TETRA TECH

Erik Armistead
Project Manager

April 27, 2009

Mr. Rich Fetzer
On-Scene Coordinator
U.S. Environmental Protection Agency Region 3
1650 Arch Street
Philadelphia, Pennsylvania 19103

Subject: Sampling and Analysis Plan for Bioavailability Study Sampling at the Former Mohr Orchard Site
North Whitehall Township, Pennsylvania
EPA Contract No. EP-S3-05-02
TDD No. E33-020-08-07-025
Document Tracking No. 0714

Dear Mr. Fetzer:

Tetra Tech EM Inc. (Tetra Tech) is submitting the sampling and analysis plan (SAP) for the Former Mohr Orchard site located in North Whitehall Township, Pennsylvania. The SAP summarizes the planned activities for the bioavailability study soil sampling at the site. If you have any questions regarding this report, please call me at (267) 446-2837.

Sincerely,

Erik Armistead
Project Manager

Enclosure

cc: TDD File

SAMPLING AND ANALYSIS PLAN

FOR BIOAVAILABILITY STUDY
AT THE FORMER MOHR ORCHARD SITE
NORTH WHITEHALL TOWNSHIP, LEHIGH COUNTY, PENNSYLVANIA

Prepared for

U.S. Environmental Protection Agency Region 3
Hazardous Site Cleanup Division
1650 Arch Street
Philadelphia, Pennsylvania 19103

Prepared by

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EPA Contract No. EP-S3-05-02

Technical Direction Document No. E33-020-08-07-025
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April 27, 2009

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Erik Armistead
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Approved by

Donna Davies
START Backup Point of Contact

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1.0 INTRODUCTION

Under Eastern Area Superfund Technical Assessment and Response Team (START) Contract No. EP-S3-05-02, Technical Direction Document (TDD) No. E33-020-08-07-025, the U.S. Environmental Protection Agency (EPA) Region 3 tasked Tetra Tech EM Inc. (Tetra Tech) to conduct soil collection activities in association with a bioavailability study at the Former Mohr Orchard site in North Whitehall Township, Lehigh County, Pennsylvania. The objective of this assessment is to collect soil representative of the Former Mohr Orchard site with elevated concentrations of arsenic. Only soil with arsenic concentrations above 100 parts per million (ppm) will be collected. To identify areas with elevated concentrations of arsenic, soil will be screened in situ with a portable x-ray fluorescence (XRF) instrument. Samples will be collected between 0 to 12 inches below ground surface (bgs) from areas identified through the in-situ screening to contain arsenic above 100 ppm and processed for ex-situ XRF analysis to confirm the in-situ results.

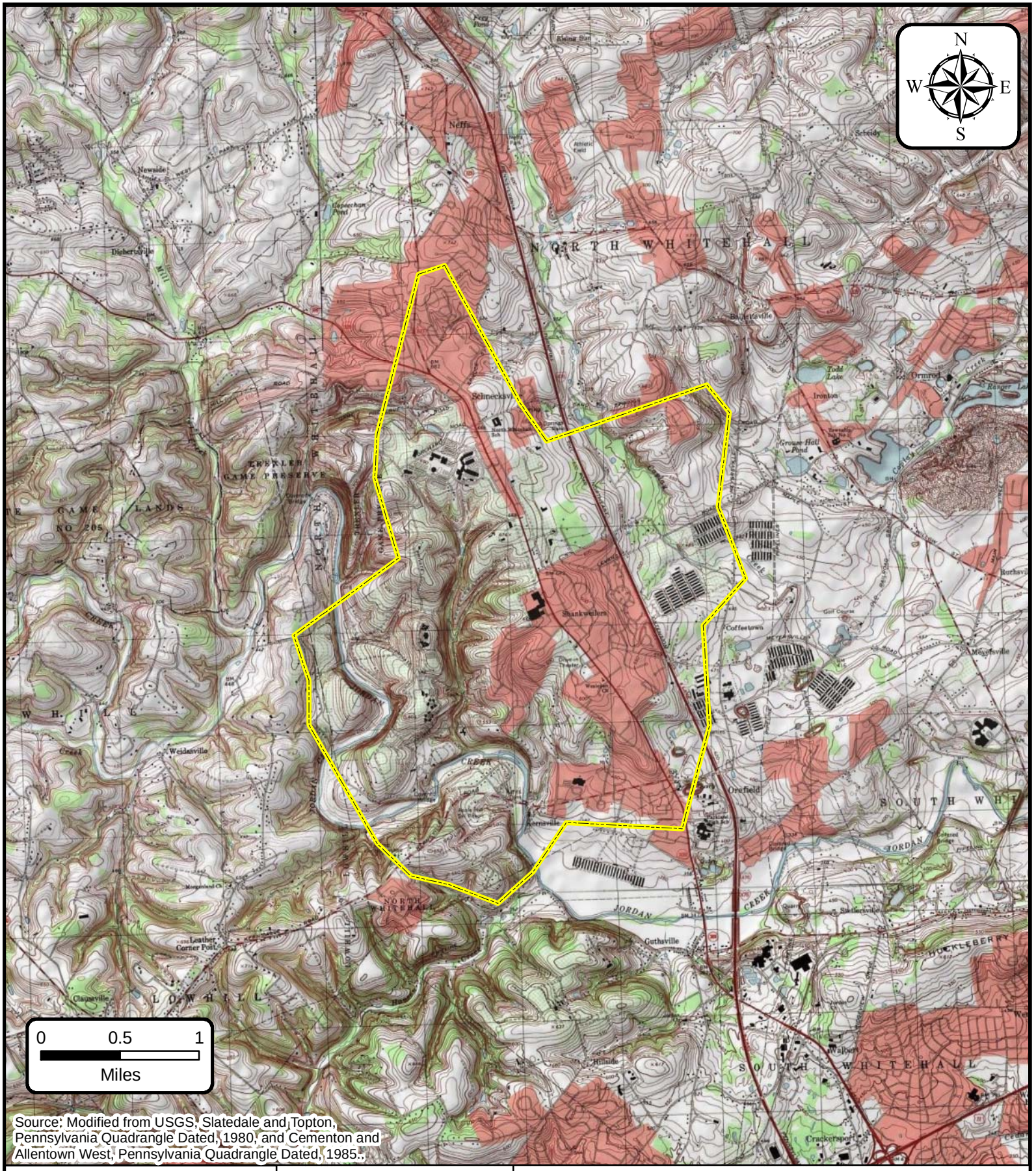
This sampling and analysis plan (SAP) presents site background information in Section 2.0, outlines project objectives in Section 3.0, describes proposed field activities in Section 4.0, specifies quality assurance and quality control (QA/QC) procedures in Section 5.0, and outlines the proposed project schedule in Section 6.0. All references cited in this SAP are listed after the text. Tetra Tech developed this SAP in accordance with the provisions of the Quality Assurance Project Plan (QAPP) for START (Tetra Tech 2006).

2.0 BACKGROUND

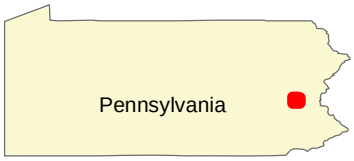
This section describes the site location, presents a description of the site, and summarizes previous site investigation activities.

2.1 SITE LOCATION

The site is primarily located within North Whitehall Township with a small portion extending into South Whitehall Township, Lehigh County, Pennsylvania, as shown in Figure 1.



Approximate Site Location =



Legend

Site Boundary

Former Mohr Orchard Site
North Whitehall Township, Lehigh County, Pennsylvania

Figure 1
Site Location Map

TDD No. E33-020-08-07-025
EPA Contract No. EP-S3-05-02

Map created on July 25, 2008
by A. Dye, Tetra Tech EM Inc.

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The geographic coordinates of the approximate center of the site are 40.6464° north latitude and 75.6014° west longitude. Numerous small unnamed ponds are located within the immediate vicinity of the site. Jordan Creek and Mill Creek are located approximately 0.25 mile west and northwest of the site, respectively.

2.2 SITE DESCRIPTION

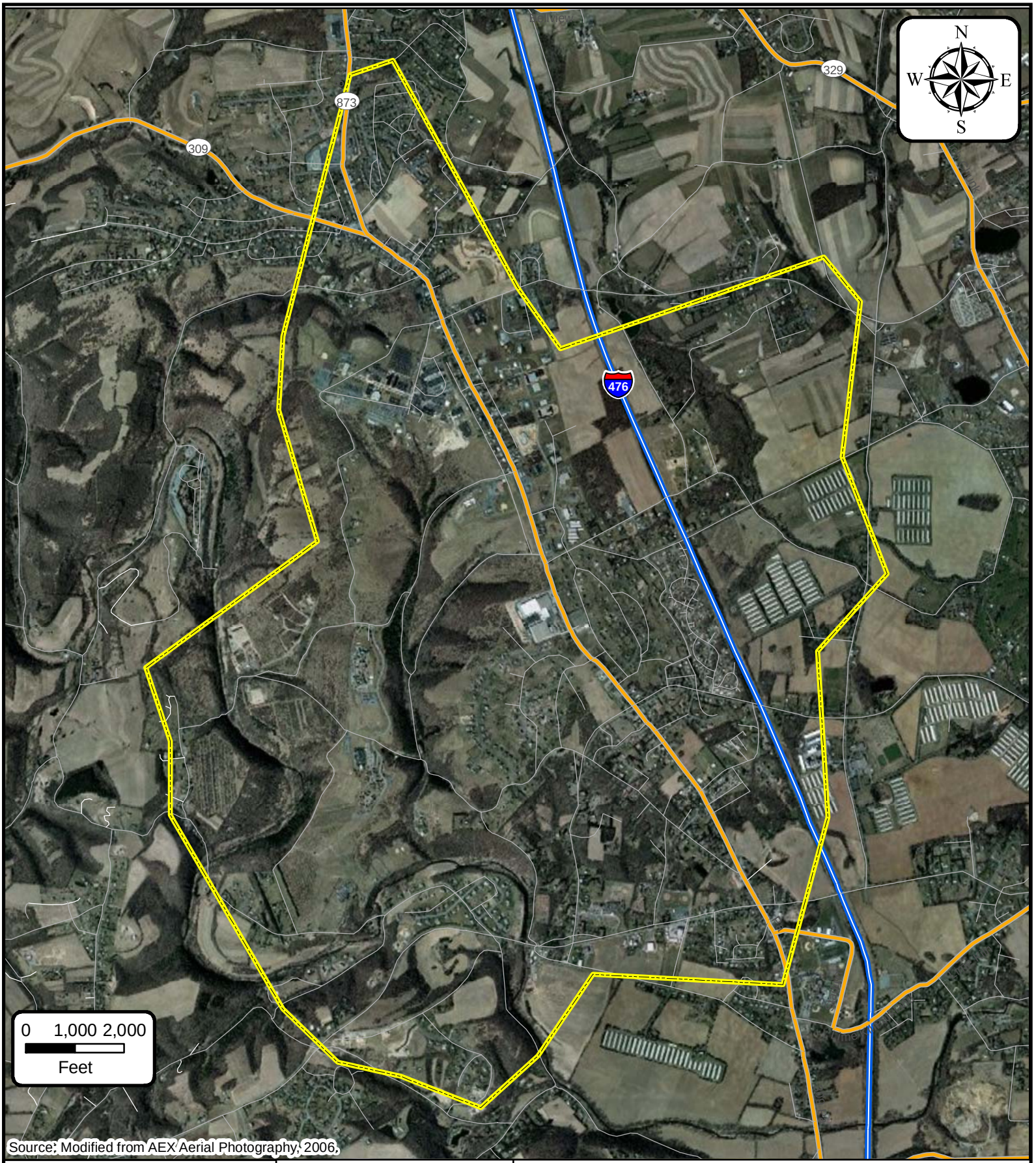
The Former Mohr Orchard site covers approximately 4,416.5 acres and consists of farmland, woodland, residential, commercial, and industrial properties. Historically, large portions of the site were utilized as orchards. State Route 309 runs from north to south through the center of the site, through Schnecksville to the north and Orefield to the south, as shown on Figure 2. Interstate 476 also runs from north to south through the site. The nearest access point to Interstate 476 is located approximately five miles to the south of the site.

This sampling assessment will focus on areas with arsenic concentrations exceeding 100 ppm as documented during previous sampling activities. These areas predominantly consist of recently undisturbed land formerly used as orchards.

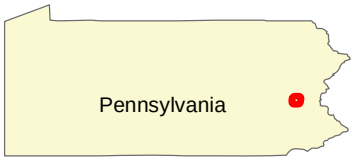
2.3 PREVIOUS SITE INVESTIGATIONS

In August 2008, under the current TDD, EPA tasked Tetra Tech to collect 12 background soil and five background groundwater samples from locations considered outside the former orchard areas. Orchard areas were identified based on historical aerial photography and through assistance of North Whitehall Township officials. These background samples were collected as grab samples from residential areas or public-use areas made accessible by local officials. Arsenic concentrations in the background samples ranged from 3.5 to 29.9 ppm, with a mean concentration of approximately 9.9 ppm. Lead concentrations ranged from 20.6 to 218 ppm, with a mean concentration of approximately 58 ppm.

Between September and December 2008, EPA tasked Tetra Tech to perform a soil sampling assessment of all residential and public-use areas within the Former Mohr Orchard site. An adaptive cluster sampling strategy was used for the initial surface soil assessment. The site was



Approximate Site Location =



Legend

Site Boundary

Former Mohr Orchard Site
North Whitehall Township, Lehigh County, Pennsylvania

Figure 2
Aerial Photograph

TDD No. E33-020-08-07-025
EPA Contract No. EP-S3-05-02

Map created on July 25, 2008
by A. Dye, Tetra Tech EM Inc.

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divided into a sampling grid with 200 by 200-foot cells, 25 percent of which were selected for initial sampling. A 10-point composite soil sample was collected from within each cell and analyzed on site using XRF technology. Additional sampling locations were chosen to the north, south, east, and west of any cells that showed arsenic concentrations greater than 40 ppm. A limited number of samples were collected from the selected sampling locations because of access restrictions/refusals.

During the initial assessment, all soil samples were collected from a depth of 0 to 3 inches bgs. Arsenic concentrations ranged from below detection limits to 149 ppm in composite surface soil samples collected and analyzed at the site between September and December 2008. The average concentration of arsenic in the surface soil samples was approximately 50 ppm. Lead concentrations for composite surface samples ranged from 35 to 1,951 ppm in surface soil samples. The average concentration of lead in the surface soil samples was approximately 349 ppm. Site specific action levels for arsenic and lead are currently in development for the Former Mohr Orchard site.

3.0 OBJECTIVE

The objective of the bioavailability study is to determine the bioavailability characteristics of arsenic in soil at the Former Mohr Orchard site. The sampling method will involve collecting sufficient volume of soil to fill approximately eight 2-gallon buckets. To accomplish this, Tetra Tech proposes to identify areas with elevated concentrations of arsenic using XRF technology to conduct in-situ soil screening. Once an area is identified with arsenic concentration greater than 100 ppm, surface soil will be collected. This soil will be shipped to EPA's Office of Research and Development, National Exposure Research Laboratory (NERL) for processing. Processed sample material will be shipped to the University of Missouri for completion of the bioavailability study. Data results received from the study will be used to determine bioavailability of arsenic in soil at the Former Mohr Orchard site.

4.0 PROPOSED ACTIVITIES

This section describes the scope of work; Tetra Tech project personnel; proposed sampling activities; and equipment decontamination procedures for the project.

4.1 SCOPE OF WORK

As part of the bioavailability study for the Former Mohr Orchard site, Tetra Tech will perform the following tasks:

- Identify sampling locations in the field based on results of previous soil sampling activities and in-situ screening with XRF technology;
- Collect and composite soil samples from identified locations;
- Homogenize, prepare and conduct ex-situ XRF analysis of soil samples to confirm arsenic concentrations greater than 100 ppm; and
- Ship collected soil to EPA's Office of Research and Development, NERL.

4.2 KEY PROJECT PERSONNEL

The Tetra Tech project manager for the TDD is Mr. Erik Armistead. As project manager, Mr. Armistead is responsible and accountable for all aspects of the project scope of work, including achieving the technical, financial, and scheduling objectives for the project. Mr. Armistead will communicate directly with the EPA Work Assignment Manager (WAM) for this project, Mr. Richard Fetzer.

Other Tetra Tech personnel proposed for the project are presented in Table 1. Technical or field support personnel used for the project may vary depending on the specific needs of the project, as well as on-site conditions and availability of staff.

TABLE 1
PROPOSED TETRA TECH PROJECT PERSONNEL

Project Function	Name	Role
Project Manager	Erik Armistead	The project manager is responsible for implementing all activities identified in the TDD; responsible for developing and implementing the site health and safety plan; has authority to commit resources necessary to complete the work; prepares deliverables required by the TDD; communicates directly with the EPA WAM, the project team, and any other personnel needed to complete the project.
Field Support Personnel	To be determined (2)	The field support personnel perform necessary sampling or monitoring, as well as other tasks defined in the TDD or assigned by the EPA WAM or the Tetra Tech project manager; communicate directly with the Tetra Tech project manager and, when appropriate, the EPA WAM.
Health and Safety Officer	Chris Draper	The health and safety officer oversees and supports development of the site health and safety plan; communicates directly with the Tetra Tech project manager to ensure that all corporate health and safety protocols applicable to the site are being followed.
Chemist	Josh Cope	The chemist coordinates with the Tetra Tech project manager regarding the analytical requirements for the project; solicits and procures necessary laboratory services; reviews and validates analytical data, if necessary; communicates directly with the Tetra Tech project manager, field support personnel, EPA WAM, and START program manager as necessary.
Graphics and Mapping Specialist	Andrew Dye	The graphics and mapping specialist generates maps and other figures for project deliverables or presentations; assists the Tetra Tech project manager or other personnel when global positioning system activities are required. Prepares Scribe database.
Financial Manager	Bob Rynkar	The financial manager works with the Tetra Tech project manager in planning related to the TDD budget and completion date; enters financial information on the project into the Tetra Tech management information system; prepares regular and special reports to assist the Tetra Tech project manager in managing the project.
Point of Contact	Sara Legard	The point of contact assists the Tetra Tech project manager as necessary to implement the project; commits or helps obtain all necessary company resources to meet the objectives of the TDD; provides document quality control reviews.
Quality Assurance Manager	Andy Mazzeo	The quality assurance manager is responsible for all quality assurance/quality control aspects of the START contract

Notes:
EPA = U.S. Environmental Protection Agency
START = Superfund Technical Assessment and Response Team
WAM = Work Assignment Manager
TDD = Technical Direction Document
Tetra Tech = Tetra Tech EM Inc.

4.3 SAMPLE COLLECTION

This section describes the proposed soil sampling activities, quantities, and locations for each sample to be collected.

Prior to sample collection, Tetra Tech will prepare the ground surface by removing any vegetation or debris with a pickaxe or trowel and, if necessary, loosen the soil. Sample locations will be selected based on in-situ screening for elevated concentrations of arsenic using XRF technology. Soil samples will be collected using clean, dedicated plastic scoops or stainless steel trowels and nitrile sample gloves. Soil will be collected from the top two inches below ground surface of each area. Soil will be stored in clean, dedicated 2-gallon buckets. During the collection process, soil will continue to be screened in-situ to determine the extents of soil with elevated concentrations of arsenic. The general location of each sample will be documented by Grid Identification Number. Grid Identification Numbers are defined in the Sampling and Analysis Plan for the Mohr Orchard Site (Tetra Tech 2008). Soil samples will be collected in accordance with Tetra Tech Standard Operating Procedure (SOP) No. 005, "Soil Sampling" (Tetra Tech 1999b).

A total of approximately eight 2-gallon buckets of soil will be collected as part of this sampling event. Each 2-gallon bucket of soil will be homogenized in a cleaned plastic storage container. Three samples of homogenized soil will be collected from each container to be analyzed for arsenic by ex-situ XRF analysis. Ex-situ analysis of the soil will be used to confirm the in situ results are accurate, and the soil contains arsenic levels greater than 100 ppm. If results of ex-situ analysis identify concentrations of soil less than 100 ppm, an additional 2-gallon bucket of soil will be collected from another area of high arsenic concentration to replace the initial sample. .

4.4 SAMPLE HANDLING AND PREPERATION

Sample handling, packaging, and shipment procedures will be in accordance with Tetra Tech No. 019, "Packaging and Shipping Samples" (Tetra Tech 2008a). Samples to be shipped to NERL will be recorded on a Forms2Lite chain-of-custody and traffic report.

The Tetra Tech project manager will assure that sample quality and integrity are maintained in accordance with Tetra Tech's "QAPP for START" (Tetra Tech 2006).

Soil samples from each homogenized 2-gallon bucket of soil will be prepared for ex-situ XRF analysis. A 20- to 50-gram aliquot of each sample will be dried in an oven at less than 150º Celsius for at least 2 hours, or until dry. Each aliquot will then be sieved through a number 60-mesh sieve. The dried and sieved aliquots will then be transferred to labeled, dedicated XRF sampling cups for analysis. All XRF analytical activities and results will be recorded in the site logbook.

Regulations for packaging, marking, labeling, and shipping hazardous materials and wastes are promulgated by the U.S. Department of Transportation. Air carriers that transport hazardous materials (in particular, Federal Express) require compliance with the current International Air Transport Association (IATA) regulations, which apply to shipment and transport of hazardous materials by air carrier. Tetra Tech will follow all applicable IATA regulations.

Upon receipt of soil at NERL, soil will be spread out in drying trays, placed in an air-drying oven and dried for approximately four days at less than 40 ºC. The soil will then be added to a vibrating 2 millimeter stainless steel sieve screen to remove plant material, rocks and large chunks of aggregated soil. Material remaining on the screen will be deaggregated and rescreened. Soil will then be screened to less than 250 micrometers. The soil will be passed through a riffler five times and 200 gram aliquots will be collected in a pre-cleaned 250 milliliter high-density polyethylene bottle for bioavailability studies. Upon completion of the preparation of soil, samples will be extracted via Neutron Activation Analysis. Arsenic concentrations of these samples will be confirmed by EPA Method 3051 or EPA Method 3050b. Prepared soil will be shipped to the University of Missouri for application in the bioavailability study.

4.5 EQUIPMENT DECONTAMINATION

Dedicated sampling equipment and personal protective equipment will be double-bagged and disposed of as dry, industrial waste. Non-dedicated sampling equipment will undergo a gross decontamination with Alconox and nitric acid, followed by a double rinse with distilled water, in

accordance with Tetra Tech SOP No. 002, "General Equipment Decontamination" (Tetra Tech 1999b). A pick axe, trowel, and sieves will be used during sample collection. These items will be decontaminated before each use. All investigation-derived waste will be double-bagged and disposed of as dry, industrial waste.

5.0 QUALITY ASSURANCE AND QUALITY CONTROL PROCEDURES

This section describes the quality assurance (QA) and quality control (QC) procedures for personnel during the site sampling event, including responsibilities, field QC, and XRF QC.

5.1 RESPONSIBILITY

The Tetra Tech project manager, Mr. Armistead, will be responsible for ensuring that sample quality and integrity are maintained in accordance with the EPA "Quality Assurance/Quality Control Guidance for Removal Actions" (EPA 1990), and that documentation procedures are in accordance with Tetra Tech's QAPP for START (Tetra Tech 2006).

5.2 FIELD QUALITY CONTROL

Each sampling location will be noted in the field logbook in accordance with Tetra Tech SOP No. 024, "Recording of Notes in Field Logbook" (Tetra Tech 2008b). Field QA/QC measures will consist of maintaining photographic, logbook, and chain-of-custody documentation. These measures will be applied in accordance with Tetra Tech's QAPP for START (Tetra Tech 2006).

5.3 X-RAY FLUORESCENCE QUALITY CONTROL

XRF QC measures will consist of the collection of instrument blanks, continuing calibration measurements, and precision measurements. An instrument blank will be analyzed at the beginning and end of each work day, and once every 20 samples, to test for any contamination that may have been introduced to the instrument. Continuing calibration measurements, using a known standard, will be analyzed at the beginning and end of each work day. Precision measurement samples will be run at least once per day by analyzing a known standard seven times to check the precision of the instrument.

6.0 SCHEDULE

Tetra Tech estimates that this SAP will be implemented in April and May 2009. In-situ screening may only be completed in dry weather conditions. Significant quantities of rain may delay sampling activities. Table 2 below provides the proposed project schedule.

TABLE 2
PROJECT SCHEDULE

Task	Completion Timeframe
Receive and accept TDD	July 9, 2008
Develop site health and safety plan	August 2008
Submit Bioavailability Study SAP	April 2009
Mobilize to site	April 2009
Conduct field work	April - May 2009
Ship collected soil to NERL	May 2009
Soil preparation at NERL	May 2009
Ship prepared sample material to University of Missouri	June 2009

Notes:
NERL = National Exposure Research Laboratory
SAP = Sampling and analysis plan
TDD = Technical Direction Document

REFERENCES

Tetra Tech EM Inc. (Tetra Tech). 1999a. "General Equipment Decontamination." SOP No. 002. December.

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Tetra Tech. 1999b. "Soil Sampling." SOP No. 005. December.

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Tetra Tech. 2008b. "Recording of Notes in Field Logbook." Standard Operating Procedure (SOP) No. 024. December.

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