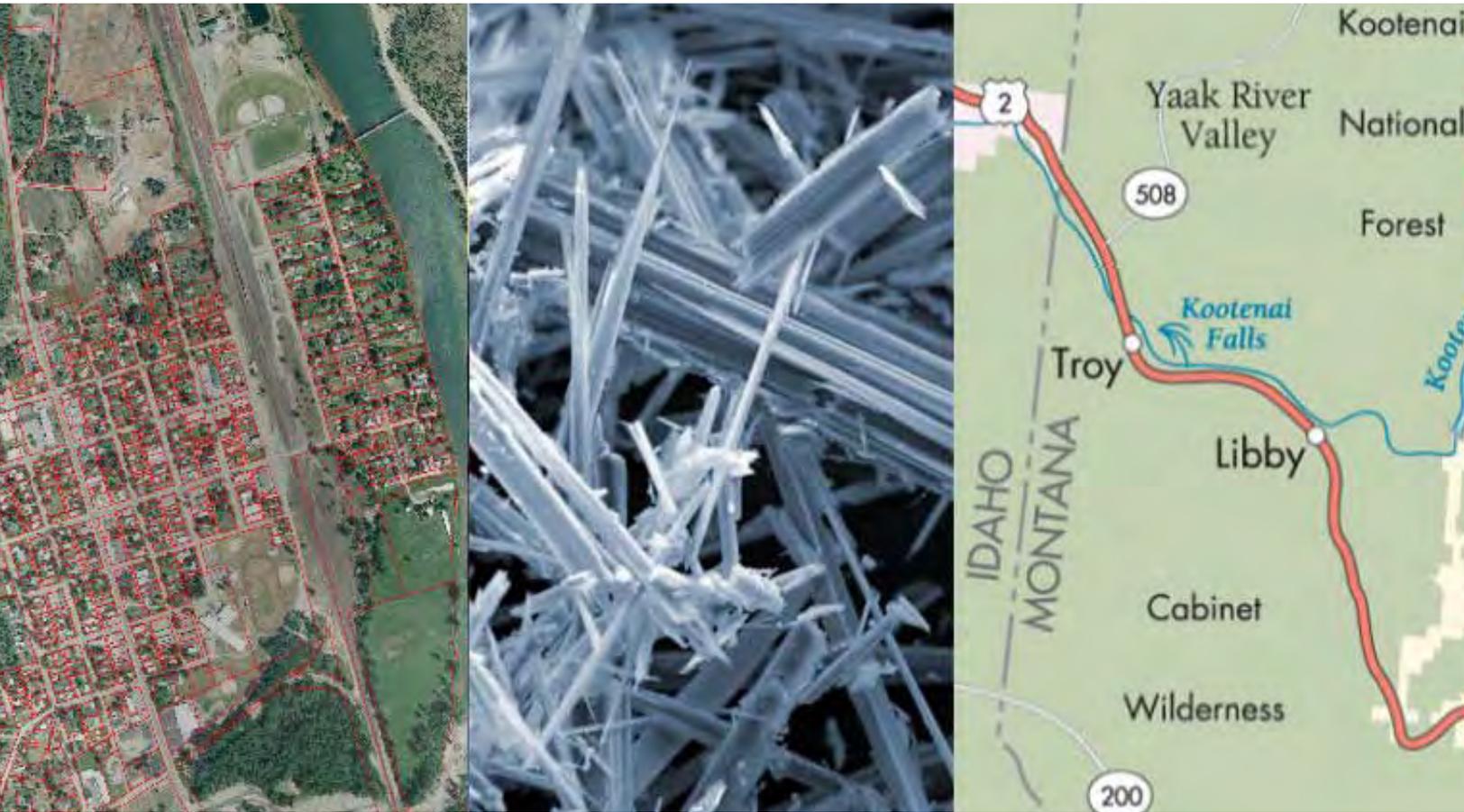


Final Quarter 6 Memorandum Outdoor Ambient Air Study

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

August 2011

**FINAL
QUARTER 6 MEMORANDUM
OUTDOOR AMBIENT AIR STUDY**

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

August 2, 2011

Prepared for:

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
Remediation Division
P.O. Box 200901
Helena, Montana 59620

Contract Number 407026
Task Order Number 76

Prepared by:

TETRA TECH EM INC.
Power Block Building, Suite 612
7 West 6th Avenue
Helena, Montana 59601
(406) 442-5588

CONTENTS

<u>Section</u>	<u>Page</u>
ACRONYMS AND ABBREVIATIONS	ii
1.0 INTRODUCTION	1
2.0 QUARTER 6 AMBIENT AIR MONITORING PLAN IMPLEMENTATION.....	1
2.1 QUARTER 6 SAMPLING SCHEDULE	4
2.2 MODIFICATIONS, ISSUES, AND RESOLUTIONS.....	4
3.0 OUTDOOR AMBIENT AIR MONITORING DATA	5
3.1 DATA VALIDATION PROCEDURES AND FINDINGS	5
3.1.1 Selection of TEM Records for Review	6
3.1.2 Consistency Review of Laboratory Bench Sheets	6
3.1.3 Verification of Data Transfer from Bench Sheet to Database	6
3.1.4 Review of Field and Laboratory Quality Control Sample Results.....	7
3.2 AMBIENT AIR LA DETECTIONS	8
4.0 REFERENCES	9

Appendices (Provided on attached CD)

A	QUARTER 6 OUTDOOR AMBIENT AIR SAMPLING FIELD SAMPLING DATA SHEETS (FSDS) FEBRUARY 9, 2011 THROUGH MAY 4, 2011
B	QUARTER 1 THROUGH QUARTER 5 CUMULATIVE AMBIENT AIR MONITORING VALIDATED ANALYTICAL RESULTS

TABLES

<u>Table</u>	<u>Page</u>
2-1 Year 2 OU7 Outdoor Ambient Air Sampling Locations	3
2-2 OU7 Outdoor Ambient Air Sampling Quarter 6 Sample Period Dates	4

FIGURE

<u>Figure</u>	<u>Page</u>
2-1 Year 2 OU7 Ambient Air Monitoring Station Locations	2

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
Tetra Tech	Tetra Tech EM Inc.

1.0 INTRODUCTION

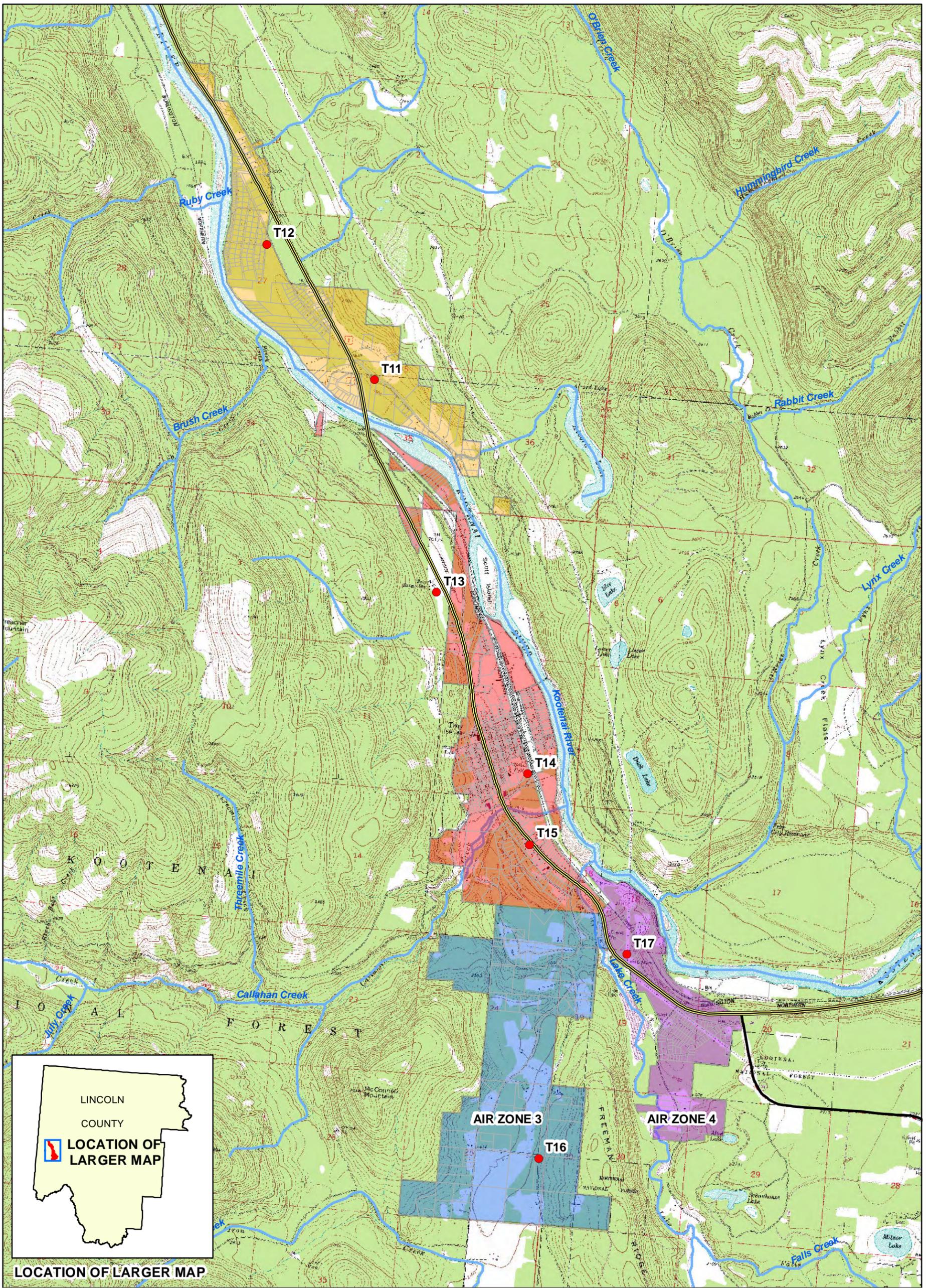
As part of the remedial investigation in Operable Unit Number 7 (OU7) of the Libby Asbestos Superfund Site, consisting of the residential and commercial areas in and around Troy, Montana, Tetra Tech EM Inc. (Tetra Tech) continued to conduct outdoor ambient air monitoring for the Montana Department of 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 6 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 February 9, 2011 through May 4, 2011. This report provides a summary of validated ambient air data available at the time this document was prepared (sampling periods 37 through 45 [collected during quarter 5]). Sampling data from periods 37 through 45 were validated during quarter 6 using methods described in Section 3.1 and the results are provided in Section 3.2.

2.0 QUARTER 6 AMBIENT AIR MONITORING PLAN IMPLEMENTATION

Quarter 6 monitoring was initiated on February 9, 2011 and was the second 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 the year 2 monitoring station locations and Table 2-1 provides the general and detailed locations and rationale for the seven year 2 station locations.



LOCATION OF LARGER MAP

LEGEND

- OU7 AMBIENT AIR MONITORING STATION - YEAR 2
- AMBIENT AIR ZONES**
- ZONE 1
- ZONE 2
- ZONE 3
- ZONE 4



LIBBY ASBESTOS SUPERFUND SITE
OPERABLE UNIT 7

**FIGURE 2-1
YEAR 2 OU7
AMBIENT AIR MONITORING
STATION LOCATIONS**

TABLE 2-1
YEAR 2 OU7 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 6 monitoring, none of the seven fixed monitoring stations needed 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 6 sampling schedule and Section 2.2 presents a summary of issues encountered and resolutions to those issues.

2.1 QUARTER 6 SAMPLING SCHEDULE

Quarter 6 ambient air sampling consisted of nine 5-day sampling periods generally separated by 5 off days between each period. Between some sampling periods, the 5 days were modified by 1 or 2 days to adjust for weather or scheduling issues, however, the overall sampling schedule was not impacted.

Quarter 6 sampling began with period 46 on February 9, 2011 and ended with period 54 on May 4, 2011. Table 2-2 provides a summary of sampling dates for periods 46 through 54.

**TABLE 2-2
OU7 OUTDOOR AMBIENT AIR SAMPLING
QUARTER 6 SAMPLE PERIOD DATES**

QUARTER 6 SAMPLE PERIODS	
Sample Period 46	February 9, 2011 through February 13, 2011
Sample Period 47	February 19, 2011 through February 23, 2011
Sample Period 48	March 1, 2011 through March 5, 2011
Sample Period 49	March 11, 2011 through March 15, 2011
Sample Period 50	March 21, 2011 through March 25, 2011
Sample Period 51	April 1, 2011 through April 5, 2011
Sample Period 52	April 10, 2011 through April 14, 2011
Sample Period 53	April 21, 2011 through April 25, 2011
Sample Period 54	April 30, 2011 through May 4, 2011

2.2 MODIFICATIONS, ISSUES, AND RESOLUTIONS

During quarter 6 sampling, no modifications to field data collection were implemented; however, several mechanical (pump) issues arose. The text below presents a discussion of quarter 6 issues and the resolutions to those situations.

The primary issue noted during quarter 6 sampling was pump failures 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 two occasions, Tetra Tech tried to exchange the failed pump with a working backup pump, using a new cassette and sample number. In both instances, the backup pump also failed and the samples were lost. The two lost samples were from sample periods 50 and 51 and both were from station T12. Field Sampling Data Sheets (FSDS) (Appendix A) were used to record the sampling issues, replacement samples and revised sample periods.

To address mechanical or electrical pump malfunctions, Tetra Tech arranged for the pump manufacturer to repair the pumps that malfunctioned and could not be reprogrammed during quarter 6. During this reporting period, 2 of the 11 pumps were sent in for repairs that included reprogramming. To date, the manufacturer has not returned either of the two pumps to the Troy field office.

3.0 OUTDOOR AMBIENT AIR MONITORING DATA

During this reporting period, samples from periods 46 through 54 were submitted to the Environmental Services Assistance Team (ESAT) laboratory for Transmission Electron Microscopy (TEM) analyses. All sample filter cassettes were shipped under chain-of-custody (COC) protocol to the ESAT Laboratory in Golden, Colorado, where the samples were stored in desiccators to prevent the growth of mold prior to analysis. Complete analytical data from periods 46 through 54 have not been received and/or validated and are not included in this memorandum.

During quarter 6, sample results for periods 37 to 45 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 37 to 45.

3.1 DATA VALIDATION PROCEDURES AND FINDINGS

During quarter 6, Tetra Tech conducted data review and data entry verification of the outdoor ambient air TEM data from sampling periods 37 through 45 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 LibbyTTOU7Field database using the same database protocols. Approximately 10 percent of the period 37 through 45 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 LibbyTTOU7Field 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 10 percent of the records for periods 37 through 45. Records were queried from the LibbyTTOU7Field 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 requiring 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 electronic data deliverables (EDDs), into the LibbyTTOU7Field 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 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 LibbyTTOU7Field database without error or omission. This was done for the records reviewed for periods 37 through 45.

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 requiring correction. None of the inconsistencies, omissions, or suspected errors identified during the 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 QC sample data are successfully loaded into the LibbyTTOU7Field database. It is expected that the entire field QC data set for quarters 1 through 5 will be available in the LibbyTTOU7Field database during quarter 7 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 of 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 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 indicating 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 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 has reviewed and will continue to review the results for all field blanks for adherence to the QC limits specified in SOP LB-00029b (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 co-located sample during period 44. The real sample collected at the same time and station location was non-detect for LA. Table B-1 (Appendix B) presents a summary of LA detection results for all sampling periods through quarter 5. LA detections by station for periods 37-45 are summarized below:

Station T11QC: Detection of LA fibers during period 44 (concentration of 7.76 E-05). *Note: The corresponding real sample collected at station T11 (period 44) was non-detect for LA fibers.*

The remaining samples collected during periods 37 to 45 had no detectable LA fibers. Complete analytical results and a summary of validation findings for sample periods 37 to 45 are provided in Appendix B.

4.0 REFERENCES

- Nelson, WB. 1982. Applied Life Data Analysis. John Wiley and Sons. Hoboken, NJ.
- Syracuse Research Corporation (SRC). 2007. Request for Modification to Laboratory Activities (LB-000029B). April.
- SRC. 2008. Standard Operating Procedure for TEM Data Review and Data Entry Verification. March.
- SRC. 2009. Summary of Outdoor Ambient Air Monitoring For Asbestos at the Libby Asbestos Superfund Site (October 2006 to June 2008). February.
- Tetra Tech EM Inc. (Tetra Tech). 2009a. Remedial Investigation Work Plan, Outdoor Ambient Air Study, Operable Unit 7 of the Libby Asbestos Superfund Site. October.
- Tetra Tech. 2009b. Operable Unit 7 Ambient Air Study Health and Safety Plan. October.
- Tetra Tech. 2010. First Quarter Memorandum, Outdoor Ambient Air Study, Operable Unit 7 of the Libby Asbestos Superfund Site. February.

APPENDICES

(Appendices are provided on the attached disk)

APPENDIX A

**QUARTER 6 OUTDOOR AMBIENT AIR SAMPLING
FIELD SAMPLING DATA SHEETS (FSDS)
FEBRUARY 9, 2011 THROUGH MAY 4, 2011**

APPENDIX B

**QUARTER 1 THROUGH QUARTER 5 CUMULATIVE AMBIENT AIR MONITORING
VALIDATED ANALYTICAL RESULTS**