Air Sampling for Asbestos for Comparison to Occupational Exposure Limits

17 March 2010

By: Ralph W. Rogers, CIH

1. References.

a. USA Center for Health Promotion and Preventive Medicine (USACHPPM) Technical Guide (TG) 141, Industrial Hygiene Sampling Guide, October 2008.

b. National Institute for Occupational Safety and Health (NIOSH), Manual of Analytical Methods, 4th Edition, 1994, Peter M. Eller, Editor, (NIOSH Publication No. 94-113. 1994.)

c. Occupational Safety and Health Administration Asbestos Standard Title 29 Code of Federal Regulations (CFR) Part 1910.1001 and Part 1926.1101, most current edition.

d. 2009 Threshold Limit Values (TLVs®) for Chemical Substances and Physical Agents & Biological Exposure Indices (BEI), American Conference of Governmental Industrial Hygienists (ACGIH), 2009.

2. Background. This document will outline how to conduct air sampling for asbestos for comparison with the occupational exposure limits (OEL) in the OSHA and ACGIH TLV standards. This document does not cover sampling for Army or Environmental Protection Agency (EPA) asbestos environmental or clearance levels. There are two methods used to sample and analyze for asbestos occupational exposure. Both methods use the same basic sampling procedures; however, they use different techniques for analyzing for asbestos. The first method uses phased contrast microscopy (PCM) to analyze the samples, and the second method uses transmission electron microscopy (TEM) to analyze the samples.

3. The OEL for Asbestos. There are two OELs for asbestos; the first is the eight hour time weighted average (TWA) TLV and the OSHA PEL of 0.1 fibers per cubic centimeter of air (f/cc) (reference 1c and 1d). The second OEL is the OSHA Excursion Limit of 1 f/cc for 30 minutes (reference 1c). To collect a sample to compare to the OSHA Excursion Limit it is recommended that you should only sample for 30 minutes. It is also recommended that you should collect multiple samples during the period where you expect the highest concentration of asbestos fibers.

4. Phased Contrast Microscopy Method. The PCM method is the most common and least expensive method for sampling for asbestos. However, this method does not distinguish between asbestos and non-asbestos fibers and because the PCM analysis is a visual counting method the media must not have a lot of dust on it. The PCM method used by the Army is based on the NIOSH 7400 method (reference 1b) and has been modified by both the Army in USACHPPM TG 141 (reference 1a) and OSHA in their general industry and construction standards (reference 1c). The method requires the use of a 25 millimeter mixed cellulose ester (MCE) filter in an electrically conductive plastic filter holder with a 50 mm cowling (see figure 1

below). The cassette is placed in the employee's breathing zone or in the area at the breathing zone height (between four to six feet from the ground). To sample remove the inlet cover from the filter cassette (or face cover or inlet cover) this is called sampling open face and connect the suction side of the filter to the pump, then place the cassette at the location you intend to sample face pointed down with the face pointed down (so the face of the cassette points to the ground). If the 25 mm cassette is used the method recommends that you collect a minimum of 400 liters of air at between 0.5 to 16 liters per minute (l/min), however flow rates between 2 to 4 l/min is recommend by the author. However, because the PCM method analysis is adversely affected by accumulations of dust on the filter, you should monitor the filter condition, and if you note any build up of dust on the filter the cassette should be changed and the times recorded. If 25 mm filters are not available then as alternate you could use a 37 mm cassette with MCE filter; however if a 37 mm cassette is used you would need to collect a larger minimum volume of around 3000 liters of air at 2 to 10 l/min.

5. Transmission Electron Microscopy. The TEM method is the least common and most expensive method used for sampling for asbestos to determine worker compliance with the OEL. Unlike the PCM method this method does identifies and counts only asbestos fibers and because the TEM analysis is a uses an electron microscope the amount of dust on the face of the filter does not present the same level of problem as with the PCM method. The method is based on the NIOSH 7402 method (reference 1b) and has been modified by both the Army in USACHPPM TG 141 (reference 1a) and OSHA in their general industry and construction standards (reference 1c). The method requires the use of a 25 millimeter MCE or polycarbonate filter in an electrically conductive plastic filter holder with a 50 mm cowling (see figure one below). The cassette is handled that same way as discussed in PCM method above and the same flow rates and volumes are collected.

6. After the samples have been collected they should be submitted to the US Army Public Health Command Laboratory for analysis. In addition to the samples, two field blanks should be included with the first ten samples, plus one additional blank for every additional ten samples.

7. Ship samples in a rigid container with sufficient packing material to prevent jostling or damage to the cassettes (reference 1a).

8. For additional assistance or questions concerning this fact sheet, please contact Mr. Ralph W. Rogers at commercial 410-436-3118, DSN 312-584-3118, or email at ralph.rogers@us.army.mil.

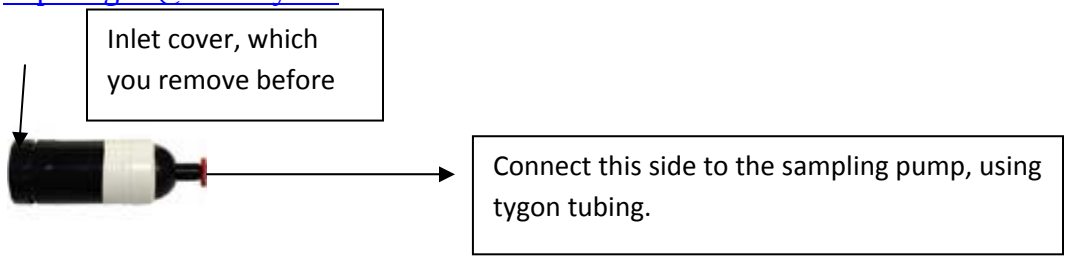

Figure 1. The recommended 25 mm MCE cassette with 50 mm cowling