech Model 451126) at the air exhaust of the HEPA filter negative air machine (Aramsco, Comanche Model #55011).

C. Tyndall lighting setup according to the protocol as described in D.T. Chambers, "Asbestos", John Wiley & Sons, 6, 193, 1979.

II. BACKGROUND AIR SAMPLES

A. Adjust and calibrate high volume area pumps to 10 liters per minute.

B. Setup four area air samples inside the ECL. Use 25 mm air cassettes Containing 0.8 micron pore size mixed cellulose ester (MCE) filters with a 5.0 micron backing pad.

C. Locate the area air samples in each quadrant of the ECL at a height of 55" from the floor and a distance of approximately 6 feet from the work activity.

III. WORK PRACTICE STUDY

Four flange assemblies will be utilized in this study. On each assembly, there are two flanges; therefore, eight spiral wound gaskets will be removed in the study. The method used will be to first remove the gasket assembly then electric wire brush to remove any residue and polish the flange facings.

A. During this study, the area samples will be calibrated and run at a rate of 10 liters/minute.

B. The worker and observer/assistant will each be fitted with two personnel air pumps and air cassettes located in their breathing zone and calibrated

at a flow rate of 2 liters/minute.

C. Both the worker and the observer/assistant will wear appropriate protective clothing, work apparel and appropriate respiratory protection equipment.

D. The work practice will be performed under both ambient and Tyndall lighting.

E. The entire procedure will be videotaped with three separate cameras. During filming, the Tyndall lighting will be turned off and overhead lights turned on at least once during the study.

F. Air samples for both the area and personnel will be collected during the entire duration of the study.

IV. LABORATORY ANALYSIS

A. All air samples will be analyzed by the NIOSH 7400 PCM method using A counting rules and by TEM analysis.

B. For the TEM analysis, all samples will be analyzed by the indirect method. Samples will be prepared using the ASTM D5755-95 method protocol.

C. Fabric samples will be analyzed by the Chatfield method.

MATERIALS ANALYTICAL SERVICES, INC.

Work Practice Simulation Protocol

I) Chamber Setup

A) The walls, ceiling, and floor are painted black to diminish light reflection.
B) Arranged lighting for Tyndall effect in general accordance with the method described in by D.T. Chambers, "Asbestos", John Wiley & Sons, 6, 193, 1979.

II) Background Air Samples

A) Adjust and calibrate high volume area pump to appropriate flow rate.
B) Set up two or more air samples inside the chamber and one outside air sample in general accordance with the procedure outlined in the NIOSH 7400 method.

III) Work Practice Study[1]

A) Review the appropriate information on work practices simulation.
B) Acquire all necessary tools and materials required for work practice simulation.
C) Calibrate personnel and high volume sampling pumps appropriate to flow rates.
D) Set ventilation to 200 cubic feet per minute as measured with the Extech Flow Anemometer.
E) Set up two or more inside air samples and one outside air sample in general accordance with the procedure outlined in the NIOSH 7400 Method.
F) Participants in the study are to wear protective clothing, work apparel, and respiratory protection equipment.
G) Set up the personnel air samples in general accordance with the procedure outlined in the NIOSH 7400 method.
H) Determine the appropriate time for the length of study.
I) Work practice study performed as determined in Section III, A&B.

[1] Parts of the procedure may be done in advance of chamber set up.

J) If appropriate, film the work practice study from start to finish in two directions. During filming, turn off Tyndall lighting and turn the overhead lights on at least on one occasion.

IV. ANALYSIS

A) Analyze air samples by NIOSH 7400 PCM methods with A counting rules.[2]
B) Analyze air samples by either TEM direct or indirect method.
C) Analyze the cloth/fabric samples by the Chatfield method.
D) Analyze dust samples by the ASTM D-5595 method.

V. RESULTS

A) Air: Report PCM results as fibers/cc, report TEM results all sizes (structures/cc) and greater than or equal to 5 microns in fibers/cc.
B) Fabric: Report TEM results as number of asbestos structures per cm^2 and per square foot of cloth sample.
C) Dust: Report TEM results as number of asbestos structures per cm^2 and per square foot of surface area sampled.

[2] If the air samples are two overloaded for PCM analysis, use the indirect method as descrived by ASTM D-5595.

Spiral Wound Gasket Removal Study
Asbestos Air Analysis Results

I. BACKGROUND SAMPLES

Sample No.	Sample Description	PCM Fibers/cc	TEM (All) Structures/cc	TEM ≥ 5.0µm Fibers/cc
A-0-A (NE)	IWA Background	0.00	0.00	N/A
A-0-B (SE)	IWA Background	0.00	0.00	N/A
A-0-C (SW)	IWA Background	0.00	0.00	N/A
A-0-D (NW)	IWA Background	0.00	0.00	N/A

II. PERSONNEL SAMPLES (WORKER)

Sample No.	Sample Description	PCM Fibers/cc	TEM (All) Structures/cc	TEM ≥ 5.0µm Fibers/cc
P-1-A	Personnel WLR	1.4	402.2	71.0
P-1-B	Personnel WLL	1.1	76.5	19.8
P-1-C	Personnel RHR	1.2	50.1	11.1
P-1-D	Personnel RHL	1.0	7.7	1.7

III. AREA SAMPLES

Sample No.	Sample Description	PCM Fibers/cc	TEM (All) Structures/cc	TEM ≥ 5.0µm Fibers/cc
A-1-A (NE)	IWA Area	0.29	26.52	90.03
A-1-B (SE)	IWA Area	0.55	21.72	3.90
A-1-C (SW)	IWA Area	0.20	25.51	7.21
A-1-D (NW)	IWA Area	0.18	10.02	2.23

IV. FABRIC ANALYSIS

Sample No.	Sample Description	Asbestos Structures/ft.^{2}	Asbestos Structures/cm^2
WL-F-B	Fabric Control	0.00	0.00
WL-F-1	Fabric Area	131.7 million	141.7 thousand