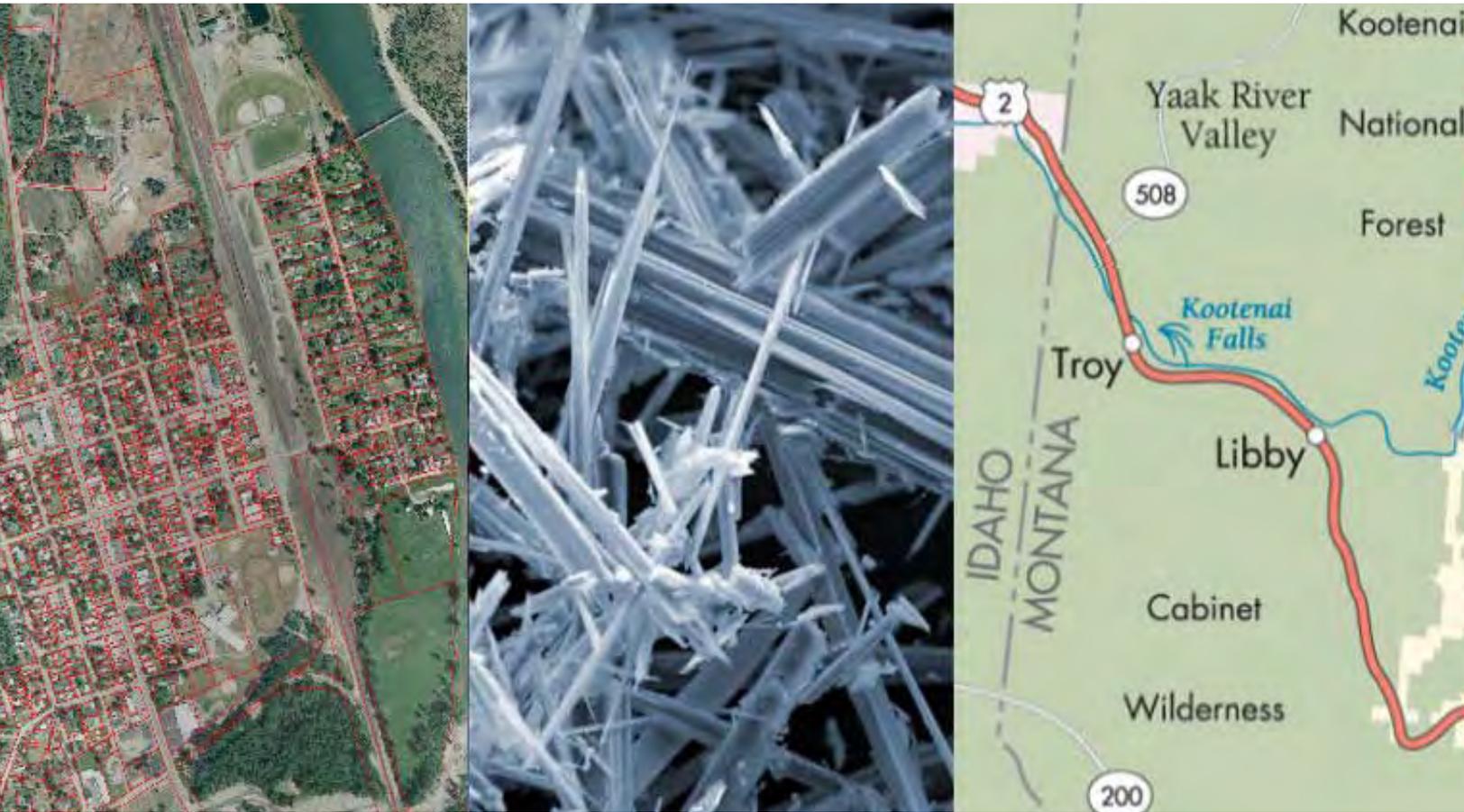


Final Quarter 5 Memorandum Outdoor Ambient Air Study

Operable Unit Number 7 of the
Libby Asbestos Superfund Site



Prepared for:

Montana Department of Environmental Quality

Helena Montana

Prepared by:

Tetra Tech

Helena, Montana

February 2011

**FINAL
QUARTER 5 MEMORANDUM
OUTDOOR AMBIENT AIR STUDY**

**Operable Unit Number 7
of the Libby Asbestos Superfund Site**

February 22, 2011

Prepared for:

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LIST OF ACRONYMS AND ABBREVIATIONS

COC	Chain-of-custody
DEQ	Montana Department of Environmental Quality
EDD	Electronic data deliverables
ESAT	Environmental Services Assistance Team
FSDS	Field sampling data sheet
ISO	International Organization for Standardization
LA	Libby amphibole
OU7	Operable Unit Number 7
QC	Quality control
SOP	Standard operating procedure
SRC	Syracuse Research Corporation
TEM	Transmission electron microscopy
TFO	Troy Field Office
Tetra Tech	Tetra Tech EM Inc.

1.0 INTRODUCTION

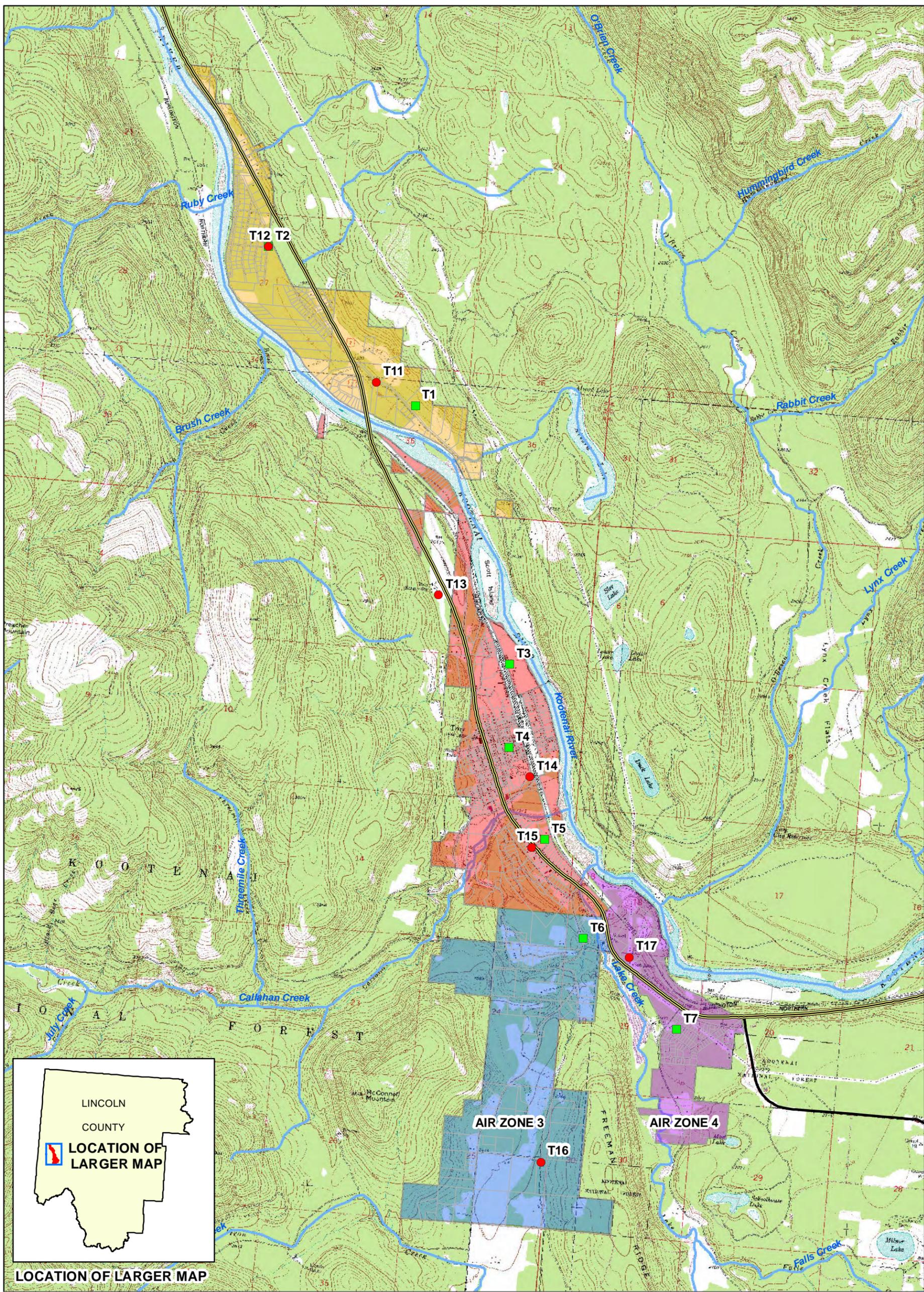
As part of the remedial investigation in Operable Unit Number 7 (OU7), which consists of the residential and commercial areas in and around Troy, Montana of the Libby Asbestos Superfund Site, Tetra Tech EM Inc. (Tetra Tech) continued to conduct outdoor ambient air monitoring for the Montana Department of Environmental Quality (DEQ) to evaluate the presence of Libby Amphibole (LA) asbestos in outdoor ambient air throughout OU7.

The outdoor ambient air monitoring program implemented by Tetra Tech is based on the Remedial Investigation Work Plan, Outdoor Ambient Air Study (Tetra Tech 2009a) and the associated health and safety plan (Tetra Tech 2009b) and includes monitoring of ambient air in four distinct “air zones” across OU7. After taking into account variable wind patterns, Tetra Tech established seven initial monitoring station locations in the four air zones during year 1 to evaluate human health exposure scenarios throughout OU7. Year 1 began on October 30, 2009 and ended on October 27, 2010. Monitoring events were reported by quarter (1 through 4) with 9 sampling periods per quarter. As the ambient air monitoring continued into year 2, six of the seven station locations from year 1 were moved to different locations to further support data collection efforts for the OU7 human health risk assessment.

This Quarter 5 Memorandum summarizes activities of the outdoor ambient air monitoring program related to placement of monitoring stations, maintenance performed, monitoring activities, issues encountered, and resolutions from November 10, 2010 through February 2, 2011. This report also provides a summary of validated ambient air data available at the time this document was prepared (sampling periods 24 through 36 [collected during quarter 3 and quarter 4 of year 1]). Sampling data from periods 24 through 36 were validated during quarter 5 using methods described in Section 3.1 and the results are provided in Section 3.2.

2.0 QUARTER 5 AMBIENT AIR MONITORING PLAN IMPLEMENTATION

The Quarter 5 OU7 monitoring was initiated on November 10, 2010 and was the first quarter of year 2 monitoring. Initial field activities such as selection of site monitoring stations and assembly and installation of monitoring equipment are described in the Quarter 1 Memorandum (Tetra Tech 2010). At the start of quarter 5 (beginning of year 2), six of the seven monitoring stations were moved from their year 1 locations to new locations in order to collect further data in support of the OU7 human health risk assessment. Figure 2-1 shows both the year 1 and year 2 monitoring station locations and Table 2-1 provides the general and detailed locations and rationale for the seven year 2 station locations.



LEGEND

- OU 7 AMBIENT AIR SAMPLE STATION - YEAR1
- OU 7 AMBIENT AIR SAMPLE STATION - YEAR2
- AMBIENT AIR ZONES**
- ZONE 1
- ZONE 2
- ZONE 3
- ZONE 4



LIBBY ASBESTOS SUPERFUND SITE
OPERABLE UNIT 7

**FIGURE 2-1
YEARS 1 AND 2
AMBIENT AIR MONITORING
STATION LOCATIONS**

TABLE 2-1
YEAR 2 OUTDOOR AMBIENT AIR SAMPLING LOCATIONS

Station Number	Location*	Purpose
T11	Community exposure site and middle portion of OU7, located at the small community area NE of the Kootenai River	This site is used to evaluate LA concentrations at the small community area and the northern boundary of OU7
T12	Upwind and downwind site near the NW border of OU7	This site is used to evaluate LA concentrations at the northernmost boundary of OU7 and confirm if any LA is entering or leaving OU7
T13	City of Troy northern site	This site is used to evaluate LA concentrations north of the Troy community
T14	City of Troy population exposure site	This site is used to evaluate LA concentrations in the Troy community (specifically in the population center).
T15	City of Troy southern site	This site is used to evaluate LA concentration south of the Troy community
T16	SW upwind and downwind site	This site is used to evaluate LA concentrations at the southwestern boundary of the OU and confirm if any LA is entering or leaving OU7
T17	SE upwind and downwind site	This site is used to evaluate LA concentrations at the southeastern boundary of the OU and confirm if any LA is entering or leaving OU7
TXXQC	Rotating co-located sampling station to each of the seven sampling locations	Co-located sampling station to evaluate analytical variability at each of the seven station locations

Notes:

LA	Libby Amphibole	SE	Southeast
NE	Northeast	SW	Southwest
NW	Northwest	OU	Operable Unit
XX	Station Location Number	QC	Quality Control

* Predominant winds in the area blow from the southeast and northwest. Stations on the southeast and northwest boundaries of OU7 act as upwind and downwind receptors depending on wind direction. A summary of historic meteorological conditions is in Section 4.4.1. of the Ambient Air RI Work Plan (Tetra Tech 2009a).

During quarter 5 monitoring, none of the seven fixed monitoring stations were required to be moved to allow for property owner activities or overloading issues; however, some mechanical issues were encountered related to pump faults. Section 2.1 provides the quarter 5 sampling schedule and Section 2.2 presents a summary of issues encountered and resolutions to those issues.

2.1 QUARTER 5 SAMPLING SCHEDULE

Quarter 5 ambient air sampling consisted of nine five-day sampling periods generally separated by five off days between each period. Between some sampling periods, the five days were modified by one or two days to adjust for weather or scheduling issues, however, the overall sampling schedule was not impacted. Quarter 5 sampling began with period 37 on November 10, 2010 and ended with period 45 on February 2, 2011. Table 2-2 provides a summary of sampling dates for periods 37 through 45.

**TABLE 2-2
OU7 OUTDOOR AMBIENT AIR SAMPLING
QUARTER 5 SAMPLE PERIOD DATES**

QUARTER 5 SAMPLE PERIODS	
Sample Period 37	November 10, 2010 through November 14, 2010
Sample Period 38	November 20, 2010 through November 24, 2010
Sample Period 39	December 1, 2010 through December 5, 2010
Sample Period 40	December 10, 2010 through December 14, 2010
Sample Period 41	December 20, 2010 through December 24, 2010
Sample Period 42	December 30, 2010 through January 3, 2011
Sample Period 43	January 9, 2011 through January 13, 2011
Sample Period 44	January 19, 2011 through January 23, 2011
Sample Period 45	January 29, 2011 through February 2, 2011

2.2 MODIFICATIONS, ISSUES, AND RESOLUTIONS

During quarter 5 sampling, two modifications to field data collection were implemented (Troy Field Office [TFO]-00003 and TFO-00004). Several mechanical (pump) issues arose. Section 2.2.1 presents a summary of the two TFO's implemented and Section 2.2.2 provides a discussion of quarter 5 issues and the resolutions to those situations.

2.2.1 Modifications to Ambient Air Sampling Protocol

Prior to initiating quarter 5 sampling, TFO-00003 (Ambient Air Station Locations) and TFO-00004 (Ambient Air QC Station Locations) were implemented. TFO-00003 called for the ambient air monitoring stations to be relocated for the year 2 sampling for more comprehensive coverage of the four "air zones" identified in OU7. This modification was implemented to provide additional data to support the human health risk analysis related to ambient air exposure. Year 2 monitoring station locations are provided on Figure 2-1 and are described in Table 2-1. TFO-00003 is provided in Appendix B.

TFO-00004 provided modifications to sampling protocol involving the rotation of the co-located sampling station (Station TQC) among all of the seven ambient air sampling stations for year 2 sampling. Analytical protocol will not be impacted; however, moving the co-located sampling station will allow for an evaluation of analytical variability at all seven monitoring stations.

Co-located field samples were collected (station TQC) from rotating station locations for each sample period throughout quarter 5. Station TQC was placed next to the monitoring stations. Station TQC was moved after each sampling period (beginning with monitoring station T11) and was cycled through each of the remaining stations (T12, T13, T14, T15, T16, T17). After cycling through station 17, station TQC was returned to station T11 to start the process anew. Cycling of station TQC will continue throughout year 2 so that a minimum of 5 co-located samples will be collected at each of the seven monitoring stations. TFO-00004 is provided in Appendix B.

2.2.2 Pump Failures and Repairs

The primary issue noted during quarter 5 sampling was the five pump failures that were generally attributed to pump faults related to software, not battery failures. When failures were identified, Tetra Tech was often able to minimize data loss by reprogramming the pump and re-sampling with a new cassette and sample number. However, on three occasions, Tetra Tech had to exchange the pump for a working backup pump, using a new cassette and sample number. The Field Sampling Data Sheets (FSDS) were used to record the replacement samples and revised sample periods. Only one sample was deemed unusable during periods 37 to 45 from pump malfunctions (Period 41 station T13) as total air volume collected was insufficient to allow analysis.

To address mechanical or electrical pump malfunctions, Tetra Tech arranged for the pump manufacturer to repair the pumps that malfunctioned during quarter 5. During this reporting period, 3 of the 11 pumps were sent in for repairs that included reprogramming. To date, the manufacturer has returned two of the three pumps to the Troy office where they are now being used for backup pumps in the event of further pump failures.

3.0 OUTDOOR AMBIENT AIR MONITORING DATA

During this reporting period, samples from periods 37 through 45 were submitted to the Environmental Services Assistance Team (ESAT) laboratory for Transmission Electron Microscopy (TEM) analyses. All sample filter cassettes were shipped to the ESAT Laboratory in Golden, Colorado, under chain-of-custody (COC) protocol, where the samples were stored in desiccators to prevent the growth of mold prior to analysis. Complete analytical data from periods 37 through 45 have not been received and/or validated and are not included in this memorandum.

During quarter 5, sample results for periods 24 to 36 were validated. The following sections provide a description of the data validation procedures, data validation findings, and a summary of LA detections noted during sample periods 24 to 36.

3.1 DATA VALIDATION PROCEDURES AND FINDINGS

During quarter 5, Tetra Tech conducted data review and data entry verification of the outdoor ambient air TEM data from sampling periods 24 through 36 in accordance with standard operating procedure (SOP) EPA-LIBBY-09 (revision 1) (Syracuse Research Corporation [SRC] 2008). A copy of this SOP is contained in Appendix F of the Remedial Investigation Work Plan, Outdoor Ambient Air Study (Tetra Tech 2009a). Tetra Tech followed the data review and verification procedures outlined in this SOP, with minor deviations for OU7. An OU7-specific deviation is that the SOP refers to the Libby 2 Database; however, OU7 data are stored in the LibbyOU7TTCombined database using the same database protocols. Approximately 25 percent of the period 24 through 36 data records underwent review and verification. The records were selected in accordance with the SOP process for selecting TEM records for review and verification.

Tetra Tech's verification and validation process has three steps: (1) the selection of data records for review and verification, (2) a review of the original laboratory bench sheets, and (3) verification of the transfer of results from the bench sheets onto the electronic data deliverables, and verification that the electronic data were uploaded properly to the LibbyOU7TTCombined database. Tetra Tech reviewed field quality control (QC) sample results for adherence to minimum frequency requirements and procedures and QC limits specified in SOP LB-000029b (SRC 2008). The data verification and validation process is described in detail in the subsections below.

3.1.1 Selection of TEM Records for Review

SOP EPA-Libby-09 specifies review and verification of a minimum of 10 percent of the sample records. Tetra Tech reviewed approximately 25 percent of the records for periods 24 through 36. The decision to exceed this minimum and review 25 percent of the records was in part due to the high incidence of significant errors (e.g., incorrect transfer of structure counts from bench sheets to electronic data deliverables [EDD]) noted during analysis of early samples, and in part because the structure of the database was recently changed at the request of EPA and a number of data formatting and structural issues have arisen as a result.

Tetra Tech will consult with DEQ regarding reducing the percentage of samples for validation from 25 to 10 percent during year 2. The reduction is based on an increased confidence in laboratory reporting and is in line with the SOP specifications.

Records were queried from the LibbyOU7TTCombined database using applicable selection criteria from the SOP EPA-Libby-09 (Revision 1) (SRC 2008). The criteria are used to select a representative subset of the sample records for review and verification on the basis of analyst, detected results, and nondetected results. The record selection process is described in detail in the SOP EPA-Libby-09 (Revision 1) (SRC 2008).

3.1.2 Consistency Review of Laboratory Bench Sheets

Tetra Tech inspected the information recorded on the original hand-written laboratory bench sheets in accordance with the consistency review of laboratory bench sheets procedure outlined in Section 5 of SOP EPA-LIBBY-09 (revision 1) (SRC 2008), modified as needed for OU7. The bench sheets were reviewed to identify any data omissions, apparent inconsistencies, or potential errors in structure. The review determined whether the raw structure data were recorded in accordance with International Organization for Standardization (ISO) 10312 counting rules (as modified by all applicable Libby laboratory modifications).

Corrective Action – Tetra Tech summarized all apparent inconsistencies, omissions, and suspected errors, and provided them to ESAT, which forwarded them to the appropriate labs for response. The ESAT laboratory determined which items were authentic errors that required correction. None of the inconsistencies, omissions, or suspected errors identified during the quarter 5 data review and verification affected the outcome of interest to the investigation (i.e., the number of LA structures or the concentration of LA). Tetra Tech anticipates the analytical laboratories may submit revised bench sheets to ESAT. If

this occurs, Tetra Tech will download the revised documents provided by ESAT, review them, and replace the previous ones as appropriate.

3.1.3 Verification of Data Transfer from Bench Sheet to Database

To ensure that data from laboratory bench sheets are transferred, through the EDDs, into the LibbyOU7TTCombined database without error or omission, Tetra Tech compared selected analysis-specific information in the laboratory bench sheets to that in the EDD. Tetra Tech followed the verification of data transfer procedure outlined in Section 6.0 of SOP EPA-LIBBY-09 (revision 1) (SRC 2008), modified as needed for OU7. The bench sheets include the laboratory COC form, sample check-in form, preparation log, and hand-written data record sheets. This process compared analysis-specific information in the EDD to the original laboratory job documentation (e.g., internal laboratory COC; preparation logs; bench sheets, etc.); and included verifying (by recalculation) the reported air sensitivities for amphibole and chrysotile; the area analyzed; and for indirect preparations, the indirect preparation dilution factor. Using the bench sheets, Tetra Tech also recounted the countable LA structures across all grid openings evaluated and compared this number (and the calculated concentrations) to the total number of LA structures in the EDD.

The final step in the process was to verify that the data were loaded into the LibbyOU7TTCombined database without error or omission. This was done for the records reviewed for periods 24 through 36, but not for records from previous periods since the data had not been loaded into the database at the time of the verification.

Corrective Action – Tetra Tech summarized all apparent inconsistencies, omissions, and suspected errors, and provided them to ESAT, which forwarded them to the appropriate laboratories for response. The ESAT laboratory determined which items were authentic errors that require correction. None of the inconsistencies, omissions, or suspected errors identified during the quarter 5 data review and verification affected the outcome of interest to the investigation (i.e., the number of LA structures or the concentration of LA). Tetra Tech anticipates the analytical laboratories may submit revised bench sheets and/or EDDs to ESAT. If this occurs, Tetra Tech will download the revised documents provided by ESAT, review them, and replace the previous ones as appropriate.

3.1.4 Review of Field and Laboratory Quality Control Sample Results

Review of field and laboratory QC sample results, including implementation of corrective actions, will be completed once all year one QC sample data are successfully loaded into the LibbyOU7TTCombined database. It is expected that the entire year 1 field QC data set will be available in the LibbyOU7TTCombined database during quarter 6 and will allow for a complete review and implementation of corrective actions, if necessary.

Tetra Tech will review field QC samples (including co-located samples and field blanks) and the laboratory reviews the laboratory QC samples for adherence to the minimum frequency requirements set forth in the work plan (Tetra Tech 2009a) and in SOP LB-000029b (SRC 2007), and for conformance with the QC limits specified in SOP LB-000029b (SRC 2007).

For the co-located field samples, Tetra Tech will use the same statistical comparison test used for the Libby ambient air study (SRC 2009). Each co-located sample pair will be compared using the Poisson rate test (Nelson 1982), included as Attachment 4 to SOP LB-00029b (SRC 2007), to determine whether the results are statistically different from one other at the 95 percent confidence level. The Poisson rate test is suitable for this analysis because fiber counts on TEM grids are considered independent and random.

Corrective Action – For laboratory QC sample exceptions to QC criteria, the appropriate corrective actions are described in detail in LB-00029b (SRC 2007). For co-located field sample pairs, Tetra Tech will review the Poisson rate test results and investigate the basis for any statistical differences and the need for any appropriate corrective actions. Poisson rate test results that indicate the co-located samples are similar at the 95 percent confidence interval will be considered good. Test results in the 90 to 95 percent confidence interval range will be considered acceptable, and test results that fall below the 90 percent confidence interval will be considered poor for similarity. If test results are below the 90 percent interval, Tetra Tech will investigate the basis for the discrepancy and take corrective action in sampling and/or analysis of the samples. Tetra Tech will generally report the results from the original sample (as opposed to co-located sample or laboratory recount sample results). A possible exception to this rule is an ESAT interlab recount result. If, during validation, an interlab recount result is deemed to be more representative than the original result, Tetra Tech will discuss these findings with DEQ and report whichever result is determined to be most representative.

Tetra Tech has reviewed and will continue to review the results for all field blanks for adherence to the QC limits specified in SOP LB-000029b (SRC 2007). All of the field blank results to date are within QC limits.

3.2 AMBIENT AIR LA DETECTIONS

LA fibers were detected in a single sample from period 24 to 36 samples at one station location. Table C-1 (Appendix C) presents a summary of LA detection results for all sampling periods through year 1. LA detections by station for periods 24-36 are summarized below:

Station T5: Detection of LA fibers during Period 35 (concentration of 3.97 E-05)

The remaining samples collected during periods 24 to 36 had no detectable LA fibers. Complete analytical results and a summary of validation findings for sample periods 24 to 36 are provided in Appendix C.

4.0 REFERENCES

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APPENDICES

(Appendices are provided on the attached disk)

APPENDIX A

**QUARTER 5 OUTDOOR AMBIENT AIR SAMPLING
FIELD SAMPLING DATA SHEETS (FSDS)
NOVEMBER 10, 2010 THROUGH FEBRUARY 2, 2011**

APPENDIX B

**OUTDOOR AMBIENT AIR SAMPLING MODIFICATIONS
(TFO-00003 and TFO-00004)**

APPENDIX C

**YEAR 1 CUMULATIVE AMBIENT AIR MONITORING
VALIDATED ANALYTICAL RESULTS**