



Laboratory Quality Control

Phase Contrast Microscope Asbestos Fiber Counting

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Based upon a number of requests for information received at the National Institute for Occupational Safety and Health (NIOSH) and on a recent article in *Asbestos Issues*, there seems to be some confusion regarding aspects of NIOSH Method 7400.⁽¹⁾ The following comments are in response to these issues.

NIOSH 7400 Revision 3

The current version of NIOSH Method 7400 is Revision 3 (dated May 15, 1989) which introduced a number of changes to NIOSH 7400 to improve sensitivity and reproducibility. Laboratories which report using NIOSH 7400 should be using this latest revision. The *NIOSH Manual of Analytical Methods* is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402; telephone: (202)783-3238. Individual copies of the method are available from NIOSH Publications, Robert A. Taft Laboratories, 4676 Columbia Parkway, Cincinnati, OH 45226, telephone: (513)533-8287.

Field Sample Integrity

Sample integrity is an important part of providing accurate results. Any samples that show indications of being mishandled or improperly taken (i.e., asbestos samples which are torn or wet) should be rejected. A basic assumption of fiber counting methods such as NIOSH 7400 is that particles are distributed evenly on the surface of the filter. If the filter is torn during sampling, the air flow will not pass through the filter and the sample will be inaccurate. Similarly, the filter should be rejected if it appears to have been soaked with water; i.e., it is wrinkled or has obvious uneven loading due to splashed water. As with any sampling problem, laboratories should notify field personnel and clients about sam-

ple integrity problems so that adequate precautions can be taken to prevent these types of problems from recurring.

Optimum Fiber Loading Levels

The optimum fiber loading range for NIOSH Method 7400 is 100 to 1300 fibers/sq. mm of filter surface area, and any measured loadings outside this range should be clearly reported as being probably biased. Both the Proficiency Analytical Testing (PAT) and Asbestos Analyst Registry (AAR) provide audit samples outside this range of fiber densities in order to challenge participating laboratories with a broad range of fiber densities. However, above 1300 fibers/sq. mm, the reported concentration has a negative bias, i.e., the reported concentration is lower than the true concentration. At concentrations below 100 fibers/sq. mm, the bias is probably positive, although this may not always be consistent.⁽²⁾

Biases such as these, which are an inherent part of the method at low- and high-fiber densities, will not be identified by PAT or AAR because these programs use reference values obtained by a portion of participating laboratories or counters. These biases would not be identified by exchanging samples among counters and laboratories. In addition to qualifying results, the laboratory should also indicate to field personnel or clients that lengthening or shortening sampling times may be needed to obtain samples that fall within the optimum range of the method.

Limit of Detection (LOD)

Under no circumstances should a number be reported that is below the limit of detection (LOD). NIOSH Method 7400 estimates a limit of detection of 5.5 fibers counted or 7 fibers/sq. mm. of filter surface area. This was determined by taking the mean of

blank counts obtained by laboratories participating in the PAT Program plus three standard deviations. A laboratory may develop its own limit of detection (LOD), but the data on which it is based need to be documented.

Particulate Overloading

NIOSH Method 7400 indicates that if more than 50 percent of the filter is covered with particulates, the sample is too overloaded to count and should be rejected. The optimum cutoff percentage for rejecting samples is currently under investigation at NIOSH and the results of this research will probably result in a future revision of NIOSH Method 7400 with a cutoff less than 50 percent. Again, the laboratory needs to communicate with field personnel and clients that smaller air volumes sampled might eliminate this problem.

QA Procedures

NIOSH Method 7400 has more quality assurance procedures than any other NIOSH analytical method to ensure that counts are repeatable and reproducible within the United States. Details of the recommended procedures for establishing a quality assurance program for fiber counting have been presented in the paper "The Quality of Fiber Count Data" published in *Applied Industrial Hygiene*, pp. 273-285, November 1989.

References

1. Marshall, C.P.: PCM Filter Rejection Policies Differ. *Asbestos Issues* 3(10):16-18 (1990).
2. Cherrie, J.; Jones, A.; Johnston, A.: The Influence of Fiber Density on the Assessment of Fiber Concentration Using the Membrane Filter Method. *Am. Ind. Hyg. Assoc. J.* 47:465-74 (1986).

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