DoD/DOE QSM 6.0 Module 3 Asbestos Testing Checklist

Checklists used for this assessment activity:

- ☐ **M1/M2 PT/QMS**
- ☐ **M3 Asbestos Testing**
- ☐ **M4 Chemical Testing**
- ☐ **M5 Microbiological Testing**
- ☐ **M6 Radiochemical Testing**
- ☐ **M7 Toxicity Testing**
- ☐ **M8 Industrial Hygiene Testing**

This checklist is only a tool, and not considered as the requirements of the standard(s)!

If there is a disagreement between this checklist and the standard(s), the standard(s) shall prevail.

Identify conformity for each requirement along with comments/objective evidence for each clause assessed.

A *clarifying statement* provides additional information to help understand a requirement.

A *permission* is an approach that a conformity assessment body can use to achieve compliance.

Assessment Number:

CAB Name:

Physical Address:

Assessment Date(s):

Assessors(s):

DoD/DOE QSM 6.0 Clause	Requirement	Conformity C / NC / NA	Comments/Objective Evidence
M3	Quality Systems for Asbestos Testing		
M3: 4.0	Method Selection		
M3: 4.0	Does the CAB apply the requirements in the Module 2 section on “Selection, Verification and Validation of Methods”?		
M3: 4.0	When adding a new analyte to a reference method, does the inclusion of the analyte in the method meet all required calibration requirements of the method and the QC requirements of the method to which the analyte is being added?		
M3: 4.0	If no QC exists in the method, does the laboratory		

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	adhere to the requirements outlined in a similar reference method (when available)?		
M3: 4.0	Does the CAB identify the method that meets these requirements in such a way so that there is no confusion that the method has been modified?		
M3: 4.0	When it is necessary to use methods not covered by reference methods, are these subject to agreement with the customer and include a clear specification of the customer's requirements and the purpose of the environmental test?		
M3: 4.0	Is the laboratory developed method validated appropriately before use?		
M3: 5.0	Method Validation		
M3: 5.0	Before acceptance and institution of any method for which data will be reported, are all methods validated?		
M3: 5.0	For all methods except reference methods, does validation meet the requirements in the Module 2 section "Selection, Verification and Validation of Methods" as well as all criteria in this Module?		
M3: 6.0	Demonstration of Capability (DOC)		
M3: 6.1	General		
M3: 6.1.1	Does an individual who performs any activity involved with preparation and/or analysis of samples have constant, close supervision as defined in the laboratory's training procedure until a satisfactory initial DOC is completed?		
M3: 6.1.1.a	Is the Initial DOC a blind sample (i.e., one whose true type and value is unknown to the analyst)?		
M3: 6.1.2	Thereafter, are ongoing DOCs in accordance with this manual required?		
M3: 6.1.3	In cases where an individual has prepared and/or analyzed samples using a method that has been in use by the laboratory for at least one year before applying for accreditation, and there have been no significant changes in instrument type or method, the on-going DOC shall be acceptable as an initial DOC.		Clarifying Statement
M3: 6.1.3	Does the laboratory have records on file to demonstrate that an initial DOC is not required?		
M3: 6.1.4	Are all demonstrations recorded?		
M3: 6.1.4	Are all data applicable to the demonstration retained and readily available at the laboratory?		
M3: 6.2	Initial DOC		
M3: 6.2	Does an individual successfully perform an initial DOC before using any method (see 1.6.1.a) above), and at any time there is a change in instrument type or		

DoD/DOE QSM 6.0 Clause	Requirement	Conformity C / NC / NA	Comments/Objective Evidence
	method, or any time that a method has not been performed by the analyst in a 12-month period?		
M3: 6.2.1	Does the laboratory maintain records of each initial DOC in a manner such that the following information is readily available for each affected employee:		
M3: 6.2.1.a	analyst(s) involved in preparation and/or analysis;		
M3: 6.2.1.b	matrix;		
M3: 6.2.1.c	analyte(s), class of analyte(s), or measured parameter(s);		
M3: 6.2.1.d	identification of method(s) performed;		
M3: 6.2.1.e	identification of laboratory-specific procedures used for analysis, including revision number;		
M3: 6.2.1.f	date(s) of analysis; and		
M3: 6.2.1.g	summary of analyses, including information outlined in Section 6.2.2.c?		
M3: 6.2.2	For asbestos, if the method or regulation does not specify a DOC, the following procedure is acceptable.		Clarifying Statement
M3: 6.2.2	Does the laboratory document other approaches to DOC if used and are adequate?		
M3: 6.2.2.a	Is the analyte(s) diluted in a volume of clean quality system matrix (a sample in which no target analytes or interferences are present at concentrations that will impact the results of a specific method) sufficient to prepare four aliquots?		
M3: 6.2.2.b	Are at least four aliquots prepared and analyzed according to the method either concurrently or over a period of days?		
M3: 6.2.2.c	Using all of the results, is the mean recovery calculated in the appropriate reporting units and the standard deviations of the population sample calculated (in the same units) for each analyte of interest?		
M3: 6.2.2.c	When it is not possible to determine mean and standard deviations, such as for presence/absence and logarithmic values, does the laboratory assess performance against established and documented criteria?		
M3: 6.2.2.d	Is the information compared from (c) above to the corresponding acceptance criteria for precision and accuracy in the method (if applicable) or in laboratory-generated acceptance criteria (if there are not established mandatory criteria)?		
M3: 6.2.2.d	If all analytes meet the acceptance criteria, the analysis of actual samples may begin.		Clarifying Statement
M3: 6.2.2.d	If any one of the analytes does not meet the acceptance criteria, the performance is unacceptable for that analyte.		Clarifying Statement

DoD/DOE QSM 6.0 Clause	Requirement	Conformity C / NC / NA	Comments/Objective Evidence
M3: 6.2.2.e	When one or more of the tested analytes fail at least one of the acceptance criteria, does the analyst proceed by beginning with c) above, repeat the test for all analytes that failed to meet criteria?		
M3: 6.2.2.f	Does repeated failure, however, confirm a general problem with the measurement system?		
M3: 6.2.2.f	If this occurs, does the laboratory locate, and correct the source of the problem and repeat the test for all compounds of interest beginning with b)?		
M3: 6.3	Ongoing DOC		
M3: 6.3.1	Does the laboratory have a procedure describing ongoing DOC that includes procedures for how the laboratory will identify data associated with ongoing DOCs?		
M3: 6.3.1	Do(es) the analyst(s) demonstrate on-going capability by routinely meeting the QC requirements of the method, laboratory procedures, customer specifications, and/or this standard?		
M3: 6.3.1	If the method has not been performed by the analyst in a 12-month period, is an initial DOC performed?		
M3: 6.3.1	It is the responsibility of the laboratory to document that other approaches to ongoing DOC are adequate.		Clarifying Statement
M3: 6.3.2	For asbestos, is this ongoing DOC one of the following:		
M3: 6.3.2.a	acceptable performance of a blind sample (single blind to the analyst) or successful analysis of a blind performance sample on a similar method using the same technology (e.g., EPA Methods 100.1 and 100.2);		
M3: 6.3.2.b	another initial DOC;		
M3: 6.3.2.c	at least four consecutive laboratory control samples (LCS) with acceptable levels of precision and accuracy.		
M3: 6.3.2.c	The laboratory shall determine the acceptable limits for precision and accuracy before analysis.		Clarifying Statement
M3: 6.3.2.c	The laboratory shall tabulate or be able to readily retrieve four (4) consecutive passing LCS or reference sample(s) for each method for each analyst each year;		Clarifying Statement
M3: 6.3.2.d	following a procedure for reviewing records of QC samples meeting the QC requirements of the method, laboratory procedure, customer requirements, and/or this standard.		
M3: 6.3.2 d	A review of these records may be used to identify patterns and determine if implementation of the nonconforming work process and/or retraining is necessary; or		Clarifying Statement
M3: 6.3.2.e	if a) through d) are not technically feasible, then is analysis of real-world samples with results within		

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	predefined acceptance criteria (as defined by the laboratory or method) performed?		
M3: 7.0	Technical Requirements		
M3: 7.1	Calibration		
M3: 7.1	Refer to methods referenced in the following Sections for specific equipment requirements. If NIST standard reference materials (SRM) specified below are unavailable, the laboratory may substitute an equivalent reference material with a certificate of analysis.		Clarifying Statement
M3: 7.1.1	Transmission Electron Microscopy Refer to methods referenced in the following sections for specific equipment requirements.		Clarifying Statement
M3: 7.1.1.1.	Water and Wastewater Are all calibrations listed below (unless otherwise noted) performed under the same analytical conditions used for routine asbestos analysis and recorded?		
M3: 7.1.1.1.	Frequencies stated below may be reduced to “before next use” if no samples are analyzed after the last calibration period has expired. Likewise, frequencies shall have to be increased following non-routine maintenance or unacceptable calibration performance		Clarifying Statement
M3: 7.1.1.1.a	Magnification Calibration Is magnification calibration done at the fluorescent screen, with the calibration specimen at the eucentric position, at the magnification used for fiber counting, generally 10,000 and 20,000x? Are records of calibration maintained? Are calibrations performed monthly to establish the stability of magnification? Is calibration data recorded such that trends are detectable?		
M3: 7.1.1.1.b	Camera Constant Is the camera length of the TEM in the Selected Area Electron Diffraction (SAED) mode calibrated before SAED patterns of unknown samples are observed? Was the diffraction specimen at the eucentric position for this calibration?		

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	Does this calibration allow accurate (less than 10% variation) measurement of layer-line spacings on the medium used for routine measurement, i.e., the phosphor screen or camera film? Does this also allow accurate (less than 5% variation) measurement of zone axis SAED patterns on permanent media (e.g., film)? Are calibrations performed monthly to establish the stability of the camera constant? Where non-asbestiform minerals may be expected (e.g., winchite, richterite, industrial talc, vermiculite, etc.), is an internal camera constant standard such as gold, deposited and measured on each sample to facilitate accurate indexing of zone axis SAED patterns.? In such cases, is layer line analysis alone not used? Is calibration data recorded such that trends are detectable?		
M3: 7.1.1.1.b.i	Is a gold standard grid used to obtain the characteristic diffraction rings from which the camera constant can be calculated?		
M3: 7.1.1.1.c	Spot Size Is the diameter of the smallest beam spot at crossover not less than 250 nm as calibrated quarterly? Is calibration data recorded such that trends are detectable?		
M3: 7.1.1.1.d	Beam Dose Is the beam dose calibrated so that beam damage to chrysotile is minimized, specifically so that an electron diffraction pattern from a single fibril greater than 1 µm in length from a NIST SRM chrysotile sample is stable in the electron beam dose for at least 15 seconds?		
M3: 7.1.1.1.e.i	Energy Dispersive X-Ray Analysis (EDXA) System Is the x-ray energy vs. channel number for the EDXA system calibrated to within 20 eV for at least two peaks between 0.7 keV and 10 keV? Is one peak from the low end (0.7 keV to 2 keV) and the other peak from the high end (7 keV to 10 keV) of this range?		

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	Is the calibration of the x-ray energy checked before each analysis of samples and recalibrated if out of the specified range?		
M3: 7.1.1.1.e.ii	Is the ability of the system to resolve the Na Kα line from the Cu L line confirmed quarterly by obtaining a spectrum from the NIST SRM 1866 crocidolite sample on a copper grid?		
M3: 7.1.1.1.e.iii	Are the k-factors for elements found in asbestos (Na, Mg, Al, Si, Ca, and Fe) relative to Si calibrated semiannually, or anytime the detector geometry may be altered? Is NIST SRM 2063a used for Mg, Si, Ca, Fe, while k-factors for Na and Al may be obtained from suitable materials such as albite, kaersutite, or NIST SRM 99a? Are the k-factors determined to a precision (2 s) within 10% relative to the mean value obtained for Mg, Al, Si, Ca, and Fe, and within 20% relative to the mean value obtained for Na? Is the k-factor relative to Si for Na between 1.0 and 4.0, for Mg and Fe shall be between 1.0 and 2.0, and for Al and Ca between 1.0 and 1.75? Is the k-factor for Mg relative to Fe 1.5 or less? Is calibration data recorded such that trends are detectable?		
M3: 7.1.1.1.e.iv	Is the detector resolution checked quarterly to ensure a full-width half maximum resolution of less than 175 eV at Mn Kα (5.90 keV). Is calibration data recorded such that trends are detectable?		
M3: 7.1.1.1.e.v	Are the portions of a grid in a specimen holder for which abnormal x-ray spectra are generated under routine asbestos analysis conditions determined and these areas avoided in asbestos analysis?		
M3: 7.1.1.1.e.vi	Is the sensitivity of the detector for collecting x-rays from small volumes verified quarterly by collecting resolvable Mg and Si peaks from a unit fibril of NIST SRM 1866 chrysotile? Are records maintained?		
M3: 7.1.1.1.f	Low Temperature Asher		

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	Is the low temperature asher calibrated quarterly by determining a calibration curve for the weight vs. ashing time of collapsed mixed cellulose ester (MCE) filters? Is calibration data recorded such that trends are detectable?		
M3: 7.1.1.1.g	Grid Openings Is the magnification of the grid opening measurement system calibrated using an appropriate standard at a frequency of 20 openings/20 grids/lot of 1000 or 1 opening/sample? Is the variation in the calibration measurements (2 s) less than 5% of the mean calibration value?		
M3: 7.1.1.2	Air Are all calibrations performed in accordance with Section 7.1.1.1, except for magnification?		
M3: 7.1.1.2	Is magnification calibration done at the fluorescent screen, with the calibration specimen at the eucentric position, at the magnification used for fiber counting, generally 15,000 to 20,000x?		
M3: 7.1.1.2	Are records of calibration maintained?		
M3: 7.1.1.2	Are calibrations performed monthly to establish the stability of magnification?		
M3: 7.1.1.3	Bulk Samples Are all calibrations performed in accordance with Section 7.1.1.1?		
M3: 7.1.2	Phase Contrast Microscopy		
M3: 7.1.2.1	At least once daily, does the analyst use the telescope ocular (or Bertrand lens, for some microscopes) supplied by the manufacturer to ensure that the phase rings (annular diaphragm and phase-shifting elements) are concentric?		
M3: 7.1.2.2	Is the phase-shift detection limit of the microscope checked daily and after modification or relocation using an HSE/NPL phase-contrast test slide for each analyst/microscope combination?		
M3: 7.1.2.2	This procedure assures that the minimum detectable fiber diameter (less than ca. 0.25 µm) for this microscope is achieved.		Clarifying Statement
M3: 7.1.2.3	Before ordering the Walton-Beckett graticule, is calibration, in accordance with National Institute for Occupational Safety and Health (NIOSH) 7400,		

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	performed to obtain a counting area 100 µm in diameter at the image plane?		
M3: 7.1.2.3	Is the diameter, dc (mm), of the circular counting area and the disc diameter specified when ordering the graticule?		
M3: 7.1.2.3	Is the field diameter (D) verified (or checked), to a tolerance of 100 µm ± 2 µm, with a stage micrometer upon receipt of the graticule from the manufacturer?		
M3: 7.1.2.3	When changes (zoom adjustment, disassembly, replacement, etc.) occur in the eyepiece-objective-reticle combination, is the field diameter re-measured (or recalibrated) to determine field area (mm^2)?		
M3: 7.1.2.3	Is recalibration of field diameter also required when there is a change in interpupillary distance (i.e., change in analyst)?		
M3: 7.1.2.3	Acceptable range for field area shall be 0.00754 mm^2 to 0.00817 mm^2.		Clarifying Statement
M3: 7.1.2.3	Is the actual field area recorded and used?		
M3: 7.1.3	Polarized Light Microscopy		
M3: 7.1.3.1	Microscope Alignment		
M3: 7.1.3.1.a	Are both stereoscope and polarized light microscope aligned and checked for function and optimized for correct operation before every use by every analyst?		
M3: 7.1.3.1.b	Are records of all alignments and function checks maintained?		
M3: 7.1.3.2	Refractive Index Liquids		
M3: 7.1.3.2	Series of nD = 1.49 through 1.72 in intervals less than or equal to 0.005.		Clarifying Statement
M3: 7.1.3.2	Refractive index liquids for dispersion staining, high-dispersion series 1.550, 1.605, 1.680.		Clarifying Statement
M3: 7.1.3.2	The accurate measurement of the refractive index (RI) of a substance requires the use of calibrated refractive index liquids.		Clarifying Statement
M3: 7.1.3.2	Are these liquids calibrated at first use and semiannually, or next use, whichever is less frequent, to an accuracy of 0.004, with a temperature accuracy of 2 °C using a refractometer or RI glass beads?		
M3: 7.2	Quality Control		
M3: 7.2.1	Negative Controls		
M3: 7.2.1.1	Transmission Electron Microscopy		
M3: 7.2.1.1.a	Water and Wastewater		
M3: 7.2.1.1.a.i	Are blank determinations made before sample collection?		

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	When using polyethylene bottles, is one bottle from each batch, or a minimum of one from each 24, tested for background level? When using glass bottles, are four bottles from each 24 tested? Is an acceptable bottle blank level, less than 0.01 million fibers per liter (MFL) greater than 10 µm observed?		
M3: 7.2.1.1.a.ii	Is a process blank sample consisting of fiber-free water run before the first field sample? Is the quantity of water greater than 10 mL for a 25-mm diameter filter and 50 mL for a 47-mm diameter filter?		
M3: 7.2.1.1.b	Air		
M3: 7.2.1.1.b.i	Is a blank filter prepared with each set of samples? Is a blank filter left uncovered during preparation of the sample set and a wedge from that blank filter prepared alongside wedges from the sample filters? At minimum, is the blank filter analyzed at a frequency of one per 20 samples analyzed?		
M3: 7.2.1.1.b.ii	Is the maximum contamination on a single blank filter no more than 53 structures/mm^2? Is the maximum average contamination for all blank filters no more than 18 structures/mm^2?		
M3: 7.2.1.1.c	Bulk Samples		
M3: 7.2.1.1.c.i	Are contamination checks using asbestos-free material, such as the glass fiber blank in SRM 1866, performed at a frequency of one for every twenty samples analyzed? Does detection of asbestos at a concentration exceeding 0.1% require an investigation to detect and remove the source of the asbestos contamination?		
M3: 7.2.1.1.c.ii	Does the laboratory maintain a list of non-asbestos fibers that can be confused with asbestos? Does the list include crystallographic and/or chemical properties that disqualify each fiber being identified as asbestos?		
M3: 7.2.1.1.c.iii	Does the laboratory have a set of reference asbestos materials, from which a set of reference diffraction and x-ray spectra may be developed?		

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M3: 7.2.1.2	Phase Contrast Microscopy		
M3: 7.2.1.2	Are at least two field blanks (or 10% of the total samples, whichever is greater) submitted for analysis with each set of samples? Are field blanks handled in a manner representative of actual handling of associated samples in the set with a single exception that air shall not be drawn through the blank sample? Is a blank cassette opened for approximately 30 seconds at the same time other cassettes are opened just before analysis? Are results from field blank samples used in the calculation to determine final airborne fiber concentration? Is the identity of blank filters unknown to the counter until all counts have been completed? If a field blank yields greater than seven fibers per 100 graticule fields, is possible contamination of the samples reported?		
M3: 7.2.1.3	Polarized Light Microscopy		
M3: 7.2.1.3.a	Friable Materials Is at least one blank slide prepared daily or with every 50 samples analyzed, whichever is less? Is this prepared by mounting a sub-sample of an isotropic verified non-asbestos-containing material (non-ACM) (e.g., fiberglass in SRM 1866) in a drop of immersion oils normally used on a clean slide, rubbing preparation tools (forceps, dissecting needles, etc.) in the mount and placing a clean coverslip on the drop? Is the entire area under the coverslip scanned to detect any asbestos contamination? Is a similar check made after every 20 uses of each piece of homogenization equipment? Is an isotropic verified non-ACM homogenized in the clean equipment, a slide prepared with the material and the slide scanned for asbestos contamination? (This may be substituted for the blank slide mentioned in this Section.)		

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M3:7.2.1.3.b	Non-Friable Materials Is at least one non-ACM non-friable material prepared and analyzed with every 20 samples analyzed? Does this non-ACM shall go through the full preparation and analysis regimen for the type of analysis being performed?		
M3: 7.3	Test Variability/Reproducibility		
M3: 7.3.1	Transmission Electron Microscopy Are quality assurance (QA) analyses performed regularly covering all time periods, instruments, tasks, and personnel? Is the selection of samples random and samples of special interest included in the selection of samples for QA analyses? When possible, are the checks on personnel performance executed without their prior knowledge? Are a disproportionate number of analyses not performed before internal or external audits?		
M3: 7.3.1.1	Water and Wastewater Are all analyses performed on relocator grids so that other laboratories can easily repeat analyses on the same grid openings? Is quality assurance analyses not postponed during periods of heavy workloads? Is the total number of QA samples and blanks greater than or equal to 10% of the total sample workload?		
M3: 7.3.1.1.a	Replicate Are second, independent, analysis performed on the same grids but on different grid openings than used in the original analysis of a sample? Are results within 1.5x of Poisson standard deviation? Is this replicate performed at a frequency of one per 100 samples?		
M3: 7.3.1.1.b	Duplicate		

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	Is a second aliquot of sample filtered through a second filter, prepared, and analyzed in the same manner as the original preparation of that sample? Are results shall be within 2.0x of Poisson standard deviation? Is this duplicate performed at a frequency of one per 100 samples?		
M3: 7.3.1.1.c	Verified Analyses Is a second, independent, analysis performed on the same grids and grid openings used in the original analysis of a sample? Are the two sets of results compared in accordance with NISTIR 5351, Airborne Asbestos Method: Standard Test Method for Verified Analysis of Asbestos by Transmission Electron Microscopy – Version 2.0 (S. Turner and E.B. Steel, 1994)? Is this comparison performed at a frequency of one per 20 samples? Do qualified analysts maintain an average of greater than or equal to 80% true positives, less than or equal to 20% false negatives, and less than or equal to 10% false positives?		
M3: 7.3.1.2	Air		
M3: 7.3.1.2.a	Are all analyses performed on relocator grids so that other laboratories can easily repeat analyses on the same grid openings?		
M3: 7.3.1.2.b	Do the laboratory and TEM analysts obtain mean analytical results on NIST SRM 1876b so that trimmed mean values fall within 80% of the lower limit and 110% of the upper limit of the 95% confidence limits as published on the certificate? Are these limits derived from the allowable false positives and false negatives given in Section 7.3.1.1.c, Verified Analysis? Is SRM 1876b analyzed a minimum of once per year by each TEM analyst?		
M3: 7.3.1.2.c	Does the laboratory have a record demonstrating that TEM analysts correctly classify at least 90% of both bundles and single fibrils of asbestos structures greater than or equal to 1 µm in length in known standard		

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	materials traceable to NIST, such as NIST bulk asbestos SRM 1866?		
M3: 7.3.1.2.d	Are inter-laboratory analyses performed to detect laboratory bias? Does the frequency of inter-laboratory verified analysis correspond to a minimum of one per 200 grid square analyses for customers?		
M3: 7.3.1.2.e	If more than one TEM is used for asbestos analysis, are inter-microscope analyses performed to detect instrument bias?		
M3: 7.3.1.2.e.i	Replicate Is a second, independent analysis performed in accordance with Section 7.3.1.1.a?		
M3: 7.3.1.2.e.ii	Duplicate Is a second wedge from a sample filter prepared and analyzed in the same manner as the original preparation of that sample? Are results within 2.0x of Poisson standard deviation? Is this performed at a frequency of one per 100 samples?		
M3: 7.3.1.2.e.iii	Verified Analyses Is a second, independent analysis performed on the same grids and grid openings in accordance with Section 7.3.1.1.c?		
M3: 7.3.1.3	Bulk Samples Are at least 30% of a laboratory's QC analyses performed on samples containing from 1% to 10% asbestos?		
M3: 7.3.1.3.a	Intra-Analyst Precision Is at least one out of 50 samples re-analyzed by the same analyst? For single analyst laboratories, is at least one out of every 10 samples re-analyzed by the same analyst?		
M3: 7.3.1.3.b	Inter-Analyst Precision Is at least one out of 15 samples re-analyzed by another analyst?		

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	Do inter-analyst results require additional re-analysis, possibly including another analyst, to resolve discrepancies when classification (ACM vs. non-ACM) errors occur, when asbestos identification errors occur, or when inter-analyst precision is found to be unacceptable?		
M3: 7.3.1.3.c	Inter-Laboratory Precision Does the laboratory participate in round robin testing with at least one other laboratory? Are samples sent to this other laboratory at least four times per year? Are these samples previously analyzed as QC samples? Are results of these analyses assessed in accordance with QC requirements?		
M3: 7.3.2	Phase Contrast Microscopy		
M3: 7.3.2.a	Inter-Laboratory Precision Does each laboratory analyzing air samples for compliance determination implement an inter-laboratory quality assurance program that includes participation of at least two other independent laboratories? Does each laboratory participate in round robin testing at least once every six months with at least all the other laboratories in its inter-laboratory quality assurance group? Does each laboratory submit slides typical of its own workload for use in this program? Is the round robin designed, and results analyzed using appropriate statistical methodology? Are results of this QA program posted in each laboratory to keep the microscopists informed?		
M3: 7.3.2.b	Intra- and Inter-Analyst Precision Does each analyst select and count a prepared slide from a “reference slide library” on each day on which air counts are performed?		

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	Are reference slides prepared using well-behaved samples taken from the laboratory workload? Do fiber densities cover the entire range routinely analyzed by the laboratory? Are these slides counted by all analysts to establish an original standard deviation and corresponding limits of acceptability? Are results from the daily reference sample analysis compared to the statistically derived acceptance limits using a control chart or a database? Is inter-analyst precision posted in each laboratory to keep the microscopists informed?		
M3:7.3.3	Polarized Light Microscopy Refer to Section 7.3.1.3.		
M3: 7.4	Other Quality Control Measures		
M3: 7.4.1	Transmission Electron Microscopy		
M3: 7.4.1.a	Water and Wastewater		
M3: 7.4.1.a.i	Are filter preparations made from all six asbestos types from NIST SRMs 1866 and 1867? Do these preparations have concentrations between one and 20 structures greater than 10 µm per 0.01 mm^2? Is one of these preparations analyzed independently at a frequency of one per 100 samples analyzed? Are results evaluated as verified asbestos analysis in accordance with NISTIR 5351?		
M3: 7.4.1.a.ii	Is NIST SRM 1876b analyzed annually by each analyst? Are results evaluated in accordance with limits published for that SRM?		
M3: 7.4.1.b	Air		
M3: 7.4.1.b.i	Are filter preparations made from all six asbestos types in accordance with Section 7.4.1.a.i?		
M3: 7.4.1.b.ii	Is NIST SRM 1876b analyzed annually?		
M3: 7.4.1.c	Bulk Samples Are all analysts able to correctly identify the six regulated asbestos types (chrysotile, amosite, crocidolite, anthophyllite, actinolite, and tremolite)?		

DoD/DOE QSM 6.0 Clause	Requirement	Conformity C / NC / NA	Comments/Objective Evidence
	Are standards available for the six asbestos types listed are available from NIST (SRMs 1866 and 1867)?		
M3: 7.4.2	Phase Contrast Microscopy		
M3: 7.4.2.a	Test for Non-Random Fiber Distribution. Are blind recounts by the same analyst performed on 10% of the filters counted? Does a person other than the counter re-label slides before the second count? Is a test for type II error performed to determine whether a pair of counts by the same analyst on the same slide shall be rejected due to non-random fiber distribution? If a pair of counts is rejected by this test, are the remaining samples in the set recounted and the new counts tested against first counts? Are all rejected paired counts discarded?		
M3: 7.4.2.b	It is not necessary to use this statistic on blank recounts.		Clarifying Statement
M3: 7.4.2.c	Does the laboratory participate in a national sample testing scheme such as the Proficiency Analytical Testing (PAT) program or the Asbestos Analysts Registry (AAR) program, both sponsored by the American Industrial Hygiene Association (AIHA)?		
M3: 7.4.3	Polarized Light Microscopy		
M3: 7.4.3.a	Friable Materials Because accuracy cannot be determined by re-analysis of routine field samples, is at least one out of 100 samples a standard or reference sample that has been routinely resubmitted to determine analyst's precision and accuracy?		
M3: 7.4.3.a	A set of these samples may be accumulated from proficiency testing samples with predetermined weight compositions or from standards generated with weighed quantities of asbestos and other bulk materials		Permission
M3: 7.4.3.a	Does at least half of the reference samples submitted for this QC contain between 1% and 10% asbestos?		
M3: 7.4.3.b	Non-Friable Materials Is at least one out of 100 samples a verified quantitative standard that has routinely been resubmitted to determine analyst precision and accuracy?		
M3: 7.5	Analytical Sensitivity		
M3: 7.5.1	Transmission Electron Microscopy		

DoD/DOE QSM 6.0 Clause	Requirement	Conformity C / NC / NA	Comments/Objective Evidence
M3: 7.5.1.1	Water and Wastewater Is an analytical sensitivity of 200,000 fibers per liter (0.2 MFL) required for each sample analyzed?		
M3: 7.5.1.1	Analytical sensitivity is defined as the waterborne concentration represented by the finding of one asbestos structure in the total area of filter examined.		Clarifying Statement
M3: 7.5.1.1	This value will depend on the fraction of the filter sampled and the dilution factor (if applicable).		Clarifying Statement
M3: 7.5.1.2	Air Is the analytical sensitivity of 0.005 structures/cm^2 for each sample analyzed?		
M3: 7.5.1.2	Analytical sensitivity is defined as the airborne concentration represented by the finding of one asbestos structure in the total area of filter examined. This value will depend on the effective surface area of the filter, the filter area analyzed, and the volume of air sampled.		Clarifying Statement
M3: 7.5.1.3	Bulk Samples The range is dependent on the type of bulk material being analyzed. The sensitivity may be as low as 0.0001%.		Clarifying Statement
M3: 7.5.2	Phase Contrast Microscopy The normal quantitative working range of the method is 0.04 to 0.5 fiber/ cm^2 for a 1000 L air sample. The limit of detection (LOD) is estimated to be 5.5 fibers per 100 fields or 7 fibers/mm^2.		Clarifying Statement
M3: 7.5.2	While the LOD in fiber/cc will depend on sample volume and quantity of interfering dust, is it less than 0.01 fiber/cm^2 for atmospheres free of interferences?		
M3: 7.5.2	Is the ideal counting range on the filter 100 to 1300 fibers/mm2?		
M3: 7.5.3	Polarized Light Microscopy Does the laboratory utilize a method that provides a limit of detection that is appropriate and relevant for the intended use of the data? Is the limit of detection determined by the procedure in the method or applicable regulation?		
M3: 7.6	Quality of Standards and Reagents		
M3: 7.6.1	Transmission Electron Microscopy		

DoD/DOE QSM 6.0 Clause	Requirement	Conformity C / NC / NA	Comments/Objective Evidence
M3: 7.6.1.a	Does the quality control program establish and maintain provisions for asbestos standards?		
M3: 7.6.1.b	Are reference standards that are used in an asbestos laboratory obtained from NIST, EPA, or suppliers who participate in supplying NIST standards or NIST traceable asbestos? Are any reference standards purchased outside the United States traceable back to each country's National Metrology Institute?		
M3: 7.6.1.c	Are all reagents used analytical reagent grade or better?		
M3: 7.6.1.d	Does the laboratory have mineral fibers or data from mineral fibers that will allow differentiating asbestos from at least the following "look-alikes": fibrous talc, sepiolite, wollastonite, attapulgite (palygorskite), halloysite, vermiculite scrolls, antigorite, lizardite, pyroxenes, hornblende, richterite, winchite, or any other asbestiform minerals that are suspected as being present in the sample?		
M3: 7.6.2	Phase Contrast Microscopy. Standards of known concentration have not been developed for this testing method. Routine workload samples that have been statistically validated and national proficiency testing samples such as Proficiency Analytical Testing (PAT) and Asbestos Analysts Registry (AAR) samples available from the American Industrial Hygiene Association (AIHA) may be utilized as reference samples to standardize the optical system and analyst.		Clarifying Statement
M3: 7.6.2	Do all other testing reagents and devices (HSE/NPL test slide and Walton-Beckett Graticule) conform to the specifications of NIOSH 7400?		
M3: 7.6.3	Polarized Light Microscopy Refer to Section 7.6.1.		
M3: 7.7	Data Acceptance/Rejection Criteria		
M3: 7.7.1	Transmission Electron Microscopy		
M3: 7.7.1.1	Water and Wastewater		
M3: 7.7.1.1.a	Is the concentration of asbestos in each sample calculated in accordance with EPA/600/R-94/134, Method 100.2, Section 12.1, Determination of Asbestos Structures Over 10 µM in Length in Drinking Water?		
M3: 7.7.1.1.b	Measurement Uncertainties		

DoD/DOE QSM 6.0 Clause	Requirement	Conformity C / NC / NA	Comments/Objective Evidence
	Does the laboratory calculate and report the upper and lower 95% confidence limits on the mean concentration of asbestos fibers found in the sample?		
M3: 7.7.1.2	Air		
M3: 7.7.1.2.a	Is the concentration of asbestos in each sample calculated in accordance with the method utilized?		
M3: 7.7.1.2.b	Measurement Uncertainties. Does the laboratory calculate and report the upper and lower 95% confidence limits on the mean concentration of asbestos fibers found in the sample?		
M3: 7.7.1.3	Bulk Samples		
M3: 7.7.1.3.a	Is the concentration of asbestos in each sample calculated in accordance with the method utilized (e.g., EPA/600/R-93/116, Method for the Determination of Asbestos in Bulk Building Materials)?		
M3: 7.7.1.3.b	Measurement Uncertainties Proficiency testing for floor tiles analyzed by TEM following careful gravimetric reduction has revealed an inter-laboratory standard deviation of approximately 20% for residues containing 70% or more asbestos. Standard deviations range from 20% to 60% for residues with lower asbestos content.		Clarifying Statement
M3: 7.7.2	Phase Contrast Microscopy		
M3: 7.7.2.1	Is the airborne fiber concentration in each sample calculated in accordance with NIOSH 7400?		
M3: 7.7.2.2	Measurement Uncertainties Does the laboratory calculate and report the intra-laboratory and inter-laboratory relative standard deviation with each set of results in accordance with NIOSH 7400?		
M3: 7.7.2.3	Are fiber counts above 1300 fibers/mm^2 and fiber counts from samples with greater than 50% of the filter area covered with particulate reported as “uncountable” or “probably biased”? Are other fiber counts outside the 100-1300 fibers/mm^2 range reported as having “greater than optimal variability” and as being “probably biased”?		
M3: 7.7.3	Polarized Light Microscopy		
M3: 7.7.3.1	Is the concentration of asbestos in each sample calculated in accordance with the method utilized (e.g., EPA 600/M4-82-020, Interim Method for the Determination of Asbestos in Bulk Insulation Samples)?		
M3: 7.7.3.2	Method Uncertainties		

DoD/DOE QSM 6.0 Clause	Requirement	Conformity C / NC / NA	Comments/Objective Evidence
	Are precision and accuracy determined by the individual laboratory for the percent range involved? If point counting and/or visual estimates are used, is a table of reasonable expanded errors generated for different concentrations of asbestos?		
M3: 7.8	Constant and Consistent Test Conditions (Sample and Sampling Requirements)		
M3: 7.8.1	Are samples transported to the laboratory as soon as possible after collection? Are date and time of sampling noted on submittal forms? Are the names of the collectors with their signatures and the site included on the chain-of-custody forms? Are no preservatives required during sampling?		
M3: 7.8.2	Does the laboratory establish and adhere to written procedures to minimize the possibility of cross contamination between samples?		
M3: 7.8.3	Does the lab refer to the specific method of analysis for additional requirements?		