

Applicable Polarized Light Microscopy Method for Asbestos NESHAP Compliance Testing

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ABSTRACT

The Clean Air Act mandates a specific analytical procedure to be followed when analyzing building products for the presence of asbestos, thus defining the universe of material that is subject to regulation under the asbestos National Emissions Standard for Hazardous Air Pollutants (NESHAP). The method requires that a representative sample of the material in question be collected in the field, individual layers within the sample analyzed separately, and the layer data combined to yield an estimate of the asbestos content of the entire sample. In 1993, the U.S. Environmental Protection Agency issued a variation of the polarized light microscopy (PLM) test method that removed the compositing of layers and effectively sought to regulate any material, with some exceptions, as asbestos-containing on the basis of any individual layer within the sample. In 1994 and again in 1995, the EPA recommended that the 1993 PLM method be used in preference to the mandated procedure. These recommended modifications to the NESHAP regulations, while published in the Federal Register, have not been

subjected to formal rulemaking and therefore lack the force of law. Two recent court rulings have questioned the enforcement of the NESHAP regulations when the bulk samples have been analyzed in accordance with the 1993 non-binding PLM method. It is incumbent upon the laboratory, absent a directive from its client, to follow the promulgated analytical procedures.

INTRODUCTION

The U.S. Environmental Protection Agency (EPA) primarily regulates asbestos-containing materials under the authority of the Clean Air Act (CAA), the Toxic Substances Control Act (TSCA), and the Asbestos Hazard Emergency Response Act (AHERA). These acts regulate materials if they contain more than 1% asbestos using a specific test method common to all three statutes. Although TSCA defines ACM as more than 1% by weight, the regulatory test method adopted by EPA in TSCA rulemaking in 1982 that now applies to all three statutes is not so clear, leading to some inconsistent court rulings. To document that a material is regulated under one of these acts, the EPA has promulgated one analytical method that specifies PLM as the analytical procedure. The binding method (1) was originally promulgated in 1982 under the Asbes-

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tos in Schools Rule (2) and is currently located at 40 CFR Part 763, Appendix E to Subpart E (under AHERA).

The EPA initially regulated asbestos under the CAA by promulgating regulations under the National Emission Standards for Hazardous Air Pollutants (NESHAP) program in 1973 (3). This initial regulation defined "asbestos material" as "asbestos or any material containing asbestos"; there was no requirement to quantify the amount of asbestos at this time except as it related to spray-on insulation or fireproofing. Spray-on materials were regulated unless they contained less than "1 percent asbestos on a dry weight basis."

By 1990, EPA had decided it was "long overdue" to adopt a specific test method to determine asbestos content to "reduce confusion over what activities are subject to the regulation" (4). EPA initiated rulemaking to, among other things, modify the regulation's weight-based standard (with no test method) because EPA had concluded that a one percent dry-weight standard tended to underestimate asbestos quantity in denser materials (5).

Instead of developing an entirely new analytical test method to quantify asbestos for NESHAP purposes alone, in 1990 EPA incorporated a pre-existing asbestos test method (1) that had previously been through EPA rulemaking procedures in 1982 and again in 1987 under AHERA. That 1990 test method was added into the very definition of "friable asbestos material" under the NESHAP and therefore is a fundamental component of the definition of regulated asbestos-containing material (RACM) (6). The 1990 test method mandates a multi-step analysis of all layers of the material to generate a composite or "average" asbestos percentage result for the material as a whole:

Bulk samples of building materials taken for the identification and quantitation of asbestos are first examined for homogeneity. . . . When discrete strata are identified, each is treated as a separate material so that fibers are first identified and quantified in that layer only, and then the results for each layer are combined to yield an estimate of asbestos content for the whole sample (7).

Within only a few years of the 1990 promulgation of the first and only binding asbestos NESHAP test method, EPA concluded that the test method excluded certain multi-layered materials from the definition of "regulated asbestos-containing material". Multi-layered materials that in EPA's view should be regulated

fell below the NESHAP's one percent threshold under the literal application and averaging of the 1990 test method. Therefore, in 1993, EPA concluded that a new asbestos test method was desirable (8). The new 1993 test method promised "significant revisions" to the 1990 test method and "new procedures." Included among the significant revisions was an emphatic rejection of the multi-layered averaging of asbestos content mandated by the 1990 test method.

By EPA's own admission, the "much improved" 1993 test method substantially expands the universe of "regulated" material to include material not otherwise above the one percent threshold under the 1990 test method.

Because the [1990 test method] allowed the result to be reported as one number, multi-layered samples which may contain asbestos in a single layer may have been reported by laboratories as nonasbestos-containing. The improved method directs laboratories to analyze and report a result for individual layers. . . . [A] multi-layered sample which previously was determined to be non asbestos-containing may now have layers which will be classified as asbestos-containing based on the presence of asbestos in greater than 1 percent (9).

The EPA has not promulgated the 1993 test method as a formal rule, but has advised of its availability (10) and has recommended its use (9). In 1995, EPA was forced to respond yet again to ongoing public frustration in harmonizing the NESHAP's 1990 test method (averaging) and the non-binding 1993 test method (no averaging) (11). In the face of the irreconcilable positions of the two test methods, EPA elected to point to its long-standing "unwritten policy" against averaging. The EPA admonished industry that its regulatory objectives are more accurately set forth in the non-promulgated 1993 test method, and EPA promised to amend the NESHAP regulation to make the 1993 test method new law. The agency has never done so.

CURRENT ISSUES

The implications of EPA's 1993 policy decision to switch analytical procedures finally coalesced in 2006 in separate criminal and civil proceedings. Due process instructs that criminal prosecutions rest upon statutes and promulgated regulations only, not on

agency “policy” or discretionary test methods that have never been adopted into law. This maxim is especially applicable where an agency does not purport simply to interpret an existing regulation, but instead to replace the promulgated regulatory definitions and test method. To be enforceable, such a change in the governing regulation must be accomplished through CAA rulemaking with public participation and judicial review. In fact, the CAA specifically mandates that all NESHAP test methods must be developed and promulgated through the rulemaking procedures set forth in the asbestos NESHAP statute itself (12). Applying this irreducible constitutional principle to EPA’s asbestos NESHAP enforcement program, EPA (and delegated states) continues to openly defy basic constitutional safeguards by prosecuting companies and individuals based upon the findings of a non-binding asbestos test method.

Two cases of first impression, decided within one month of each other in 2006, vindicate the long-standing due process principle that no prosecution can lie where the government relies upon the findings of non-binding test methods that have never been subjected to rulemaking. In January 2006, the federal government indicted San Diego Gas & Electric Company (“SDG&E”) a company with a 125-year history, two employees of its parent company, and an outside contractor for the removal of multi-layered coal-tar pipe coating by licensed and qualified asbestos abatement subcontractors (13). None of the project’s asbestos abatement contractors were indicted, only the property owner, two employees of the parent company and the project’s general contractor. In *United States v. San Diego Gas & Electric*, there was no dispute that the removal project was entirely lawful if the quantity of asbestos in the pipe coating material is one percent or less. Stated differently, unless the quantity of asbestos in the multi-layered SDG&E pipe coating material exceeded the one percent jurisdictional threshold to become RACM, the asbestos NESHAP and its “work practices” did not apply at all.

In July 2003, the State of Wisconsin filed suit seeking to impose substantial civil penalties on a licensed asbestos abatement contractor for the removal of multi-layered asbestos-containing wall systems in the Milwaukee Auditorium under a delegated state asbestos program that is identical to the federal asbestos NESHAP program (14). In 2005, the trial court granted summary judgment in favor of the state, but the court of appeals reversed in October 2006 on the ground that the state cannot impose liability based on a non-binding

test method (15). In *State of Wisconsin v. Harendra Enterprises*, there was no dispute that depending upon the test method used, the asbestos content of the multi-layered wall system at issue either exceeded or fell below the one percent jurisdictional threshold for the NESHAP work practices to apply. The state conceded that if the 1990 test method is used, the Milwaukee Auditorium wall system is not regulated. Contrary to EPA’s position in the federal *SDG&E* case, Wisconsin argued, and the trial court agreed, that the 1990 test method is “not clear,” which the trial court believed opened the doors to look to two EPA “clarifications” purporting to adopt the 1993 test method (16).

The crux of EPA’s and Wisconsin’s constitutional dilemma is that the 1990 test method, incorporated directly into core definitions of the asbestos regulation, operates to draw a bright jurisdictional dividing line between regulated and non-regulated materials and, hence, lawful and unlawful activity. Changing the test method moves that dividing line with dramatic consequences to individuals and corporations who are charged with violating the asbestos NESHAP. The 1990 test method upon which friable asbestos material and RACM are explicitly defined calculates asbestos content based upon the average of all layers of multi-layered material. The non-binding 1993 test method does not. The non-binding test method upon which both the *SDG&E* and *Harendra Enterprises* cases are based asks the much narrower question of whether any single layer (or any portion thereof) exceeds one percent asbestos, in which event the “entire material is deemed to be regulated asbestos containing material” (17). By definition, the 1993 test method therefore reports artificially high concentrations of asbestos for multi-layered material and positively identifies certain material as “regulated” that would not exceed the law’s jurisdictional threshold using the binding 1990 test method.

The federal court in *SDG&E* concluded in November 2006 that the indictment was fatally defective because the government’s theory of prosecution effectively re-wrote the regulation without rulemaking (18). The court dismissed all asbestos NESHAP counts of the indictment. San Diego Gas & Electric Company persuasively argued that if the government were allowed to prosecute five to six years after project completion, based upon an informal “single layer” test method, the defendants would be deprived of the ability to vindicate themselves using the only scientific test method authorized by law to demonstrate that their conduct was lawful during active subcontractor removal operations in 2000-2001.

The issue has arisen in other venues, such as Florida (19), leading to a clear need for the Federal agencies to revise and coordinate their regulations in accordance with formal rulemaking. Only then will these issues be settled.

IMPLICATIONS FOR ANALYTICAL LABORATORIES

It is current standard practice for laboratories to analyze and report separately each layer without combining the asbestos content for the whole sample. The one exception to this general rule is for a wall system (i.e., joint compound, joint tape and wallboard) when composite sampling is routinely performed. At the direction of their clientele, laboratories must now contemplate returning to the 1982 PLM method found in Appendix E of AHERA by which the laboratory is to report a composite result for all multi-layer samples as well as data for the individual layers. A review of the analytical requirements follows.

The analytical test method specified by the asbestos NESHAP is found in the regulations at 40 CFR Part 763, Appendix E to Subpart E, Section 1, Polarized Light Microscopy. The 1993 PLM test method has not been promulgated for NESHAP compliance testing, even though the EPA has touted it as an improvement over the promulgated method (9).

As noted in the analytical method (40 CFR Part 763, Appendix E to Subpart E, Section 1.7.1), the sample to be analyzed by the laboratory must be representative of the entire material. The collected sample must penetrate through the material and include all possible layers. As with all laboratory analyses, the analyses can only be based on the material that is submitted for analysis; it cannot presume to represent material that is not incorporated into the sample.

Each layer must be analyzed separately. Matrix reduction should be performed as needed to improve the analysis of a layer. Quantitation of the asbestos content can be determined using either a point-counting procedure or calibrated visual estimation. However, the user is cautioned about the accuracy of visual estimation procedures – there are a number of publications that have documented the errors associated with visual estimation (20).

After the asbestos content of each layer has been determined, it is necessary to combine the data into a composite result for the whole sample. However, the regulation is silent on the method of combining multiple layers. There are at least three possible proce-

dures to combine results that can be used to quantify the asbestos content of the multi-layer material: 1) average by the number of layers; 2) average by the volume or thickness of the various layers; or 3) average by the weight of the various layers. Depending on the sample, these three procedures could provide widely different results and all should be evaluated to determine conclusively that the material exceeds (or does not exceed) 1% asbestos. Further, all of these combination procedures presume that the collected sample is intact and representative of the suspect ACM.

1. Average by the Number of Layers

As suggested by the description, the composite average is calculated by adding the asbestos content from each layer and then dividing by the number of layers. It is a simple arithmetic average of the data.

2. Average by the Volume or Thickness of Layers

The volume or thickness procedure is a weighted average of the asbestos content of each layer, with the weighting factor the thickness of each layer. The formula for this procedure is given by:

$$\text{Average Asbestos, vol\%} = \frac{\sum \text{Layer Thickness} \times \text{Layer Asbestos Content}}{\sum \text{Layer Thickness}}$$

The total layer thickness is also the overall thickness of the sampled material. If the sample is incomplete or the total thickness is unknown, then this calculation can only provide an upper bound on the possible composite asbestos content (assuming the unrepresented material contains no asbestos).

3. Average by the Weight of Layers

The weight average procedure is similar to the volume average except the density of the various layers must be accounted as follows:

$$\text{Average Asbestos, wt\%} = \frac{\sum \text{Layer Thickness} \times \text{Layer Density} \times \text{Layer Asbestos Content}}{\sum \text{Layer Thickness} \times \text{Layer Density}}$$

The difficulty with this procedure is the need to know the density for each layer. A sufficiently large sample must be received to permit these measurements with any accuracy or precision.

The first two procedures are the easier to use since they require the least amount of data. However, if the sample has layers that are not uniformly thick or have widely varying densities, then these two procedures will result in biased composite concentrations.

One check on the averaging procedures is to analyze a composite sample. A uniform slice through the entire sample is taken, homogenized, and analyzed. In this way, all of the layers and their relative thickness/density contribute to the final asbestos concentration. This composite testing is only appropriate with intact samples.

CONCLUSION

The EPA defines and regulates asbestos-containing materials under authority from the Clean Air Act through the asbestos NESHAP regulation, in addition to other statutes. Of importance to the CAA is the promulgation of a specific analytical procedure that must be used to produce data in compliance with the CAA. While there are a number of published analytical procedures that could produce acceptable data, only one has been promulgated and approved for asbestos NESHAP compliance testing.

By EPA's own admission, the differences between the non-binding 1993 and the promulgated 1990 test methods are substantive. The EPA concedes in the introduction of the 1993 test method that it "contains significant revisions" to the enumerated 1990 test method and adds "new procedures" that expand the universe of regulated material (8). Upon promulgating the 1990 test method as part of the 1990 amendments to the asbestos NESHAP, EPA admitted that it would have to undergo CAA rulemaking and judicial review if it wanted to amend the regulation's test method at any time in the future (4). Indeed, EPA went so far as to commit in 1995 to "amend the asbestos NESHAP in the near future" in order to make the 1993 test method new law (11). It has never done so, but if the EPA wants to use the 1993 test method for compliance and enforcement purposes then it needs to promulgate the method.

Laboratories must now consider the routine reporting of composite results for all multi-layered samples. There are several ways the data from individual layers can be combined, ranging from simple averaging to averages weighted on the basis of thickness and/or density of the layers. At times, all available averaging techniques may be requested by spe-

cific clients. For many samples, the choice of averaging procedure will not affect the determination of whether the sample is RACM or not RACM. Nonetheless, in order to confirm the RACM classification of a sample, it may be necessary to analyze a uniform slice of the entire sample that is composited or homogenized prior to the analysis.

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