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November 15, 2013

Dania Zinner
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Document ID #: 3019-11152013-2

Dear Ms. Zinner:

EPA CONTRACT NUMBER EP-W-10-033
TASK ORDER NUMBER 3019
QA SUPPORT FOR THE LIBBY ASBESTOS SITE

Enclosed please find the Summary Asbestos On-site Audit Report for the on-site audit performed on May 8, 2013 at TechLaw, Inc. ESAT Region 8 Laboratory in Golden, Colorado. This report and the accompanying checklist are deliverables under Task 5 of the subject Task Order.

If you have any questions, please feel free to contact me.

Sincerely,

Timothy L. Vonnahme
Audit Group Manager, QATS Program
CB&I Federal Services, LLC
Phone: (702) 895-8729
E-Mail Address: timothy.vonnahme@cbifederalservices.com

cc: Administrative Contracting Officer (letter only)
Audit Group Files

REPORT

FOR

TASK ORDER NUMBER 2019
QUALITY ASSURANCE SUPPORT FOR THE LIBBY ASBESTOS SITE

SUMMARY ASBESTOS ON-SITE AUDIT REPORT

TechLaw, Inc. ESAT Region 8

Prepared by:

The Data Auditing Group
Quality Assurance Technical Support Program
CB&I Federal Services, LLC
2700 Chandler Avenue
Las Vegas, Nevada 89120

November 14, 2013

QATS Contract Number: EP-W-10-033

Prepared for:

Dania Zinner
Task Order Manager

Region 8
U.S. Environmental Protection Agency
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Libby-Specific Asbestos Laboratory On-site Audit Checklist (EPA Only)

LABORATORY INFORMATION AND AUDIT SCOPE

This report summarizes the results of an asbestos on-site laboratory audit of TechLaw, Inc. ESAT Region 8 in Golden, Colorado performed on May 8, 2013. The audit was conducted in support of the United States Environmental Protection Agency (EPA) Region 8 Libby Superfund Site activities. The purpose of the audit was to evaluate corrective actions taken by the laboratory to address deficiencies identified from the last on-site audit conducted on May 22-23, 2012. CB&I Federal Services, LLC Quality Assurance Technical Support (QATS) staff participation in the on-site audit and subsequent preparation of this report was performed under Task 5, Task Order (TO) 2019, QATS Contract EP-W-10-033.

Detailed information regarding the subject laboratory is as follows:

Date of On-site:	**May 8, 2013**
Laboratory:	**TechLaw, Inc. ESAT Region 8** **16194 West 45th Drive** **Golden, Colorado 80403** **(303) 312-7054**
QA Coordinator:	**Nikki McDonald**
Audit Team	
US EPA:	**Dania Zinner (by teleconference)**
CB&I QATS:	**Michael Lenkauskas, CQA, Senior Auditor**

The Audit Team, comprised of CB&I Federal Services, LLC QATS personnel, performed the technical and evidentiary aspects of the on-site audit. Due to unforeseen circumstances, a representative of the EPA was not able to attend but participated in the debriefing via conference call. The technical and evidentiary parts of the audit involved an evaluation of the corrective actions taken by the laboratory to address the deficiencies identified during the previous on-site audit conducted May 22-23, 2012.

The processes evaluated included direct and indirect sample preparation for Transmission Electron Microscopy (TEM) analysis, analysis by Polarized Light Microscopy (PLM), analysis by TEM, and Quality Assurance/Quality Control (QA/QC). All pertinent laboratory instrumentation and equipment were inspected for proper maintenance and calibration, and laboratory personnel were interviewed to determine their understanding and adherence to laboratory procedures.

During the course of the audit, the applicable sections of the Libby-Specific Asbestos Laboratory On-site Audit Checklist were completed by the Audit Team. Sections of the checklist not completed during the audit are indicated with an “NA.” The checklist is provided as an attachment to this report (EPA only).

EXECUTIVE SUMMARY

An asbestos laboratory on-site audit of TechLaw, Inc. ESAT Region 8, in Golden, Colorado was performed on May 8, 2013 in support of EPA Region 8 Libby Superfund Site activities. The primary focus of the audit was to evaluate the corrective actions taken by the laboratory to address the deficiencies identified during the previous on-site audit conducted on May 22-23, 2012. The laboratory areas and processes evaluated included direct and indirect sample preparation for TEM analysis, analysis by TEM, analysis by PLM, and QA/QC.

The corrective action applied by the laboratory to the 11 deficiencies identified in the May 2012 on-site audit were evaluated during the current on-site audit. The Audit Team determined that the laboratory had addressed 10 of 11, for a corrective action rate of 910%.

The on-site audit identified two deficiencies which are summarized below by laboratory area:

Indirect and Direct Preparation of Air Filter and Dust Samples – Two deficiencies were assessed for inadequate completion of preparation documentation (**partial repeat defect**) and deviations from required indirect preparation procedures. The deviations observed for the indirect preparation procedures were done to comply with the laboratory chemical hygiene plan and are documented in Laboratory Modification LB-000091.

With the exception of the deficiencies noted above, the on-site evaluation revealed TechLaw, Inc. ESAT Region 8, in Golden, Colorado to have sufficient facilities, equipment, and staff to analyze samples in accordance with the specified methodologies and Libby-specific protocol. All staff and management were cooperative, readily answered all questions asked by the Audit Team, and appeared responsive to the identified deficiencies.

AUDIT FINDINGS

Sample Receipt, Storage, Log-in, and Chain-of-Custody (COC)

This area was not evaluated since there were no sample receipt, storage, log-in, or COC issues identified in the previous audit.

Indirect and Direct Preparation of Air Filter and Dust Samples

The evaluation of this area focused on the five deficiencies identified from the previous audit. Four of the five deficiencies have been addressed as described in the "Corrective Action Applied from the Previous Audit Deficiencies" section starting on Page 6 of this report. In addition to a previous deficiency that had not been fully addressed, one additional deficiency was identified:

1. Two steps for the indirect preparation procedure were not being performed as described in the applicable methodology and laboratory-specific procedure. The indirect preparation sample suspensions are not being adjusted to a pH between 3 and 4 with a 10% solution of glacial acetic acid, as described in Sections 4.1.16 and 4.2.8 of the Libby-specific SOP for the Indirect Preparation of Air and Dust Samples for TEM Analysis (SOP EPA-Libby-08), and Acetone is used in place of the DMF solution to collapse the MCE filters. The requirement to use Acetone is described in Sections 9.4.2 and 9.4.3 of ISO Method 10312. (Checklist Nos. 6.7.1, 6.8.3.3.1, and 6.14.1)

   Recommended Corrective Action – The deviations described above are performed to remain in compliance with the USEPA Region 8 Golden Laboratory Chemical Hygiene Plan which states, "Prior to conducting laboratory research involving hazardous materials it is essential for employees to determine if substitution of materials with less hazardous substances is possible." These deviations have been documented in Laboratory Modification LB-000091. No further corrective action is necessary.

2. Although the TEM indirect preparation bench sheet has been revised to accommodate some of the indirect preparation data (i.e., sample volumes) for the secondary filter selected for preparation and analysis, the preparation information for the remaining dilutions is only recorded on the petri dish where the filters are stored, which will eventually be stored off-site and eventually disposed. The requirement that the laboratory keep all records necessary to establish an audit trail of its operations, including original data and observations, QA/QC activities, calibration records, and copies of test reports, is described in Section 13.1.2 of the laboratory's SOP for Asbestos Analysis by Transmission Electron Microscopy (TEM-01.01, Rev.1). (Checklist No. 6.15.1) **This is a partial repeat finding.**

   Recommended Corrective Action – Ensure that all sample preparation records are documented in a manner which is both permanent and readily retrievable.

Transmission Electron Microscopy (TEM) Analysis

The evaluation of this area focused on the one deficiency identified in the previous on-site audit, which was found to have been adequately addressed. No additional deficiencies were observed.

Polarized Light Microscopy (PLM) Analysis

The evaluation of this area focused on the four deficiencies identified in the previous on-site audit, all of which were found to have been adequately addressed. No additional deficiencies were observed.

Quality Control and Quality Assurance

The evaluation of this area focused on the one deficiency identified in the previous on-site audit, which was found to have been adequately addressed. No additional deficiencies were observed.

CORRECTIVE ACTION APPLIED FROM THE PREVIOUS AUDIT FINDINGS

The on-site laboratory evaluation included an assessment of the 11 deficiencies identified in the previous on-site audit performed on May 22-23, 2012. Of these eleven deficiencies, the Audit Team determined that the laboratory had completely addressed 10 (91%) and partially addressed 1 (9%). The following are the deficiencies identified during the previous on-site audit, the laboratory's verbatim responses to the audit comments, and effectiveness checks performed during the current on-site audit.

Sample Receipt, Storage, Log-in, and Chain-of-Custody (COC)

No observations made by the Audit Team in this area.

Indirect and Direct Preparation of Air Filter and Dust Samples

1. The results from the most recent plasma asher calibration, which is performed quarterly to determine the length of time required to etch 10% of the filter material, is not posted on or near the instrument. The requirement to print the current etching time and post it in the laboratory in proximity to the plasma asher is described in Section 14.7.8 of the laboratory's SOP for Asbestos Analysis by TEM (SOP TEM-01.00, Rev. 0). (Audit Checklist No. 6.4.5.1)

   Recommended Corrective Action – Ensure that a copy of the most current quarterly plasma asher calibration is printed and posted near the instrument.

   Laboratory Response (07/31/2012): *See Corrective Action Report (CAR) 2012-0021 (Attachment A)*

   SOP TEM-01.00, Asbestos Analysis by TEM, is currently under revision (when the revision is complete it will be SOP TEM-01.01). Section 14.7.7 has been revised so that current ashing time will be posted by the plasma etcher in a way that meets TechLaw document control requirements. The current ashing time is posted by the plasma etcher now.

   Effectiveness Check (05/08/2013): This deficiency has been completely addressed.

2. Laboratory blanks are not always prepared in the same manner as the associated samples. Due to analytical sensitivity requirements the sample preparation analyst sometimes prepares additional filter material to accommodate the number of grid

preparation needed; however, in those instances where more filter material is necessary, additional filter material is not prepared for the associated laboratory blank. The requirement that laboratory blanks use the same preparation steps as the associated samples is described in Section 10.3 of the laboratory's SOP for Asbestos Analysis by TEM (SOP TEM-01.00, Rev. 0). (Audit Checklist No. 6.13.1.1)

Recommended Corrective Action – Ensure that laboratory blanks are prepared in the same manner as the associated samples.

Laboratory Response (07/31/2012): *All laboratory blanks have been prepared in the exact same manner (Indirect, Direct, In-direct Ash) as client samples. For example an Indirect Ash laboratory blank is prepared by obtaining a blank filter, placing it in a beaker, ashing it with client samples, rinsing into a 100ml sealed jar, sonicating and shaking, pipetted into a funnel assembly, placed in a petri-dish, collapsed on the same slide as client samples, etched, coated, and placed on grids. The audit finding is referring to the size of excised filter only which is not prescriptive. For samples that do not require extended grid opening counts (for example, AHERAs with target analytical sensitivity of 0.005 s/cc for field samples and an area analyzed of 0.1 mm2 for blanks, as specified in the SAP Analytical Summary Sheet), one filter section with an area of 59 mm2 is excised with the cork borer for both the field samples and lab blank. For samples that require extended grid opening counts (for example, fluidized bed samples that require an area analyzed of 3.0 mm2), ESAT will excise 2 filter sections with the cork borer for both the field samples and blanks, corresponding to a filter area of 118 mm2.*

Effectiveness Check (05/08/2013): This deficiency has been completely addressed.

3. Pertinent information collected during the indirect preparation procedure (i.e. the filter portion used, total filtrate, and volume suspended) is not recorded in a permanent logbook and is not included in the final data package. Information collected from indirect preparation is currently recorded on uncontrolled, personal legal pads, copies of which are neither provided in the final package nor become part of the case (job) file. The requirement that the laboratory keep all records necessary to establish an audit trail, including original data and observations, is described in Section 13.1.2 of the laboratory's SOP for Asbestos Analysis by TEM (SOP TEM-01.00, Rev. 0). (Audit Checklist No. 6.15.1)

Recommended Corrective Action – Ensure that all observations made during sample process are retained in permanent logbooks and are included in the applicable laboratory deliverables.

Laboratory Response (07/31/2012): *See CAR 2012-0022 (Attachment B)*

Records necessary to establish an audit trail of original observations (TEM-01.00 section 13.1.2) for sample preparation have been documented in laboratory notebooks which were not provided to the client in final data packages. ESATR8 has discontinued use of laboratory notebook for sample preparation and now captures all required indirect prep data inputs on the TEM Analytical Bench Sheet. Whenever samples are received at the lab, we will print these sheets before sample preparation begins and they will accompany the samples through the preparation and analysis process. Analysts record, by hand, the required data inputs on the bench sheets at the time the observations are made. Bench sheets are included in final data packages.

Effectiveness Check (05/08/2013): This deficiency has been partially addressed. Refer to Comment 2 on Page 5 above. This documentation issue will again be evaluated during the next on-site audit of this laboratory.

4. The laboratory uses a syringe with Teflon tubing rather than disposable pipets to extract the necessary suspension volumes to prepare secondary filters for the indirect preparation procedure described in the Libby-specific SOP. While the laboratory has generated data to determine the volume lost during transfer and the effectiveness of decontamination between samples for this alternative technique, they have not determined the potential for fibers to adhere to the syringe and tubing. The requirement to use disposable pipets to measure suspension volumes is described in Sections 3.0, 4.1.20, and 4.2.14 of the Libby-specific SOP for the Indirect Preparation of Air and Dust Samples for TEM Analysis (SOP EPA-Libby-08). (Audit Checklist No. 6.14.1)

   Recommended Corrective Action – Use disposable pipets to measure the aliquots of the filter suspension applied to the secondary filters prepared during the indirect preparation procedure.

   Laboratory Response (07/31/2012): *Statistical data of the technique we use to bring samples to a specific volume and obtain aliquots for indirect sample preparations has been determined (see Attachment C) and included in our estimation of analytical uncertainty (TEM-02.00 Draft). The transfer loss has been determined to be -0.09ml ±.31ml at the 95% confidence interval. The potential for fibers to adhere to the syringe and Teflon tubing has not been further determined for our technique; however, it has not been determined for the recommended corrective action either as described in Sections 3.0, 4.1.20 and 4.2.14 of SOP EPA-Libby-08, the Libby-specific SOP for the Indirect Preparation of Air and Dust Samples for TEM Analysis. In response to the audit finding, ESATR8 has petitioned to purchase a 1 to 10 ml adjustable volume Eppendorf pipette with disposable tips. If the purchase is approved, ESAT will discontinue use of the syringes with tubing for indirect preparation and begin using the pipette with disposable tips. ESAT TEM staff cannot take anymore action on this item until they are authorized to purchase the pipette.*

   QATS Rationale for Assigning the Defect (12/24/2012): The laboratory's response does not include a contingency plan should their request to purchase the necessary equipment be rejected. It only states that they will use the pipetting equipment described in the SOP "if" the purchase is approved. The laboratory needs to indicate whether or not the purchase request for the necessary equipment has been approved or to state the laboratory's contingency plan in the event it has not.

   EPA Resolution (01/17/2013): EPA would like the laboratory to use a pipette with disposable tips. EPA will approve the purchase request for this equipment.

   Effectiveness Check (05/08/2013): This deficiency has been completely addressed.

5. Indirect preparation sample suspensions are not adjusted to a pH range of 3-4 with a 10% solution of glacial acetic acid as required by the Libby-specific SOP. The pH is adjusted to destroy any biological growth; however, the analysts explained that since the laboratory water is treated with ultra-violet (UV), any bacteria should have been destroyed. The requirement to adjust the pH of indirect preparation suspensions to a pH

range of 3-4 is described in Sections 4.1.16 and 4.2.8 of the Libby-specific SOP for the Indirect Preparation of Air and Dust Samples for TEM Analysis (SOP EPA-Libby-08). (Audit Checklist No. 6.8.3.3.1)

Note that one analyst's argument for not adjusting the pH is that there is no biological growth in the laboratory water, which is treated with UV light, and that ashing of the sample will destroy any biological growth in the actual sample. However; because not all samples require ashing, which is determined in the applicable SAP Analytical Summary, samples not ashed could contain biological growth and pH adjustment would be necessary.

Recommended Corrective Action – In order to minimize/prevent biological growth which can interfere with fiber detection and/or identification during TEM analysis, ensure that sample suspension are adjusted to a pH range of 3-4 with a 10% glacial acetic acid solution.

Laboratory Response (07/31/2012): *The reason for performing pH adjustment during indirect preparation is provided in ASTM D5755, not in SOP EPA-Libby-08. The purpose of reducing the pH to 3 or 4 is to limit microbial growth, which in the experience of the EAST TEM staff, does not work. pH affects regulation of protons and ions and solubility of substances that some bacteria and fungi need. In fact, some bacteria are acidophilic. The EPA Region 8 laboratory facility has a water treatment process in which de-ionized water is treated with UV (see Attachment D). Sample suspensions are done with UV treated water, and therefore, ESATR8 contests that we need to adjust pH to limit microbial growth because microbes cannot grow when they have been destroyed. The EPA Region 8 Chemical Hygiene Plan (CHP) prohibits keeping flammables (acetone) in the same hood as acids and the ESAT TEM Lab is required to abide by the CHP. The chemical fume hood in Room D123 (TEM Sample Prep Room) is the only place ESAT has to store the chemical reagents that are in current use for TEM prep. Libby SOP EPA-Libby-08 needs to be revised to allow the option to not use acetic acid if UV-treated de-ionized water is used for indirect sample preparation.*

QATS Rationale for Assigning the Defect (12/24/2012): Although the Audit Team disagrees with the laboratory that the referenced SOP needs to be revised, this does not change the fact that their current procedure deviates from the project-specific procedure and should, at a minimum, be addressed in a laboratory-specific Laboratory Modification to document this deviation.

EPA Resolution (01/17/2013): EPA agrees that this deviation should be documented in a laboratory-specific Laboratory Modification.

Effectiveness Check (05/08/2013): This deficiency has been completely addressed.

Transmission Electron Microscopy (TEM) Analysis

6. The following discrepancies and/or inconsistencies were identified during a review of the laboratory's SOP for Asbestos Analysis by TEM (SOP TEM-01.00, Rev. 0):

- Section 11.13.2, the General Asbestos Structure Identification Requirements states, "measurement and documentation of SAED patterns is required for each structure identified as chrysotile (usually the first 4) that would cause the analysis to exceed

70 s/mm2 concentration;" however, this rule is specific to AHERA and does not apply to the other TEM analytical methods.

- Sections 11.13.6 though 11.13.8 are also specific to AHERA and do not apply to the other TEM analytical methods.

- Section 14.6.1 states that air monitoring will be performed every 6 months; however, the Audit Team determined during the on-site audit that a quarterly air monitoring events were performed by the staff.

The above discrepancies identify inconsistencies between how specified activities are performed and how they are described in the laboratory's SOP. (Audit Checklist No. 7.14.1)

Recommended Corrective Action – Ensure that the available SOPs reflect activities as currently performed by the laboratory.

Laboratory Response (07/31/2012): *TEM-01.00 Sections 11.13.2 and 11.13.6 through 11.13.8, while specific to AHERA, also apply to other TEM analytical methods as NIST Handbook 150-13:2006, Section 4.4.2 states "NON-AHERA work shall meet NVLAP and Client requirements" (See Attachment E). The appearance of the discrepancies above is a direct result of trying to comply with NVLAP while meeting Libby specific needs. As a NVLAP-accredited TEM lab, we are required to comply with, at a minimum, all requirements of the AHERA method and the NVLAP Airborne Asbestos Analysis Program for all TEM analytical work performed at the lab, which is why the SOP is written the way it is, and ESAT does not expect to change section 11.13 of its SOP. When project analytical requirements are above and beyond what is specified in the AHERA method, those requirements are adequately documented in the TEM-01.00 SOP.*

SOP TEM-01.00 is currently under revision (when the revision is complete it will be SOP TEM- 01.01). Section 14.6.1 has been revised to say, "Once every quarter, collect at least one area air sample per room from rooms D123 and B147 with standard 25mm MCE filter cassettes and the Allegro high-volume air sampling pump." See CAR 2012-0023 (Attachment F)

Effectiveness Check (05/08/2013): This deficiency has been completely addressed.

Polarized Light Microscopy (PLM) Analysis

7. The analytical balance available for weighing samples is not suitable for the procedures described in the Libby-specific SOP. The SOP specifies the availability of two balances, one "accurate to 0.01g, range of 0.01g to 1000g (for weighing total samples)" and another "accurate to 1 mg (for weighing asbestos)". The available analytical balance is not capable of weighing up to 1000 grams. The requirement to have two balances, one accurate to 0.01g with a range of 0.01g to 1000g and another accurate to 1 mg is described in Section 4.0 of the Libby-specific SOP for the Qualitative Estimation of Asbestos in Coarse Soil by Visual Estimation using Stereomicroscopy and PLM (SRC-Libby-01). (Audit Checklist No. 8.4.4.1.1)

Recommended Corrective Action – In order to properly prepare and analyze coarse soil samples as described in the applicable Libby-specific procedures, ensure the availability of two balances, one accurate to 0.01g with a range of 0.01g to 1000g and second accurate to 1 mg.

Laboratory Response (07/31/2012): *See Car 2012-0024 (Attachment G)*

Libby-specific SOP SRC-LIBBY-01 was recently revised by ESAT, and this finding was addressed. One of the changes made eliminates the need for two different analytical balances. The revision requires labs to have one analytical balance accurate to 1 mg, with a recommended upper limit of 60-100 g. If a lab has a balance with the recommended upper limit, there must be another balance available for use (it does not have to be specific to PLM work). At ESAT, we have one balance accurate to 1 mg with an upper limit of 60 g. In the event that a sample cannot be split into multiple weighed aliquots, there is a balance available for use in the chemistry department with an upper limit of 1000 g, located in room B106.

Effectiveness Check (05/08/2013): This deficiency has been completely addressed.

8. The polarized light microscopes are currently not traceable to their respective calibration records. No documentation was observed linking the microscopes to their calibration and maintenance documents. The requirement to keep all records necessary to establish an audit trail of its operations, including calibration, is described in Section 18.1.2 of the Libby-specific SOP for the Bulk Asbestos Analysis by PLM (SOP PLM-01.01, Rev. 1). (Audit Checklist No. 8.15.1)

Recommended Corrective Action – Ensure that all laboratory equipment is traceable to their associated calibration and maintenance records.

Laboratory Response (07/31/2012): *See CAR 2012-0025 (Attachment H)*

Although ESAT has only two microscopes and both are different models, each has been assigned an instrument ID (Nikon microscope ID = PLM-1; Zeiss microscope ID = PLM-2) to improve traceability between the microscopes and all associated records. Each page of the microscope maintenance logbooks has been labeled with the appropriate instrument ID (in the event that a page becomes separated from the binding). All other logbooks have been revised to allow the analyst to record the instrument ID on which the calibration/contamination check/ maintenance was performed. Bench sheets have been revised to allow each analyst to record the instrument ID for each sample analysis (see Attachment I).

Effectiveness Check (05/08/2013): This deficiency has been completely addressed.

9. The laboratory is not currently performing the PLM analysis of fine ground soil samples as described in the Libby-specific SOP. One analyst described collecting the five random slide mounts prior to performing the fiber pick procedure. A second analyst combined (composited) five random samples from which they prepared the required five slide mounts. Both of these practices are deviations from SOP SRC-Libby-03 as currently written. The requirement that the laboratory supervisor ensure that all analyses are performed in accordance with the SOP and identify and take appropriate action to address any deviations is described in Section 3.1 of the Libby-specific SOP for the

Analysis of Fibers in Soil by PLM (SRC-Libby-03, Rev. 2). (Audit Checklist Nos. 8.11.3.1 and 8.14.1)

Recommended Corrective Action – Ensure that all analyses are performed in accordance with the procedures described in the Libby-specific SOP for the Analysis of Fibers in Soil by PLM.

Laboratory Response (07/31/2012): *Regarding fiber picks, all analysts at ESAT currently follow the proper procedures. The entire sample is examined under the stereoscope, and a fiber pick is performed if suspect fibers are observed. Regardless if fibers are found and a fiber pick mount is made, the sample is agitated and reviewed a second time under the stereomicroscope. If a fiber pick mount was mounts may be made at the analyst's discretion, but they are not required. What is required is that the sample is examined in its entirety twice; once in its homogeneous state, and once after agitation (in an inhomogeneous state). Sections 13.1.5, 13.1.6, 13.1.8, 13.3, and 13.4.1 of SRC-LIBBY-03, Revision 3 have been revised to more clearly explain these procedures (see Attachment J).*

QATS Rationale for Assigning the Defect (12/24/2012): At the time of the on-site audit, the laboratory was operating under Revision 2 of SOP*SRC-LIBBY-03.* This SOP has since been revised to address deviations from the SOP that were observed at the time of the audit. QATS requests that the laboratory revise their laboratory response to reflect the subsequent revisions to the SOP that have been made to address these deviations.

EPA Resolution (01/17/2013): EPA agrees that the laboratory should revise their response to reference the updated SOP which has addressed these deviations.

Effectiveness Check (05/08/2013): This deficiency has been completely addressed.

10. The Laboratory Duplicate Cross-check (LDC) analytical observations (i.e. optical properties) are currently recorded on the same bench sheet as the observations of the original (first) analysis, and are therefore not "blind." In addition, for samples identified as trace (Bin B1) the original analyst will circle the fiber on the slide, making it easier for the second QC analyst to find and identify it, which is also not acceptable for an LDC analysis. The LDC sample should be a unique separate analysis. (Audit Checklist No. 8.13.1.1)

Recommended Corrective Action – Ensure that LDC results are recorded on a separate bench sheet than that used to record the original results, and that the results from the original analyses are not known to the individual performing the QC analysis. In addition, the original analyst should not circle observed fibers as an aid to the second QC analyst.

Laboratory Response (07/31/2012): *See CAR 2012-0026 (Attachment K)*

To ensure that QC analyses remain blind, they will be recorded on a separate bench sheet. Analysts will no longer circle LA in the QC sample; it will be up to the second analyst to detect it. If the original analysis has a detection, but the second does not, the second will be recorded as 'ND' on the bench sheet. If the original analysis does not have a detection, but the second does, the original will remain an 'ND' and the second

will be recorded with the appropriate qualifier. The exception to this will be if there is more than one Bin category difference between the two analyses, at which point, a third analyst will be brought in to analyze the QC sample and results will be revised accordingly in order to meet Libby-specific QC acceptance criteria (original and QC results must be within one Bin category of each other). If an analyst questions whether or not a fiber or grain is asbestos, it may be circled to allow a second analyst to review the fiber; however, these circled fibers will no longer be analyzed as QC samples.

Effectiveness Check (05/08/2013): This deficiency has been completely addressed.

Data Management

No observations concerning data management were identified.

Quality Control and Quality Assurance

11. Although the laboratory's corrective action report (CAR) process appears to be more than adequate, follow-up, specifically the schedule to which corrective actions will be performed, is not currently tracked. The requirement to monitor the area of work that had been affected by the deficiency or departure from procedure is described in Sections 15.4.1 and 21.4.1 of laboratory SOPs for Asbestos Analysis by TEM (SOP TEM-01.00, Rev. 0) and Bulk Asbestos Analysis by PLM (SOP PLM-01.01, Rev. 1). (Audit Checklist No. 10.4.1)

    Recommended Corrective Action – In order to more effectively monitor the area of work affected by the deficiency or departure from procedure resulting in a CAR, track the date on which the effectiveness (follow-up) of the corrective action will be assessed.

    Laboratory Response (07/31/2012): *See CAR 2012-0017 (Attachment L)*

    As a result of this finding, TechLaw Form TLF-01.03 was revised to include a Corrective Action Follow-Up (now TLF-01.04; see the attached CARs). The ESAT Region 8 Corrective Action Log was also updated to include columns for Follow-Up Date and Follow-Up Comments.

    Effectiveness Check (05/08/2013): This deficiency has been completely addressed.

CONCLUSIONS

An asbestos on-site audit was performed of TechLaw, Inc. ESAT Region 8, in Golden, Colorado on May 8, 2013 in support of EPA Region 8 Libby Superfund Site activities. The audit involved an evaluation of corrective actions taken by the laboratory to address the deficiencies identified during the previous on-site audit conducted on May 22-23, 2012. The laboratory areas and processes evaluated included direct and indirect sample preparation for TEM analysis, analysis by TEM, analysis by PLM, and QA/QC.

The Audit Team evaluated the corrective action applied to the six deficiencies identified in the previous on-site audit, and determined that the laboratory completely addressed 10 of 11, for a corrective action rate of 91%.

The on-site audit identified the following two deficiencies:

- Preparation documentation is inadequately completed (**partial repeat defect**).
- Deviations from required indirect preparation procedures are performed to comply with the laboratory Chemical Hygiene Plan. This is documented in laboratory Modification LB-000091 and requires no further action.

With the exception of the deficiencies noted above and in the report, the on-site evaluation revealed TechLaw, Inc. ESAT Region 8 in Golden, Colorado to have sufficient facilities, equipment, and staff to analyze samples in accordance with the specified methodologies and Libby-specific protocol. All staff and management were cooperative, readily answered all questions asked by the Audit Team, and appeared to be responsive to the identified deficiencies.

ATTACHMENT

Libby-Specific Asbestos Laboratory On-site Audit Checklist (EPA Only)

LIBBY-SPECIFIC ASBESTOS LABORATORY ON-SITE AUDIT CHECKLIST

USEPA Date(s) of On-site: 05/08/2013

Laboratory: Techlaw, Inc. ESAT Region 8

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Laboratory Personnel Contacted

Name	Title
Nikki McDonald	QA Coordinator
Douglas Kent	Senior Asbestos Microscopist
Nathan Delhierro	TEM Analyst
Talena Oliver	PLM Analyst
Paul Young	Analyst
Katie Shaw	Analyst

Evaluation Team

Name	Title
Michael Lenkauskas, CQA	CB&I Federal Services, LLC (QATS), Senior Auditor

LIBBY-SPECIFIC ASBESTOS LABORATORY ON-SITE AUDIT CHECKLIST

USEPA Date(s) of On-site: 05/08/2013

1.0 LABORATORY STATUS & CAPABILITIES	Yes	No	Comments
1.1 Which of the following capabilities does the laboratory possess:			
1.1.1 Phase Contrast Microscopy (PCM)?	☐	☒	
1.1.2 Polarized Light Microscopy (PLM)?	☒	☐	
1.1.3 Transmission Electron Microscopy (TEM)?	☒	☐	
1.1.4 Others (list)?	☐	☒	
1.2 Is the laboratory currently receiving samples from Libby Superfund Site Operable Units?	☒	☐	

If "**YES,**" complete the following table:

Operable Unit	Matrix/Method(s)	Project/Comments
Various	Soil by PLM-VE (Libby SOP)	
Various	Soil by PLM-GRAM (Libby SOP)	
Various	TEM by ISO, ASTM and AHERA	

2.0 LABORATORY SECURITY	Yes	No	Comments
2.1 Are visitors required to sign in?	☒	☐	
2.2 Are all entrances to the laboratory secured?	☒	☐	

Additional Comments:

3.0 PROJECT INITIATION/PROJECT MANAGEMENT	Yes	No	Comments
3.1 Are there designated project managers or a project management team to ensure samples received are properly processed?	☐	☒	
3.2 Are project-specific requirements and procedures communicated to laboratory staff:			
3.2.1 Project-specific SOPs?	☒	☐	Available in the eRoom
3.2.2 Laboratory Modifications?	☒	☐	
3.2.3 SAP Analytical Summaries?	☒	☐	
3.2.4 Project-specific Electronic Data Deliverables (EDDs)?	☒	☐	
3.2.5 Other (list)?	☐	☒	

Additional Comments:

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4.0 SAMPLE RECEIPT, LOG-IN, STORAGE, & TRACKING	Yes	No	Comments
4.1 Is the sample receiving area adequate, clean, and orderly?	☒	☐	

Personnel Interviewed

Name	Title	Experience

4.2 Sample Receipt			
4.2.1 Is there a sample custodian and designated alternate responsible for sample receipt and log-in?	NA	NA	
4.2.2 Is the custodian or alternate available to receive and log-in samples at any time delivery services are operating?	NA	NA	
4.2.3 Are sample shipping containers opened in a HEPA hood (as necessary) to both minimize personal exposure and safeguard against laboratory contamination?	NA	NA	
4.2.4 Does the sample custodian verify and record the following when inspecting shipments and reviewing documentation:			
4.2.4.1 Presence and condition of custody seals?	NA	NA	
4.2.4.2 Presence or absence of Chain-of-Custody (COC) records?	NA	NA	
4.2.4.3 Presence or absence of air bill sticker(s)?	NA	NA	
4.2.4.4 Sample condition?	NA	NA	
4.2.4.5 Presence of packaging or packing material which could compromise samples (i.e., vermiculite & polystyrene)?	NA	NA	
4.2.4.6 Problems/discrepancies between samples, documentation, client requests, etc.?	NA	NA	
4.2.4.7 Bulk and air samples received separately?	NA	NA	
4.2.5 Are COC records signed and dated at the time of sample receipt?	NA	NA	
4.2.6 Is a system in place to ensure laboratory personnel are made aware of project specific requirements?	NA	NA	
4.2.7 Is a system in place to contact the client in case of absent documentation, or discrepancies between COCs, client requests, etc.?	NA	NA	
4.2.8 Are subsequent resolutions to problems and discrepancies documented?	NA	NA	
4.3 Sample Identification			
4.3.1 Are sample receipt identification logbooks, or a LIMS, used to log-in samples and assign unique laboratory identification numbers?	NA	NA	
4.3.1.1 Does the logbook or logging system serve as a direct cross-reference between laboratory ID numbers and client ID numbers?	NA	NA	

Additional Comments:

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4.0 SAMPLE RECEIPT, LOG-IN, STORAGE, & TRACKING	Yes	No	Comments
4.4 Sample Storage			
4.4.1 Are storage facilities sufficient?	NA	NA	
4.4.2 Is the sample storage area secured to prevent entry of unauthorized personnel?	NA	NA	
4.4.3 Is a logbook or other means used to record sample locations?	NA	NA	
4.4.4 Are samples easy to locate from logbook references?	NA	NA	
4.5 Sample Tracking			
4.5.1 Is a system in place to keep track of samples entering and leaving the storage, sample preparation, and analysis areas?	NA	NA	
4.5.2 Are the retention and/or disposal of unused portions of samples and prepared samples documented?	NA	NA	
4.5.2.1 Are project-specific retention and/or disposal requirements communicated and followed?	NA	NA	
4.6 Standard Operating Procedures (SOPs)			
4.6.1 Are the applicable laboratory SOPs available and followed by laboratory personnel (list)?	NA	NA	

Document Title	Control No.	Description

4.7 Document Control:	Yes	No	Comments
4.7.1 Are all logbooks, notebooks, forms, or other laboratory documents legible, accurate, and complete (list)?	NA	NA	

Document Title	Description/Comments

Additional Comments:

LIBBY-SPECIFIC ASBESTOS LABORATORY ON-SITE AUDIT CHECKLIST

USEPA Date(s) of On-site: 05/08/2013

5.0 PHASE CONTRAST MICROSCOPY (PCM)	Yes	No	Comments
5.1 Does the laboratory perform PCM analyses on samples received from the Libby Superfund site? ***If answered "No" precede to Section 6.0 of the checklist.***	☐	☒	
5.2 Is the PCM area adequate, clean, and orderly?	NA	NA	
5.3 Are steps taken to prevent the cross-contamination of equipment, supplies, and reagents?	NA	NA	

Personnel Interviewed

Name	Title	Experience

5.4 Methods and Guidance Documents	Yes	No	Comments
5.4.1 Are the applicable guidance documents available for reference:			
5.4.1.1 NIOSH Method 7400 (Issue 2), 1994?	NA	NA	
5.4.1.2 Other (list)?	NA	NA	
5.4.2 Are project-specific requirements communicated to laboratory personnel and available for reference:			
5.4.2.1 Laboratory Modification LB-000015A?	NA	NA	
5.4.2.2 SOP EPA-Libby-08?	NA	NA	
5.4.2.3 SAP Analytical Summaries?	NA	NA	
5.4.2.4 Project-specific Electronic Data Deliverables (EDDs)?	NA	NA	
5.4.2.5 Other (list)?	NA	NA	
5.5 Equipment			
5.5.1 Ventilation Hoods:			
5.5.1.1 Checked routinely and recorded in a permanent logbook?	NA	NA	
5.5.2 Are the microscopes used to analyze samples equipped with the following:			
5.5.2.1 Positive phase contrast, with green or blue filter?	NA	NA	
5.5.2.2 Adjustable field iris?	NA	NA	
5.5.2.3 Eyepiece (8 to 10X)?	NA	NA	
5.5.2.4 Phase magnification (40 to 45X)?	NA	NA	
5.5.2.5 Walton-Beckett Graticule?	NA	NA	
5.5.2.6 Stage micrometer with 0.01 mm subdivisions?	NA	NA	
5.5.3 Are microscope and phase ring alignment checks conducted daily?	NA	NA	
5.5.4 Is resolution periodically checked using an HSE/NPL slide?	NA	NA	
5.5.5 Are maintenance and calibration activities recorded in microscope-specific logbooks?	NA	NA	

Additional Comments:

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5.0 PHASE CONTRAST MICROSCOPY (PCM)	Yes	No	Comments
5.6 Sample Preparation			
5.6.1 Are filters prepared as described in the applicable method(s)?	NA	NA	
5.6.2 Are filters visibly overloaded (>25%) or contain loose debris prepared indirectly as described in SOP EPA-Libby-08?	NA	NA	
5.7 Sample Analysis			
5.7.1 Are the appropriate counting rules used (A or B)?	NA	NA	
5.7.2 How are the fields and fibers tracked and recorded? _____			
5.8 Quality Control			
5.8.1 Is each analyst provided a minimum of one reference slide per work day?	NA	NA	
5.8.2 Are recounts analyzed at a frequency of 1 per 10 samples analyzed?	NA	NA	
5.8.2.1 For count pairs not within acceptance limits are associated samples recounted?	NA	NA	
5.9 Standard Operating Procedures (SOPs)			
5.9.1 Are the applicable laboratory SOPs available and followed by laboratory personnel (list)?	NA	NA	

Document Title	Control No.	Description

5.10 Document Control	Yes	No	Comments
5.10.1 Are all logbooks, notebooks, forms, or other laboratory documents legible, accurate, and complete (list)?	NA	NA	

Document Title	Description/Comments

Additional Comments:

LIBBY-SPECIFIC ASBESTOS LABORATORY ON-SITE AUDIT CHECKLIST

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6.0 TRANSMISSION ELECTRON MICROSCOPY (TEM) GRID PREPARATION	Yes	No	Comments
6.1 Are the grid preparation areas adequate, clean, and orderly?	☒	☐	
6.2 Are bulk samples prepared in an area separate from that used to prepare air and dust samples?	☒	☐	
6.3 Are steps taken to prevent the cross-contamination of equipment, supplies, and reagents?	☒	☐	

Personnel Interviewed

Name	Title	Experience
Nathan Delhierro	Senior TEM Analyst	10 Years
Douglas Kent	Senior Asbestos Microscopist	19 Years

6.4 Equipment & Supplies	Yes	No	Comments
6.4.1 Ventilation Hoods:			
6.4.1.1 Checked routinely and recorded in a permanent logbook?	☒	☐	
6.4.2 Drying oven:			
6.4.2.1 Checked routinely and recorded in a permanent logbook? *Note: Desiccator is an option for indirect preparation.*	☒	☐	A desiccator is used.
6.4.3 Muffle furnace:			
6.4.3.1 Checked routinely and recorded in a permanent logbook?	☒	☐	
6.4.4 Analytical balances:			
6.4.4.1 Checked routinely and recorded in a permanent logbook?	☒	☐	
6.4.4.2 Calibrated within the last 12 months by a certified technician?	☒	☐	
6.4.5 Plasma Asher:			
6.4.5.1 Calibrated at least quarterly and recorded in a permanent logbook? *Refer to Request for Modification LB-000085A*	☒	☐	Etched 10%
6.4.6 Sputter Coater (Vacuum evaporator):			
6.4.6.1 Checked routinely and recorded in a permanent logbook?	☒	☐	
6.4.7 Filtration Apparatus (for indirect preparation):			
6.4.7.1 Are disposable or glass funnels used (record catalogue #)?	☒	☐	25mm Environmental Express (catalogue #F1500).
6.4.7.2 Has the Effective Filtration Area (EFA) been determined and recorded for each apparatus?	☒	☐	
6.4.8 TEM Grids:			
6.4.8.1 Is documentation for average grid opening determination available?	☒	☐	

Additional Comments:

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6.0 TRANSMISSION ELECTRON MICROSCOPY (TEM) GRID PREPARATION	Yes	No	Comments
6.5 Direct and Indirect Preparation Methodology			
6.5.1 What method(s) does the laboratory use to prepare air and dust samples for TEM analysis:			
6.5.1.1 40 CFR, Chapter 1, Part 763, Subpart E - AHERA?	☒	☐	
6.5.1.2 ISO 10312:1195 E - Determination of Asbestos Fibers?	☒	☐	
6.5.1.3 ASTM D 5755-09 - Micro vacuum Sampling and Indirect Analysis of Dust by TEM?	☒	☐	
6.5.1.4 Others (list)?	☐	☒	
6.5.2 Are project-specific requirements communicated to laboratory personnel and available for reference:			
6.5.2.1 Laboratory Modifications?	☒	☐	Available in eRoom
6.5.2.2 Project-specific SOPs?	☒	☐	
6.5.2.3 SAP Analytical Summaries?	☒	☐	
6.5.2.4 Other (list)?	☐	☒	
6.6 Sample Inspection			
6.6.1 Are air filter cassettes carefully wet-wiped prior to being transferred to the clean preparation area for inspection?	☒	☐	
6.6.2 Are air filter samples which are visibly overloaded, exhibit uneven loading, or contain loose debris, prepared indirectly? *Refer to Laboratory Modifications LB-000016H & LB-000031G*	☒	☐	
6.6.3 Are all ambient air samples dried upon receipt at the on-site laboratory (i.e., EMSL-Libby) prior to preparation and analysis? *Refer to Laboratory Modification LB-000055A*	NA	NA	Performed in Libby, MT.
6.7 Direct Preparation of MCE and Polycarbonate Filters			
6.7.1 Are MCE filters collapsed using either a Di-Methyl Formamide (DMF) or acetone atmosphere (AA) technique (describe technique)? *The use of an acetone vaporizer ("hot block") is not advised due to the formation of wind rows and tilted fibers.*	☐	☒	Refer to Finding No. 1 of the Audit Report.
6.7.2 Is plasma etching performed on collapsed MCE filters?	☒	☐	
6.7.2.1 Is a 5 to10% layer of the collapsed surface removed during etching?	☒	☐	10% is etched.
6.7.3 Are collapsed MCE filters and secured polycarbonate filters transferred to a vacuum evaporator for carbon coating?	☒	☐	
6.7.4 Are excised filter sections placed on the appropriately labeled TEM grids and cleared using a Jaffe Washer or an equivalent technique (describe)?	☒	☐	Cleared for 90 minutes with Acetone.
6.7.5 Are samples checked for remaining filter residue after clearing?	☒	☐	
6.7.5.1 If residue remains, is condensation washing or an equivalent technique used (describe technique)?	☒	☐	Extend Acetone clearing
Additional Comments:			

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6.0 TRANSMISSION ELECTRON MICROSCOPY (TEM) GRID PREPARATION	Yes	No	Comments
6.8 Indirect Sample Preparation of Air and Dust Samples			
6.8.1 Are the applicable Libby guidance documents available for reference:			
6.8.1.1 SOP EPA-Libby-08 – Indirect Preparation of Air and Dust Sample for TEM Analysis?	☒	☐	
6.8.2 Sample filtration:			
6.8.3 Are the applicable SAP Analytical Summaries reviewed to determine the whether or not filter samples must be ashed?	☒	☐	
6.8.3.1 Are cassettes examined for loose material?	☒	☐	
6.8.3.1.1 If loose material or uneven loading is not evident, is a portion of the air samples retained?	☒	☐	
6.8.3.1.2 If loose material is evident, is the loose material filtered along with the air filter?	☒	☐	
6.8.3.2 Ashing (if applicable):			
6.8.3.2.1 Are filters covered with aluminum foil and placed in a plasma asher?	☒	☐	Ashed for approximately 1 ½ hours.
6.8.3.2.2 Is the plasma asher operated at minimum power?	☒	☐	
6.8.3.2.3 Is 100% ashing confirmed by visual observation?	☒	☐	
6.8.3.3 Are air filters, loose material, dust, or ash, rinsed into a beaker and brought to a final volume of 100 mL with particle-free water?	☒	☐	
6.8.3.3.1 Adjusted to a pH of 3-4 with a 10% solution of glacial acetic acid?	☐	☒	Refer to Finding No. 1 of the Audit Report.
6.8.3.3.2 Sonicated for 3 minutes and allowed to settle for 2 minutes prior to filtering?	☒	☐	
6.8.3.4 Are the appropriate aliquots of filtrate passed through a disposable 25 mm filter assembly with a 0.2 µm MCE filter with a 5.0 µm MCE support pad?	☒	☐	
6.8.4 Are serial dilutions performed as necessary?	☒	☐	
6.8.5 Are TEM grids prepared as described in Section 6.7 of this checklist?	☒	☐	

Additional Comments:

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6.0 TRANSMISSION ELECTRON MICROSCOPY (TEM) GRID PREPARATION	Yes	No	Comments
6.9 Water Sample Preparation			
6.9.1 What method(s) does the laboratory use to prepare water samples for TEM analysis:			
6.9.1.1 EPA Method 100.2 - Determination of Asbestos Structures Over 10 µm in Length in Drinking Water?	☒	☐	
6.9.1.2 EPA Method 100.1 - Determination of Asbestos Fibers Drinking Water?	☒	☐	
6.9.1.3 Others (describe)? _____	☐	☒	
6.9.2 Are samples received and filtered by the laboratory within 48 hours of collection?	NA	NA	Would need to be treated and filtered in Libby, MT.
6.9.2.1 If not, are they stored in a refrigerator until filtered?	NA	NA	
6.9.3 Laboratory Modification LB-000020A:			Equipment not available; would need to be treated and filtered in Libby, MT.
6.9.3.1 Do samples undergo treatment with ozone/UV light?	☐	☒	
6.9.3.2 Are samples hand-agitated and sonicated?	☒	☐	
Refer to Section 6.2 of EPA Method 100.1			
6.9.4 Are the appropriate aliquots of the original sample poured though a 25 mm or 47 mm MCE filter (0.22 µm or smaller pore size) with an MCE filter (5 µm pore size) backing pad?	☒	☐	
Note: No less than 1 mL must be used as an aliquot.			
6.9.5 Are TEM grids prepared as described in Section 6.7 of this checklist?	☒	☐	

Additional Comments:

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6.0 TRANSMISSION ELECTRON MICROSCOPY (TEM) GRID PREPARATION	Yes	No	Comments
6.10 OU3 Tree Bark Sample Preparation			
6.10.1 Are the applicable Libby guidance documents available for reference:			
6.10.1.1 EPA-Libby-2012-12 – Sampling and Analysis of Tree Bark for Asbestos?	☒	☐	Although the SOP is available in the eRoom, the laboratory is currently ill-equipped to prepare tree bark samples for TEM analysis.
6.10.2 Drying and Ashing:			
6.10.2.1 Are the diameter and thickness of the tree bark samples measured and recorded to an accuracy of ± 2mm?	NA	NA	
6.10.2.2 Is the entire tree bark sample weighed and placed in an oven for drying?	NA	NA	
6.10.2.2.1 Dried at 80º C until the weight stabilizes, a minimum of 6 hours, and weighed?	NA	NA	
6.10.2.3 Is the bark sample then covered and placed in a muffle furnace at 450º C for 18 hours, or until all organic matter has been removed, and weighed?	NA	NA	
6.10.2.3.1 Is the furnace ramped from 0º F to 450º C?	NA	NA	
6.10.3 Acid Treatment:			
6.10.3.1 After adding approximately 1-2 mL of DI water, is 10-20 of concentrated HCL added until no further reaction is visible (approx. 3-5 minutes)?	NA	NA	
6.10.3.2 Are samples diluted, transferred to a 100 mL container (with lid) and brought to a final volume of 100 mL with fiber-free DI water?	NA	NA	
6.10.3.3 Are samples capped, inverted 5-6 times, and sonicated for 2 minutes in preparation for filtering?	NA	NA	
6.10.4 Filtration:			
6.10.4.1 Are 5-20 mLs of solution transferred to a second container and brought to a volume of 100 mL with fiber-free DI water?	NA	NA	
6.10.4.2 Are dilutions agitated (inverted 5-6 times) and filtered through a 47 mm MCE filter (0.45 µm pore size)?	NA	NA	
6.10.4.2.1 Are additional dilutions prepared if the loading on the filter appears either too heavy (> 20%) or too light?	NA	NA	
6.10.5 Are TEM grids prepared as described in Section 6.7 of this checklist?	NA	NA	

Additional Comments:

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6.0 TRANSMISSION ELECTRON MICROSCOPY (TEM) GRID PREPARATION	Yes	No	Comments
6.11 OU3 Duff Sample Preparation			
6.11.1 Are the applicable Libby guidance documents available for reference:			
6.11.1.1 EPA-Libby-2012-11 – Sampling and Analysis of Duff for Asbestos?	☒	☐	Although the SOP is available in the eRoom, the laboratory is currently ill-equipped to prepare duff samples for TEM analysis.
6.11.2 Drying and Ashing:			
6.11.2.1 Are the appropriate number of aluminum trays weighed and tared?	NA	NA	
6.11.2.1.1 For tracking purposes, is each tray marked with a unique number?	NA	NA	
6.11.2.2 Are trays filled to approximately ¾, dried at 60º C until the weight stabilizes a minimum of 10 hours, and weighed?	NA	NA	
6.11.2.3 Are dried duff samples transferred to covered pans and placed in a muffle furnace at 450º C for 18 hours, or until all organic matter has been removed, and weighed?	NA	NA	
6.11.2.4 Are ashed samples transferred to Zip-lock bags and homogenized?	NA	NA	
6.11.2.4.1 If an individual sample was split between multiple trays, was it combined into one Zip-lock bag?	NA	NA	
6.11.3 Acid Treatment:			
6.11.3.1 After adding approximately 1-2 mL of DI water to 0.25 grams (measured to ± 0.01 g) of ashed sample, is 10-20 mL of concentrated HCL added until no further reaction is visible (approx. 3-5 minutes)?	NA	NA	
6.11.3.2 Are samples diluted, transferred to a 100 mL container (with lid) and brought to a final volume of 100 mL with fiber-free DI water?	NA	NA	
6.11.3.3 Are sample capped, inverted 5-6 times, and sonicated for 2 minutes in preparation for filtering?	NA	NA	
6.11.4 Filtration:			
6.11.4.1 Is 0.1 to 1.0 mL of solution transferred to a second container and brought to a volume of 100 mL with fiber-free DI water?	NA	NA	
6.11.4.2 Are dilutions agitated (inverted 5-6 times) and filtered through a 47 mm MCE filter (0.45 µm pore size)?	NA	NA	
6.11.4.2.1 Are additional dilutions prepared if the loading on the filter appears either too heavy (> 20%) or too light?	NA	NA	
6.11.5 Are TEM grids prepared as described in Section 6.7 of this checklist?	NA	NA	

Additional Comments:

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6.0 TRANSMISSION ELECTRON MICROSCOPY (TEM) GRID PREPARATION	Yes	No	Comments
6.12 Grid Preparation/filtrate Storage			
6.12.1 For indirect preparations, are remaining filtrates filtered onto the appropriate filter(s) to be archived?	☒	☐	
6.12.2 Are all remaining filters and filter portions labeled prior to archiving?	☒	☐	
6.12.3 Are grids stored in marked grid storage boxes or other suitable containers and stored in a dust/fiber free environment?	☒	☐	
6.12.4 Is the location of grid preparation recorded in such a manner that they can be retrieved upon request in a timely manner?	☒	☐	
6.13 Quality Control Samples			
6.13.1 Are quality control samples prepared at the described frequency:			
6.13.1.1 Are laboratory blanks (LB) prepared at a frequency of 4% or with each preparation batch, whichever is more frequent?	☒	☐	
6.13.1.2 Are re-preparations prepared at a frequency of 1%?	☒	☐	
6.14 Standard Operating Procedures (SOPs)			
6.14.1 Are the applicable laboratory SOPs available and followed by laboratory personnel (list)?	☐	☒	Refer to Finding No. 1 of the Audit Report.

Document Title	Control No.	Description

6.15 Document Control	Yes	No	Comments
6.15.1 Are all logbooks, notebooks, forms, or other laboratory documents legible, accurate, and complete (list)?	☐	☒	Refer to Finding No. 2 of the Audit Report.

Document Title	Description/Comments

Additional Comments:

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7.0 TEM ANALYSIS	Yes	No	Comments
7.1 Are TEM areas adequate, clean, and orderly?	☒	☐	
7.2 Are steps taken to prevent the cross-contamination of equipment, supplies, and reagents?	☒	☐	

Personnel Interviewed

Name	Title	Experience
Nathan Delhierro	Senior TEM Analyst	10 Years
Douglas Kent	Senior Asbestos Microscopist	19 Years

7.3 Methods and Guidance Documents	Yes	No	Comments
7.3.1 What method(s) does the laboratory use to analyze samples TEM:			
7.3.1.1 40 CFR, Chapter 1, Part 763, Subpart E (AHERA)?	☒	☐	
7.3.1.2 ISO 10312:1995 E - Determination of Asbestos Fibers?	☒	☐	
7.3.1.3 ASTM D 5755-09 - Microvacuum Sampling and Indirect Analysis of Dust by TEM?	☒	☐	
7.3.1.4 EPA Method 100.2 - Determination of Asbestos Structures Over 10 µm in Length in Drinking Water?	☒	☐	
7.3.1.5 Others (list)? _____	☐	☒	
7.3.2 Are project-specific requirements communicated to laboratory personnel and available for reference:			
7.3.2.1 Laboratory Modifications?	☒	☐	
7.3.2.2 Project-specific SOPs?	☒	☐	
7.3.2.3 SAP Analytical Summaries?	☒	☐	
7.3.2.4 Project-specific Electronic Data Deliverables (EDDs)?	☒	☐	
7.3.2.5 Other (list)? _____	☐	☒	
7.4 TEM Instrumentation			
7.4.1 Does TEM instrumentation meet the following requirements:			
7.4.1.1 Capable of being operated at between 80 and 120 kV?	☒	☐	Operated at 100 kV.
7.4.1.2 Electron diffraction (ED) and energy dispersive X-ray (EDX) capabilities?	☒	☐	
7.4.1.3 Fluorescent screen with an inscribed or overlaid calibrated scale?	☒	☐	
7.4.2 Are the instruments equipped with thin film or beryllium windows (list below if necessary)? Thin film	☒	☐	
7.4.3 Are all routine and non-routine maintenance activities recorded in instrument-specific logbooks?	☒	☐	

Instrument No.	Make	Model	Capabilities
EPA-000024	JOEL	JEM-1011	EDX/Inca Solutions software

Additional Comments:

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7.0 TEM ANALYSIS	Yes	No	Comments
7.5 Instrument Calibration (Laboratory Modification LB-00085A)			
7.5.1 Is microscope alignment performed daily:			
7.5.1.1 Centering of electron beam?	☒	☐	
7.5.1.2 Electron beam is properly stigmated on either side of crossover?	☒	☐	
7.5.1.3 Image properly focused?	☒	☐	
7.5.2 Is the TEM screen magnification calibrated monthly?	☒	☐	
7.5.3 Is the camera constant calibrated monthly?	☒	☐	
7.5.4 Is the spot size diameter determined to be less than 250 nm quarterly?	☒	☐	
7.5.5 Is the low beam dose (>= 15 seconds for Chrysotile) verified quarterly?	☒	☐	
7.5.6 EDXA System:			
7.5.6.1 Is X-ray energy versus channel for two peaks (i.e., Cu/Al) checked daily?	☒	☐	
7.5.6.2 Is detector resolution (Mn) checked quarterly?	☒	☐	
7.5.6.3 Are K-factors relative to Si determined for Na, Mg, Al, Ca, and Fe quarterly?	☒	☐	
7.5.7 Are instrument calibration records maintained in instrument-specific logbooks?	☒	☐	
7.6 Reference Materials			
7.6.1 Does the laboratory maintain a library of reference materials on asbestos and other fiber types?	☒	☐	
7.6.2 Are instrument-specific "LA" spectra available, posted near the TEM?	☒	☐	
7.7 Grid Acceptance/Rejection Criteria			
7.7.1 Grid preparation rejection criteria:			
7.7.1.1 The replica is too dark due to poor dissolution?	☒	☐	
7.7.1.2 Replica is doubled or folded?	☒	☐	
7.7.1.3 Replica has > 25% obscuration rejected?	☒	☐	
7.7.1.4 Replica has < 50 intact grid openings?	☒	☐	
Refer to Request for Modifications LB-000016H and LB-000031G			
7.7.2 Are samples associated with grids determined to be overloaded (>25%) re-prepped using the indirect-transfer technique described in SOP EPA-Libby-08?	☒	☐	

Additional Comments:

LIBBY-SPECIFIC ASBESTOS LABORATORY ON-SITE AUDIT CHECKLIST

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7.0 TEM ANALYSIS	Yes	No	Comments
7.8 Modifications to AHERA & ASTM D5755:			
7.8.1 Laboratory Modification LB-000031G:			
7.8.1.1 Are structures classified as fibers (F), bundles (B), clusters (C) or matrices (M)?	☒	☐	
7.8.1.2 Are the actual lengths and widths of fibers, bundles, clusters and matrices (M) recorded?	☒	☐	
7.8.1.3 For disperse matrices and clusters, is the length of the longest protruding structure recorded?	☒	☐	
7.8.1.4 Unless identified as a “close call” (LB-000066D), are NAMs not recorded?	☒	☐	
7.8.1.5 Is the designation “ND” used to document when no structures are detected in a grid opening?	☒	☐	
7.8.1.6 Are fibers, bundles, clusters and matrices only recorded they contain individual constituent fibers meeting the aspect ratio criterion?	☒	☐	
7.8.1.7 Are non-countable recorded, but not counted, for informational purposes?	☒	☐	
7.8.1.8 Is the entire length recorded for structures originating in one grid opening and extending to an adjacent grid opening?	☒	☐	
7.8.2 Laboratory Modification LB-000067:			
7.8.2.1 Are the structure identification codes described in Tables D.1 and D.2 of ISO Method 10312 used?	☒	☐	
7.9 Modifications to EPA Method 100.2:			
7.9.1 Laboratory Modification LB-000020:			
7.9.1.1 Are all applicable analyte structures, including those comprising the LA complex, ≥ 0.5 µ in length with a ≥ AR recorded?	☒	☐	The laboratory is ill-equipped to perform required ozone/UV light treatment but capable of performing analysis.
7.9.1.2 Are a maximum of 10 grid openings counted?	☒	☐	
7.9.2 Laboratory Modification LB-000067:			
7.9.2.1 Are the structure identification codes described in Tables D.1 and D.2 of ISO Method 10312 used?	☒	☐	

Additional Comments:

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7.0 TEM ANALYSIS	Yes	No	Comments
7.10 Modifications to ISO Method 10312:			
7.10.1 Laboratory Modification LB-000016H:			
7.10.1.1 Unless identified as a "close call" (LB-000066D), are NAMs recorded?	☒	☐	
7.10.1.2 Are bundles only recorded if they contain individual constituent fibers meeting the aspect ratio criterion?	☒	☐	
7.10.1.3 Are bundles, compact clusters, and compact matrices counted regardless of aspect ratio?	☒	☐	
7.10.1.4 Are structures that intersect non-countable grid bars recorded for informational purposes?	☒	☐	
7.10.1.5 Are component structures, which do not intersect non-countable grid bars, but are within non-countable structures counted?	☒	☐	
7.10.1.6 Is the entire length recorded for structures originating in one grid opening and extending to an adjacent grid opening?	☒	☐	
7.10.1.7 For structures which intersect more than one grid bar is the observed length of the structure recorded?	☒	☐	
7.10.1.8 Are the recorded rules for partially obscured structures properly applied (i.e., MFO and MBO)?	☒	☐	
7.10.1.9 Are the counting and recording rules for the identification of PCMe structures at "low magnification" applied?	☒	☐	
7.11 Common TEM Modifications:			
7.11.1 Laboratory Modification LB-000030:			
7.11.1.1 Are highly detailed sketches of up to 50 asbestos structures provided?	☒	☐	
7.11.2 Laboratory Modification LB-000066D:			
7.11.2.1 Is the presence or absence of sodium and potassium recorded for all LA, OA and NAM particles (NaK, NaX, XK or XX)?	☒	☐	
7.11.2.2 Is probable mineral identification code recorded for all particles?	☒	☐	
7.11.2.2.1 Are LA particles identified as WRTA, AC, TR or AT?	☒	☐	
7.11.2.2.2 Are OA particles identified as AM, AN or CR?	☒	☐	
7.11.2.2.3 Are NAMs indicated as PY, OT or UN?	☒	☐	
7.11.2.3 Is one SAED pattern recorded for each amphibole asbestos type encountered per samples?	☒	☐	
7.11.2.4 Are EDS spectrum (a maximum of 5) collected for up to 5 LA and 5 Close-call NAM per sample?	☒	☐	

Additional Comments:

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7.0 TEM ANALYSIS	Yes	No	Comments
7.12 Counting/stopping rules:			
7.12.1 Are the Analytical Summaries reviewed to determine the following:			
7.12.1.1 Analytical Sensitivity?	☒	☐	
7.12.1.2 Recording rules (i.e., AR)?	☒	☐	
7.12.1.3 Stopping rules (i.e., abundant CH)?	☒	☐	
7.12.1.4 Applicable Laboratory Modifications?	☒	☐	
7.12.1.5 Investigative or non-investigative?	☒	☐	
7.13 Quality Control Analyses (Laboratory Modification LB-000029C)			
7.13.1 Are quality control samples analyzed at the required frequencies:			
7.13.1.1 Laboratory blanks – Frequency 4%?	☒	☐	
7.13.1.2 Recount Same (RS) - Frequency of 1%?	☒	☐	
7.13.1.3 Recount Different (RD) - Frequency of 2.5%?	☒	☐	
7.13.1.4 Inter-laboratory - Frequency of 0.5%?	☒	☐	
7.13.1.5 Verified Analysis (VA) - Frequency of 1%?	☒	☐	
7.13.1.6 Re-preparations – Frequency of 1%	☒	☐	
7.13.2 Are samples selected for RS, RD and VA analyses in accordance with Laboratory Modification LB-000029C?	☒	☐	
7.13.3 Is the procedure used to evaluate QC sample analyses in accordance with Laboratory Modification LB-000029C?	☒	☐	
7.14 Standard Operating Procedures (SOPs)			
7.14.1 Are the applicable laboratory SOPs available and followed by laboratory personnel (list)?	☒	☐	

Document Title	Control No.	Description

7.15 Document Control	Yes	No	Comments
7.15.1 Are all logbooks, notebooks, forms, or other laboratory documents legible, accurate, and complete (list)?	☒	☐	

Document Title	Description/Comments

Additional Comments:

LIBBY-SPECIFIC ASBESTOS LABORATORY ON-SITE AUDIT CHECKLIST

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8.0 POLARIZED LIGHT MICROSCOPY (PLM)	Yes	No	Comments
8.1 Are PLM areas adequate, clean, and orderly?	☒	☐	
8.2 Are steps taken to prevent the cross-contamination of equipment, supplies, and reagents?	☒	☐	
Personnel Interviewed			

Name	Title	Experience
Nikki McDonald	QA Coordinator	10 Years
Talena Oliver	Senior PLM Analyst	7 Years

8.3 Methods and Guidance Documents	Yes	No	Comments
8.3.1 Are the applicable guidance documents available for reference:			
8.3.1.1 EPA SOP SRC-Libby-01?	☒	☐	
8.3.1.2 EPA SOP SRC-Libby-03?	☒	☐	
8.3.1.3 NIOSH 9002, Issue 2 - Asbestos (Bulk) by PLM?	☐	☒	
8.3.1.4 Others (list)?	☒	☐	EPA 600
8.3.2 Are project-specific requirements communicated to laboratory personnel and available for reference:			
8.3.2.1 Laboratory Modifications?	☒	☐	Available in eRoom
8.3.2.2 Project-specific SOPs?	☒	☐	
8.3.2.3 SAP Analytical Summaries?	☒	☐	
8.3.2.4 Project-specific Electronic Data Deliverables (EDDs)?	☒	☐	
8.3.2.5 Other (list)?	☐	☒	
8.4 Equipment			
8.4.1 Ventilation Hoods:			
8.4.1.1 Checked routinely and recorded in a permanent logbook?	☒	☐	
8.4.2 Drying oven (optional):			
8.4.2.1 Checked routinely and recorded in a permanent logbook?	☐	☒	Not required for PLM-VE or PLM-GRAV.
8.4.3 Muffle furnace:			
8.4.3.1 Checked routinely and recorded in a permanent logbook?	☒	☐	

Additional Comments:

LIBBY-SPECIFIC ASBESTOS LABORATORY ON-SITE AUDIT CHECKLIST

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8.0 POLARIZED LIGHT MICROSCOPY (PLM)	Yes	No	Comments
8.4.4 Analytical balances:			
8.4.4.1 Two balances:			
8.4.4.1.1 Accurate to 0.01 g, range of 0.01 to 1000 g?	☒	☐	
8.4.4.1.2 Accurate to 1 mg?	☒	☐	
8.4.4.2 Checked routinely and recorded in a permanent logbook?	☒	☐	
8.4.4.3 Calibrated within the last 12 months by a certified technician?	☒	☐	
8.5 Stereomicroscope			
8.5.1 Do stereomicroscopes meet the following requirements:			
8.5.1.1 Magnification range of 10X to 50X?	☐	☒	15 - 40x objectives.
8.5.1.2 Incandescent or fluorescent light source?	☒	☐	
8.6 Polarized Light Microscope			
8.6.1 Are PLMs equipped with the following:			
8.6.1.1 Light source and replacement bulbs?	☒	☐	
8.6.1.2 Binocular observation tube?	☒	☐	
8.6.1.3 Blue daylight filter?	☒	☐	
8.6.1.4 Oculars (10X)?	☒	☐	
8.6.1.5 Objectives: 10X, 20X and 40X (or similar)?	☒	☐	10x, 20x and 50x
8.6.1.6 10X dispersion staining objective?	☒	☐	
8.6.1.7 A 360 degree graduated rotating stage?	☒	☐	
8.6.1.8 Polarizer and analyzer aligned at 90 degrees to one another?	☒	☐	
8.6.1.9 Bertrand lens?	☒	☐	
8.6.1.10 Substage condenser with iris diaphragm?	☒	☐	
8.6.1.11 Accessory slot for compensator plate?	☒	☐	
8.6.1.12 First order red (550 nanometer) compensator plate?	☒	☐	
8.6.1.13 Crosshair reticle?	☒	☐	
8.6.1.14 Adjustment tools?	☒	☐	
8.6.2 Are microscopes well-maintained, and are all routine and non-routine maintenance activities recorded in instrument-specific logbooks?	☒	☐	

Instrument No.	Make	Model	Capabilities
1	Fisher	Stereomaster	Stereomicroscope
Serial Number	Zeiss	Axioskop 40	
Serial Number	Nikon	Eclipse 501pol	

Additional Comments:

LIBBY-SPECIFIC ASBESTOS LABORATORY ON-SITE AUDIT CHECKLIST

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8.0 POLARIZED LIGHT MICROSCOPY (PLM)	Yes	No	Comments
8.7 Refractive Index Liquids			
8.7.1 What refractive index liquids are available:			
8.7.1.1 High dispersion RI liquids from 1.620 to 1.640?	☒	☐	
8.7.1.2 1.550 high dispersion RI liquid?	☒	☐	
8.7.1.3 1.680 to 1.700 RI liquids?	☒	☐	
8.7.2 Are refractive index liquids checked daily for contamination?	☒	☐	
8.7.3 Are refractive index (RI) liquids calibrated monthly using a refractometer or other means (describe)?	☒	☐	
8.8 Reference Materials			
8.8.1 Does the laboratory maintain a library of asbestos and non-asbestos reference materials:			
8.8.1.1 NIST SRM 1866b (Ch, Am and Cr)?	☒	☐	
8.8.1.2 NIST SRM 1867a (Tr, Ac, and An)?	☒	☐	
8.8.1.3 USGS LA PEs:	☒	☐	
8.8.1.3.1 LA 0.2% by mass?	☒	☐	
8.8.1.3.2 LA 1.0% by mass?	☒	☐	
8.8.1.3.3 Other (List)?	☐	☒	
8.8.1.4 Controlled LA asbestos (USGS)?	☒	☐	
8.8.1.5 NIST testing round M12001 (winchite/richterite)?	☒	☐	
8.8.1.6 Non-asbestos (i.e., gypsum, calcite, and fiberglass)?	☒	☐	Talc, fiberglass, gypsum, etc.
8.9 PLM Calibration	**Yes**	**No**	**Comments**
8.9.1 Is PLM alignment performed daily:			
8.9.1.1 Alignment?	☒	☐	
8.9.1.2 Stage and objectives centered?	☒	☐	
8.9.1.3 Optic axis centered?	☒	☐	
8.9.1.4 Alignment of the upper/lower polars?	☒	☐	
8.9.1.5 Centered through substage condenser and iris diaphragm?	☒	☐	
8.9.2 Microscope adjustments verified and recorded prior to sample analyses?	☒	☐	Daily

Additional Comments:

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8.0 POLARIZED LIGHT MICROSCOPY (PLM)	Yes	No	Comments
8.10 PLM Analysis by NIOSH Method 9002:			
8.10.1 Does the laboratory perform PLM analyses on samples received from the Libby Superfund site? ***If answered "No" precede to Section 8.11 of the checklist.***	☐	☒	
8.10.2 Are samples visually examined by stereomicroscope for the following:			
8.10.2.1 Color?	NA	NA	
8.10.2.2 Homogeneity?	NA	NA	
8.10.2.3 Texture?	NA	NA	
8.10.3 Which of the following techniques are used to prepare samples for analysis:			
8.10.3.1 Mortar & pestle?	NA	NA	
8.10.3.2 Acid washing?	NA	NA	
8.10.3.3 Ashing?	NA	NA	
8.10.3.4 Solvents?	NA	NA	
8.10.3.5 Other (list)?	NA	NA	
8.10.4 For non-friable, organically bound samples requiring ashing and/or acid reduction, are all necessary weights and tare weights measured and recorded?	NA	NA	
8.10.5 Are slides prepared using the appropriate refractive index liquid(s) and scanned for asbestos fibers using the following optical properties:			
8.10.5.1 Morphology?	NA	NA	
8.10.5.2 Color?	NA	NA	
8.10.5.3 Refractive indices?	NA	NA	
8.10.5.4 Pleochroism?	NA	NA	
8.10.5.5 Birefringence?	NA	NA	
8.10.5.6 Extinction characteristics?	NA	NA	
8.10.5.7 Sign of elongation?	NA	NA	
8.10.5.8 Dispersion staining characteristics?	NA	NA	
8.10.6 Are the observed optical properties compared to Table 1 (Optical Properties of Asbestos Fibers) to determine the asbestos mineral present?	NA	NA	
8.10.7 Is a quantitative assessment of asbestos content made from both the gross and microscopic examinations?	NA	NA	
8.10.8 If no fibers are detected in a homogeneous samples are at least two additional slides prepared and analyzed prior to concluding no asbestos is present?	NA	NA	
8.10.9 Is at least one optical property recorded for fibers determined to be non-asbestos fibers?	NA	NA	

Additional Comments:

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8.0 POLARIZED LIGHT MICROSCOPY (PLM)	Yes	No	Comments
8.11 PLM-VE (SOP SRC-Libby-03)			
8.11.1 Stereomicroscopic Examination:			
8.11.1.1 Are all sample preparation activities performed within a HEPA-filtered hood?	☒	☐	
8.11.1.2 Is the entire sample transferred to an asbestos-free substrate for examination?	☒	☐	
8.11.1.3 Is the entire sample examined for homogeneity and the presence of suspect fibers?	☒	☐	
8.11.1.4 Are suspect fibers removed with fine forceps and mounted in the appropriate RI liquid for PLM analysis?	☒	☐	
8.11.1.5 Are the stereomicroscopic findings recorded:			
8.11.1.5.1 Sample appearance?	☒	☐	
8.11.1.5.2 Estimated percentage of LA?	☒	☐	
8.11.1.5.3 Estimated percentage of other asbestos types?	☒	☐	
8.11.2 Determination of Ashing the Sample:			
8.11.2.1 Are soil sample containing a significant amount of artifacts ashed prior to being prepared for random PLM mounts?	☒	☐	
8.11.2.1.1 Are samples ashed in a muffle furnace at approximately 480°C?	☒	☐	
8.11.2.1.2 Are the necessary gravimetric measurements recorded for the determination of “Pre-ash percent asbestos”?	☒	☐	
8.11.3 Slide Preparation for PLM-VE:			
8.11.3.1 Are a minimum of five random sub-samples mounted in the appropriate RI liquid (1.620-1.640) for measurement of LA optical properties?	☒	☐	
8.11.4 Supplemental Stereomicroscopic Evaluation:			
8.11.4.1 Following the random slide mount preparation, is the container agitated to cause the particulate to settle and asbestos fibers sort to the surface?	☒	☐	
8.11.4.2 Is the sample re-examined and the fiber pick procedure repeated?	☐	☒	

Additional Comments:

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8.0 POLARIZED LIGHT MICROSCOPY (PLM)	Yes	No	Comments
8.11.5 Classification of Asbestos Mineral Type:			
8.11.5.1 Using PLM is entire area of each prepared slide examined for asbestos, non-asbestos and matrix material?	☒	☐	
8.11.5.2 Is positive identification determined from the following six optical properties:			
8.11.5.2.1 Habit?	☒	☐	
8.11.5.2.2 Color & pleochroism (if present)?	☒	☐	
8.11.5.2.3 Both alpha and gamma Refractive indices?	☒	☐	
8.11.5.2.4 Birefringence?	☒	☐	
8.11.5.2.5 Extinction angle?	☒	☐	
8.11.5.2.6 Sign of elongation (positive-slow or negative fast)?	☒	☐	
8.11.5.3 Based on the optical properties, is asbestos classified into one of three categories:			
8.11.5.3.1 Libby Amphibole (LA)?	☒	☐	
8.11.5.3.2 Other Amphibole (OA)?	☒	☐	
8.11.5.3.3 Chrysotile (CH)?	☒	☐	
8.11.5.4 Is at least one optical property recorded for observed non-asbestos fibers?	☒	☐	
8.11.6 Quantification of Asbestos Content:			
8.11.6.1 Is asbestos reported as either mass or area percent for LA?	☒	☐	
8.11.6.2 Are other, non-LA, asbestos types reported in area percent?	☒	☐	
8.11.6.3 Are reference materials used to aid in visual estimation:			
8.11.6.3.1 LA PE reference materials (0.2% or 1.0%)?	☒	☐	
8.11.6.3.2 Are visual estimates of greater than 1% LA performed using calibration standards made in-house from NIST SRMs and NIST PEs?	☒	☐	
8.11.7 Are calibrated visual estimates determined from both the detailed stereomicroscopic observations and examination of the total area for all five random slide mounts?	☒	☐	
8.11.8 Are LA results reported in the appropriate bin categories:			
8.11.8.1 Non-detects recorded as Bin A?	☒	☐	
8.11.8.2 Less than 0.2% LA recorded as Bin B1?	☒	☐	
8.11.8.3 Greater than 0.2%, but less than 1% recorded as Bin B2?	☒	☐	
8.11.8.4 Equal to or greater than 1% recorded as Bin C, with the percentage recorded as a whole number?	☒	☐	

Additional Comments:

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8.0 POLARIZED LIGHT MICROSCOPY (PLM)	Yes	No	Comments
8.12 PLM-GRAV (SOP SRC-Libby-01)			
8.12.1 Stereomicroscopic Examination:			
8.12.2 Is the entire sample weighed and placed in an appropriate container?	☒	☐	
8.12.3 Does the stereomicroscopic examination include:			
8.12.3.1 Examination of multiple fields of view over the entire sample?	☒	☐	
8.12.3.2 Probing of the sample and breaking clumps where possible?	☒	☐	
8.12.3.3 Manipulation of the sample with the appropriate tools?	☒	☐	
8.12.3.4 Observation homogeneity, texture, friability, color and extent of any asbestos content?	☒	☐	
8.12.4 Doe the analyst refrain from segregating and weighing particles smaller than 2 - 3 mm (1/10 inch)?	☒	☐	
8.12.5 If no particles larger than 2 – 3 mm or larger are present, are one of the following recorded:			
8.12.5.1 No asbestos detected (ND)?	☒	☐	
8.12.5.2 Trace levels of asbestos observed, but not quantified (Tr)?	☒	☐	
8.12.6 Examination by PLM:			
8.12.7 Are tentatively identified asbestos particles examined by PLM as described in SOP SRC-Libby-03 (Section 8.12 of this checklist)?	☒	☐	
8.12.8 If asbestos particles are determined to be OA, are they further characterized:			
8.12.8.1 Amosite (AMOS)?	☒	☐	
8.12.8.2 Anthophylite (ANTH)?	☒	☐	
8.12.8.3 Crocidolite (CROC)?	☒	☐	
8.12.8.4 Unknown (UNK)?	☒	☐	
8.12.9 Is the total weight of each type of positively identified asbestos measured and recorded?	☒	☐	
8.12.10 Record Keeping:			
8.12.11 Is the data log sheet provided in Attachment 1 of the SOP used to record weights the initial (coarse fraction) and segregated asbestos?	☒	☐	

Additional Comments:

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8.0 POLARIZED LIGHT MICROSCOPY (PLM)	Yes	No	Comments
8.13 Quality Control Analyses			
8.13.1 Are the following types of QC analyses performed at the required frequencies:			
8.13.1.1 Laboratory duplicate self-check (LDS) at a frequency of 2%?	☒	☐	
8.13.1.2 Laboratory duplicate cross-check (LDC) at a frequency of 8%?	☒	☐	
8.13.2 For sample containing LA, are LDS and LDC analyses considered acceptable if:			
8.13.2.1 For LA results, within 1 Bin category?	☒	☐	
8.13.2.2 For LA results, %LA ≤1%?	☒	☐	
Note: For LA results greater than 1%, the laboratory should refer to their internal QA/QC system.			
8.13.3 Is the appropriate correction action taken when LDC or LDS analyses do not meet acceptance criteria (describe)?	☒	☐	
8.14 Standard Operating Procedures (SOPs)			
8.14.1 Are the applicable laboratory SOPs available and followed by laboratory personnel (list)?	☒	☐	

Document Title	Control No.	Description

8.15 Document Control	Yes	No	Comments
8.15.1 Are all logbooks, notebooks, forms, or other laboratory documents legible, accurate, and complete (list)?	☒	☐	

Document Title	Description/Comments

Additional Comments:

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9.0 DATA MANAGEMENT	PCM	TEM	PLM	Comments
9.1 Data Package Review and Assembly	**Yes**	**Yes**	**Yes**	
9.1.1 Are deliverables reviewed to ensure project-specific requirements are adhered to:				
9.1.1.1 Request for Modifications to Laboratory Activities?	NA	NA	NA	
9.1.1.2 Project-specific SOPs?	NA	NA	NA	
9.1.1.3 SAP Analytical Summaries?	NA	NA	NA	
9.1.1.4 Project-specific Electronic Data Deliverables (EDDs)?	NA	NA	NA	
9.1.1.5 Other (list)? _____	NA	NA	NA	
9.1.2 Are all deliverables reviewed for completeness and accuracy prior to being submitted:				
9.1.2.1 Hard copy deliverables?	NA	NA	NA	
9.1.2.2 Electronic deliverables?	NA	NA	NA	
9.1.3 Are all reviews documented?	NA	NA	NA	
9.2 Data Submission				
9.2.1 Is the submittal of electronic deliverables tracked and recorded:				
9.2.1.1 Date submitted?	NA	NA	NA	
9.2.1.2 Recipient?	NA	NA	NA	
9.2.2 Is the submittal of hard copy deliverables tracked and recorded:				
9.2.2.1 Date submitted?	NA	NA	NA	
9.2.2.2 Recipient?	NA	NA	NA	
9.3 Data Storage and Archiving				
9.2.3 Are electronic files archived onto suitable media on a frequent basis? How often? _____	NA	NA	NA	
9.2.4 Are all hardcopy data stored in a secured location with limited access (e.g., locking file cabinet)?	NA	NA	NA	

Additional Comments:

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10.0 QUALITY ASSURANCE/QUALITY CONTROL	PCM	TEM	PLM	Comments
10.1 Laboratory Certifications	**Yes**	**Yes**	**Yes**	
10.1.1 Is the laboratory accredited for asbestos analysis under the National Voluntary Laboratory Accreditation Program (NVLAP):				
10.1.1.1 Asbestos Fiber Analysis (TEM Method)?	NA	☒	NA	
10.1.1.2 Asbestos Fiber Analysis (PLM Method)?	NA	NA	☒	
10.1.2 Is the laboratory accredited for asbestos analysis under the American Industrial Hygiene Association (AIHA), and does it participate in the National Institute for Occupational Safety and Health (NIOSH) Proficiency Analytical Testing (PAT) Program?	NA	NA	NA	
10.2 Training				
10.2.1 Have all analysts undergone training on the proper usage of the equipment and instrumentation used in the respective areas?	NA	☒	☒	
10.2.2 Have all analysts demonstrated proficiency through the preparation and/or analysis of standards or samples of known values?	NA	☒	☒	
10.2.3 Are training records maintained in analyst-specific files?	NA	☒	☒	
10.3 Internal Audits				
10.3.1 Are internal audits conducted on an annual basis using an appropriate checklist?	NA	☒	☒	
10.3.1.1 Are internal audit reports available for review?	NA	☒	☒	
10.4 Corrective/Preventive Action:				
10.4.1 Can the laboratory demonstrate the sequence of problem identification, corrective action, and resumption of duties?	NA	☒	☒	
10.5 Quality Records				
10.5.1 Are SOPs available in the applicable areas for all laboratory-specific procedures?	NA	☒	☒	Stored in three-ring binders.
10.5.2 Does the laboratory have a Quality Assurance Manual/Plan?	NA	☒	☒	
10.5.3 Does the laboratory compile monthly quality assurance/quality control reports?	NA	☒	☒	
10.6 Environmental Controls/Laboratory Monitoring				
10.6.1 Does the laboratory conduct an environmental monitoring program?	NA	☒	☒	
10.6.2 Is quarterly air monitoring performed in all laboratory areas?	NA	☒	☒	
10.6.2.1 Are the collected samples analyzed by TEM with a target analytical sensitivity of 0.005 structures/cc?	NA	☒	☒	
10.6.2.2 If LA is detected, are the affected areas thoroughly cleaned and a new set of samples collected and analyzed?	NA	☒	☒	
Laboratory Modification LB-000085A				

Additional Comments: