QUALITY ASSURANCE PROJECT PLAN
ZONOLITE ROAD REMOVAL ACTION
ATLANTA, GEORGIA

PREPARED FOR:

W.R. GRACE & CO.-CONN.
URS JOB NO. 15262691
AUGUST 26, 2011

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TABLES

FIGURES

ATTACHMENTS

1.0 INTRODUCTION

The purpose of this Quality Assurance Project Plan (QAPP) is to define and document the specifications and methods to be employed to ensure the highest possible degree of technical accuracy and precision, statistical validity, and documentary compliance of data generated in the course of the Removal Action at the Zonolite Road Site in Atlanta, Georgia (See Figures 1 and 2). The format of the document is described in the EPA Technical Guidelines for Quality Assurance Project Plans QA/G-5 (EPA/240/R-02/009, December 2002) and also in the EPA Technical Requirements for Quality Assurance Project Plans, QA/R-5 (EPA/240/B-01/003, March 2001). Additional sources of information are Framework for Investigating Asbestos Contaminated Superfund Sites (September 2008), ERT Helpful Hints For Activity-Based Sampling for Asbestos in Air, Field Sampling Procedures Manuals EPA-600 4-79-19, EPA Region IV Field Sampling Procedure for Ambient Air Sampling, January 2011, EPA Region IV Field Sampling Procedure for Soil Sampling, November 2007, and EPA ERT SOP No. 2084 (October 2007).

1.1 SITE HISTORY

In the spring of 2010, United States Environmental Protection Agency (EPA) and EPA's Superfund Technical Assistance and Response Team (START) contractor conducted activity-based air sampling and bulk material sampling at the Zonolite Road Site located on Zonolite Road in DeKalb County, Atlanta, Georgia (See Figures 1 and 2). On November 12, 2010, EPA and START conducted a removal site evaluation at the Site in response to an initiative to investigate vermiculite facilities that received vermiculite concentrate from the W.R. Grace (Grace) vermiculite mine in Libby, Montana. The Site received between 499 and 1,225 tons of vermiculite concentrate from the W.R. Grace vermiculite mine in Libby, Montana.

In April 2011, Grace and the EPA entered into an Administrative Settlement Agreement and Order on Consent for Removal Action (AOC) to excavate an area measuring approximately 175 feet by 250 feet to the depth of native soil. The AOC contained provisions to prepare a work plan including a Health & Safety plan (HASP), Quality Assurance Project Plan (QAPP), and Quality Management Plan (QMP).

In May 2001, W.R. Grace retained the URS Corporation (URS) to implement the following scope of work as outlined in the AOC:

Pre-Removal Preparation

- Develop a Removal Action Work Plan that details plans for the excavation;
- Develop a Quality Assurance Project Plan (QAPP) and Quality Management Plan (QMP); and

- Prepare a Health and Safety Plan that ensures the protection of the public health and safety during performance of on-Site work in accordance with the schedule in the Work Plan.

Removal Action

- Excavate and remove areas of asbestos contaminated soils in the plateau area (elevated waste pile, approximately 175 feet by 250 feet) to native soil with confirmatory sampling.
- Backfill excavated areas with clean fill material, if necessary.
- Dispose of contaminated soils at an approved facility.
- Suppress dust and control erosion during the removal action.
- Monitor and sample as necessary personal and ambient air during the removal activities.
- Restore disturbed areas in a manner that prevents flooding of adjacent properties and is consistent with future land-use. All restoration activities at the site will be coordinated with the landowner.
- Install a vegetative cover to prevent erosion of the soil backfill or disturbed areas.
- Erect warning signs and fencing to prevent access to contaminated areas.
- Submit a written progress report to EPA concerning actions undertaken pursuant to the AOC every two (2) weeks after the date of receipt of EPA's approval of the Work Plan until termination of the AOC, unless otherwise directed by the OSC in writing.

Post-Removal

- Post-Removal Site Control - submit a proposal for post removal Site control.
- Final Report - Within sixty (60) days after completion of all removal actions required under the AOC, the Respondent will issue a final report.

2.0 PROJECT DESCRIPTION

2.1 INTRODUCTION

This document is written in support of field activities associated with the Removal Action to be conducted at the Zonolite Road Site in Atlanta, Georgia. Samples of materials collected during previous site investigations have been used to identify the approximate horizontal extent of potential asbestos materials at the Site. Confirmatory soil samples will be collected from pre-selected locations within the excavation area prior to completion of remediation activities at the Site. The information gathered during these activities will be used to demonstrate that appropriate remediation activities have been completed at the Site. Subsequent action may be taken based on the outcome of this study.

2.2 SITE DESCRIPTION

The Zonolite Road Site (the Site) is comprised of approximately 16 acres in Atlanta, DeKalb County, Georgia (Figures 1 and 2). The eastern portion of the Site is occupied by the Atlanta Soto Zen Center. The Site is bordered by light-industrial and commercial businesses to the north and to the east. Peachtree Creek runs along the south and west sides of the Site. In 1950, Southern Zonolite Company built the former vermiculite expansion plant at the Site. In 1957, Southern Zonolite Company merged with the Zonolite Company. In 1963, the assets of the Zonolite Company were acquired by W.R. Grace. W.R. Grace continued to operate the expansion plant at the Site until 1970. The parcel was deeded to R.W. Sterrett in 1983 and since then, DeKalb County has assumed ownership of a large part of the original property with the intention to convert their portion of the property into a park, while other entities own the other parts. The portion of the Site where the proposed Removal Action will occur is currently a vacant lot. Prior to initiating Removal Action Activities at the Site, a field trailer and portable restroom facilities will be mobilized to the site for use by field personnel throughout the activities at the Site.

2.3 TARGET COMPOUNDS

Asbestos is the primary concern of this investigation. Laboratory analytical results of soil samples collected during prior investigations at the site indicated the presence of asbestos in the soil at percentages ranging from <0.25% to 0.75%. A list of the analyses to be conducted on air and soil samples collected during the removal action activities at the site is summarized in **Table 1**. The purpose of the remediation activities at the site will be to excavate and remove the asbestos containing material from the site surface.

2.4 DATA USE

A variety of measurements will be made during the course of this investigation. Three levels of data quality are established to address all of the various measurements. The measurements to be taken, the data quality level associated with each type of measurement, and the estimated quantity of samples to be taken for each type of measurement are summarized in **Table 2** Summary of Data Quality Objectives.

2.4.1 Level III

Level III data quality objectives (DQOs) are defined as data which will be used for risk assessment, assessing the nature and extent of any contamination present and for use in support of engineering judgments. This data must accurately and precisely identify and quantify contamination present and can be relied upon to make assessments which may affect human health. This type of data is normally generated in an analytical laboratory setting. Contamination assessments, such as Remedial Investigation/Feasibility Studies (RI/FS), Requests for Information (RFI), groundwater monitoring programs and air monitoring may employ Level III data quality. Level III or Level II data deliverables may apply to these data (see Section 10.4).

2.4.2 Level II

Level II DQO is defined as data which will be used for the general evaluation of alternatives. This level of data can tentatively identify contaminants and often reports concentrations within a range. Soil gas surveys, direct push technology groundwater monitoring programs, and monitoring programs utilizing field screening methods are typical examples of tasks which may require Level II data quality. Level II data deliverables may apply (see Section 10.4).

2.4.3 Level I

Level I DQO is defined as data which will be used for site characterization and health and safety monitoring. This level of data can provide indications of contamination when present, but cannot quantify any contamination detected. Field measurements for soil hydrocarbon assessment and health and safety purposes are examples of tasks which may require Level I data quality.

2.5 SAMPLING LOCATIONS/SAMPLING RATIONALE

Activities to be conducted as part of the removal action include soil sample collection and air monitoring and sampling. Rationale for the selection of the soil sampling locations is discussed in the Removal Action Work Plan. Rationale for the selection of the air monitoring stations will be presented in a separate Air Monitoring Work Plan that will be submitted under separate cover.

3.0 PROJECT ORGANIZATION

The Project Team will include the following organizations and individuals. The organization is presented on Figure 3 – Organizational Chart. The Team will be updated once a removal contractor has been selected.

Agencies

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Removal Contractor

TBD

A Georgia licensed asbestos contractor in accordance with OCGA 391-3-14 will be selected to perform the removal activities. The contractor will be required to submit proof of a valid license and evidence of the asbestos training as required. The contractor will also be required to provide an asbestos supervisor that has satisfactorily completed the required training in the removal and abatement of asbestos. A copy of the contractor's license and documentation of the supervisor training will be maintained onsite during the removal action.

3.1 LABORATORY

URS will retain EMSL Analytical, Inc. (EMSL) located in Cinnaminson, New Jersey to perform the required asbestos analyses. EMSL participates in a QA/QC program that complies with the appropriate EPA guidance and has a documented Quality System that complies with ANSI/ASQC E-4 1994, "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs" (American National Standard, January 5, 1995), "EPA Requirements for Quality Management Plans (QA/R-2) (EPA/240/B-01/002, March 2001)," and the U.S. EPA Region 4 Standard Operating Procedures and Quality Assurance Manual (May 1996), or equivalent documentation as determined by EPA.

The laboratory was selected based upon completion of similar projects, QA/QC programs, and competitiveness. EMSL is an AIHA accredited laboratory (Certificate No. 100194, expires 07/01/2012) and is certified by NELAP-NJ Primary (Certificate No. 03036, expires 06/30/2012), NVLAP (Certificate No. 101048-0, expires 06/30/2012), and USDA (Soil Permit No P526P-09-02197, expires 03/29/2014). The subcontracted laboratory will report to the Quality Assurance Officer. The laboratory will provide their Quality Assurance Manual (QAM) which summarizes their own internal quality control procedures. This document includes:

- Chain-of-Custody Procedures
- Sample Containers and Holding Times
- Analytical Methods
- Minimum Detection Limits
- Quality Control, Precision, and Accuracy Procedures
- Data Reduction, Validation, and Reporting Procedures
- Performance and System Checks
- Sample Equipment Decontamination Procedures
- Sample Container Decontamination Procedures
- Calibration Procedures
- Data Reporting Formats
- Internal Quality Control Checks

- Preventative Maintenance
- Corrective Measures

A copy of the laboratory QAM will be submitted under separate cover due the size of the document.

4.0 QUALITY ASSURANCE (QA) OBJECTIVES FOR MEASUREMENT DATA

The QA Objectives for the project are listed below. A summary of the QA objectives for all solid matrices is provided in **Table 3** Quality Assurance Objectives for Solid Samples. The QA objectives for measurement data are provided below.

4.1 PRECISION

Precision is the degree of reproducibility of a measured quantity. Precision will be evaluated in the field at the point of measurement. Laboratory precision will be verified through data validation (see Section 10).

4.1.1 Field Measurements

Precision for air quality analyses are expected to be achievable at plus or minus the sensitivity of the analyzing instrument. Duplicate analyses of air quality are required at each station and must agree to within plus or minus the sensitivity of the instrument.

4.1.2 Laboratory Analytical Measurements

Precision objectives for laboratory analytical measurements are defined in **Table 3**.

4.2 ACCURACY

Accuracy is the degree of conformity of a generated value to the true value. The accuracy of field measurements is generally limited to the sensitivity of the instruments used. The accuracy of laboratory measurements will be evaluated through the data validation process (see Section 10).

4.2.1 Field Measurements

Accuracy of air quality analyses is limited by the sensitivity of the measuring instrument.

4.2.2 Laboratory Analytical Measurements

Accuracy objectives for laboratory analytical measurements are defined in **Table 3**.

4.3 COMPLETENESS

Completeness is the measure of reliable data points versus the total number of data points generated. The completeness for field data will be calculated for each class of measurements taken (e.g. water level, temperature, etc.). The completeness of laboratory data will be calculated per fraction per matrix (e.g. water volatiles, soil metals, etc.).

4.3.1 Field Measurements

The objective for completeness is 100 percent.

4.3.2 Laboratory Analytical Measurements

The completeness objective is 95 percent.

4.4 REPRESENTATIVENESS AND COMPARABILITY

Representativeness refers to the degree to which the field samples correspond to the general environment from which they were collected. Comparability is the assessment of the caliber of the results as compared to data collected previously at the site.

4.4.1 Field Measurements

Use of Standard Operating Procedures (SOPs) as provided in Section 5 of this QAPP will be used to control the representativeness and comparability of field measurements.

4.4.2 Laboratory Analytical Measurements

Representativeness is ensured through the appropriate selection of sample locations and sampling techniques as defined in the Removal Action Work Plan. Field replicate sample results will be reviewed in order to assess the representativeness of the sampling technique. It is expected that results of field replicate analysis will match to within ±100 percent for soil samples, and ±50 percent for air samples.

Comparability is ensured through the use of standard sampling methods, analytical methods, and the consistent application of measurement units.

5.0 SAMPLING PROCEDURES

5.1 SAMPLING PROGRAM

The basic objective of the sampling program is determine if the remedial objective of removing the asbestos materials to below <0.25% has been accomplished and to evaluate any potential human exposure from disturbance of materials while conducting the removal activities at the Site. This section describes the proposed activities and associated sampling. Accurate field sampling procedures will facilitate the acquisition of information that will assist the investigators in the identification of environmental contaminants and the extent of potential soil and groundwater contamination. The sampling program will consist of the collection of soil and air samples in support of the remediation activities at the Zonolite Road Site. Specific sampling procedures will be used throughout the investigation in an effort to produce a comparable and defensible database of information. The following subsections detail the procedures for soil sampling activities.

5.2 SAMPLE LOCATIONS

The exact sample locations will be determined after the extent of the asbestos material has been removed and a grid system can be overlain on the excavated area. All sampling locations will be staked and flagged (or surveyed) until the removal activities is complete.

Two types of bulk sampling will be performed during the removal action; 1) random bulk sampling and 2) confirmatory bulk sampling. Random bulk sampling (referred to as a verification sample) will be performed on material in areas outside the area of known asbestos material that is suspect based on visual evidence. The purpose of these samples is to determine if the suspect material will require removal. The second type of bulk sampling (referred to as a confirmatory sample) is composite sampling from areas that have been excavated. The purpose of these samples is to confirm the asbestos material has been removed to the asbestos removal clean-up level of <0.25%.

Random bulk samples will be collected in concurrence with EPA when material outside the known asbestos material contains suspect asbestos material. In this case, a random sample or samples may be collected and analyzed to determine if the removal clean-up level of <0.25% has been exceeded and the material requires removal. The samples will be shipped under chain-of-custody to EMSL Analytical, Incorporated located in Cinnaminson, New Jersey for analysis of asbestos by USEPA Method 600/R-93/116 with CARB 435 Prep 400 Count utilizing a one day laboratory analytical turnaround time. All random bulk sampling locations will be marked with a survey stake and surveyed for future reference. If the random sample location requires removal then the area where the suspect material is excavated would be incorporated in the confirmatory bulk sampling grid for confirmatory sampling.

Confirmatory bulk sampling locations will be determined based on extent of the excavation at the Site. URS will establish a grid system in the excavation area to collect confirmation samples for

laboratory analysis to verify the asbestos material has been removed in accordance with the AOC. URS proposes to collect composite confirmatory bulk (soil) samples at a rate of 1 sample per 2,500 square feet. Each composite bulk sample will be made up of five aliquots collected from within the 2,500 square foot sample grid. Grab samples will also be collected from the individual aliquots in the four quadrants comprising the grid and submitted to the laboratory on hold, pending the analyses of the composite sample. The random and confirmation samples will be collected in accordance with the QAPP. The samples will be shipped under chain-of-custody to EMSL Analytical, Incorporated located in Cinnaminson, New Jersey for analysis of asbestos by USEPA Method 600/R-93/116 with CARB 435 Prep 400 Count.

If a composite sample exceeds the removal clean-up level of <0.25% asbestos, then the four individual aliquots will be analyzed to try and ascertain which section of the grid exceeds the removal clean-up level. Each quadrant of the grid that exceeds the clean-up level will be re-excavated and resampled to verify the clean-up level has been met.

After the bulk analysis sampling indicates the asbestos materials have been removed to meet the removal clean-up level of <0.25% asbestos, then the Activity-Based Sampling (ABS) will be performed in accordance with the procedure outlined in the QAPP.

ABS will be conducted to simulate human exposure to asbestos during typical site activities. There will be three activity-based outdoor air sampling rounds. Each ABS event will occur over a minimum 120-minute period. Raking has been selected as the ABS scenario for this site. The specific location of the raking for this event will be determined based on the final area excavated with concurrence with EPA. The area will consist of an open area devoid of vegetation and with exposed soil. The event will occur prior to the final site restoration and re-vegetation activities.

In each raking event, the participant will rake the entire designated area to gather loose dust and soil, using a standard garden rake. A grab or multi-point composite bulk material sample of the raked dust/soil will be collected after the round of raking activity is completed. During each activity, air samples will be collected from the breathing zones of event participant. The participant, wearing the appropriate PPE, will be fitted with two sampling pumps, one set at a low flow rate (3 L/min) and the other set at a higher flow rate (10 L/min). The pumps will be contained within a backpack or harness, with the filter cassettes secured to the participants shoulder straps so that their inlets are within the participant's breathing zone. Both the high and low flow rate sampling trains will consist of an appropriate portable air sampling pump with an attached 25-mm diameter, 0.8 µm MCE filter cassette. The inlet caps of both the low and high flow rate filter cassettes will be removed (so that they are open-faced) during sampling and the cassettes will be positioned downward.

In addition to ABS of the personal breathing space of the participant, air samples will also be collected around the perimeter of each activity at upwind and downwind locations to assess the impact of the activity on outdoor air. Several sampling locations will be selected around the activity area and at each location there will be two sampling pump assemblies, one set at a low flow rate (3 L/min) and the other set at a higher flow rate (10 L/min). The flow rate sampling train for both

pumps will consist of an appropriate portable air sampling pump with an attached 25-mm diameter, 0.8 µm MCE filter cassette. The inlet caps of both the low and high flow rate filter cassettes will be removed (so that they are open-faced) during sampling and the cassettes will be positioned downward and perpendicular to the wind direction. Perimeter samples will be collected for the duration of each ABS event.

The removal will be considered completed when the analytical results meet the ABS action clean-up level of 0.02 fibers per cubic centimeter (cc).

5.2.1 Field Measurements

Environmental air quality field measurements will be taken as required in the field sampling SOPs (Refer to Section 5.3) and at the point of sampling. Health and safety field measurements, if required, will be collected as specified in the Health and Safety Plan.

5.2.2 Air Monitoring Locations

A perimeter air monitoring plan will be established based on extent of the excavation activities at the site. Additionally, personal air monitoring will also be conducted to ensure the air quality in the work space is within acceptable limits. The perimeter air monitoring samples will be collected from the perimeter of the work area, as specified in the Removal Action Work Plan. Air quality sampling procedures are described in Section 5.3.1.4. The perimeter and personal air quality samples will be analyzed for asbestos, as specified in the Removal Action Work Plan.

5.2.3 Sampling Equipment and Supplies

Sampling equipment and supplies provided at the site will include:

- Nitrile Gloves;
- Sample Jars;
- Stainless Steel Soil Sampling Trowels/Spoons; and
- Stainless Steel Mixing Bowls (for collection of composite soil samples);
- Lawn and Garden Rakes;
- Air Sampling Pumps (to be provided by Air Monitoring Contractor);
- Micro Cellulose Ester membrane (MCE) Filter Cassettes (to be provided by Air Monitoring Contractor for collecting air samples); and
- Decontamination Supplies (decontamination water, scrub brushes, soap, and buckets).

5.3 SAMPLING PROCEDURES

The following subsections detail the procedures for soil and air sampling. Sample logs will be recorded for every sample collected during the Removal Action Site Activities. Information to be included on the sample logs includes:

- Sample date and time;
- Sample location;

- Name or initials of person collecting the sample;
- Requested analysis; and
- Serial numbers for any equipment used in the collection of the sample.

5.3.1 Soil Sampling

Discussion

Surficial and subsurface soil samples will be collected using a stainless steel trowel/spoon and a metal bowl. Soil samples at the pre-selected locations will be collected from the surface and from immediately below the surface in order to confirm that the excavation has been advanced sufficiently enough to remove the asbestos contaminated soil. Prior to the collection of the soil sample(s) the surface will be dressed (scraped) to remove smeared soil in order to minimize the effects of contaminant migration interferences due to smearing of material from other levels. Additionally, the excavation area will be visually inspected prior to sampling to ensure all visible traces of vermiculite ore and/or exfoliated vermiculite has been removed.

Uses

The use of manual sampling techniques will allow the collection of a number of samples in a cost-effective and efficient manner such that the overall time period to confirm the effectiveness of the remediation activities is reduced. This method is generally used to collect samples from depths of less than 0.5 foot bgs.

Procedures For Use

1. Visually inspect the excavation area; ensure that all visible traces of vermiculite ore and/or exfoliated vermiculite have been removed prior to collection of the soil sample.

2. Document the location of the sampling point in the field log book. Place a stake at the sampling location and mark the stake with the sample number.

3. Put on a clean pair of protective gloves. Using a decontaminated stainless steel spoon or hand auger, collect soil from the surface and sub-surface and place in the laboratory provided sample container for analysis of asbestos.

4. Composite samples (if required) will be collected by placing an aliquot from each sample location into a stainless steel bowl and thoroughly mixed and then placed in the appropriate laboratory provided sample containers.

5. Place a label on the sampling bottle. Complete the label with all necessary information. Complete all chain-of-custody documents and record the depth of sample collection, date of collection, field observation, and measurements in the field log book.

6. Place the properly labeled sample bottle in a cooler maintained at $4^{o}C$ throughout the sampling and transportation period.

7. Return any unused sample material back to the hole from which the sample was collected.

8. Decontaminate the sampling equipment and wrap the equipment in aluminum foil or plastic bags.

5.3.1.1 Decontamination Procedures for Soil Sampling Equipment

These procedures will be used for soil samples collected during the field investigation. The following procedures will be for sampling equipment decontamination prior to use and between each sample collection event. These proceedings also apply to materials utilized for monitor well purging.

1) Wash equipment thoroughly with laboratory detergent and tap water using a brush to remove particulate matter or surface film.

2) Rinse equipment thoroughly with tap water.

3) Rinse equipment thoroughly with deionized water.

4) Rinse equipment twice with pesticide-grade isopropanol and allow to air dry.

5) Rinse equipment thoroughly with organic-free water and allow to air dry as long as possible. Deionized or distilled water will not be used.

6) Place equipment completely inside a plastic bag, wrap in plastic, or wrap in aluminum foil so that no portion of the equipment is exposed.

When this sampling equipment is used to collect samples that contain oil, grease, or other hard to remove materials, it may be necessary to rinse the equipment several times with pesticide-grade acetone or hexane to remove the materials before proceeding with Step 1. In extreme cases, when equipment is painted, badly rusted, or coated with materials that are difficult to remove, it may be necessary to steam clean, wire brush, or sandblast equipment before proceeding with Step 1.

Organic free water and isopropanol will be applied from glass containers. Distilled water will not be substituted for deionized water. In addition, if heavily contaminated areas are encountered, equipment will be pre-cleaned using either a 10% dilution of pesticide grade acetone or hexane.

5.3.1.2 Sample Container Decontamination

Pre-cleaned sample containers are provided by the contracted laboratory. Sample containers will be cleaned by the laboratory following the appropriate USEPA analytical method prior to field sampling, or will be purchased clean.

5.3.2 Air Monitoring/Sampling

Discussion

URS will contract with an outside company to perform perimeter and personal air monitoring at the Site. Perimeter and personal air monitoring and sampling will be performed throughout the course of the remediation activities at the site. URS will work with the air monitoring contractor to ensure that a comprehensive air monitoring work plan will be in place prior to initiating work at the Site. Included in the air monitoring plan will be protocols to ensure that air quality is maintained within acceptable limits both in the immediate vicinity of the work and in the surrounding areas. Types of air monitoring/sampling to be conducted at the Site will include background air sampling, meteorological monitoring, aggressive air sampling, activity based air sampling, and raking.

Uses

The use of manual and automated monitoring and sampling techniques will help to monitor air quality at the Site and ensure the health and safety of the contractors at the site as well as residents and employees in the surrounding neighborhoods.

5.3.2.1 Meteorological Monitoring

A portable meteorological station will be located on-site during all aggressive air and activity-based activities and associated sampling. Real-time data, including wind speed, wind direction, temperature, and atmospheric pressure will be available for review on the meteorological station display panel. These meteorological parameters can be measured in various ways, and may be measured during this field effort using the following instrumentation: wind speed and direction may be measured using a combination wind vane and anemometer; temperature may be measured using a thermistor; and atmospheric pressure may be measured using a manifold absolute pressure (MAP) sensor. In particular, the wind direction and wind speed data will be used to establish:

- Staging locations for personnel and the decontamination station;
- The background sampling locations;
- The perimeter aggressive air sampling locations; and
- The activity-based perimeter air sampling locations.

Procedures and methods for the background sampling locations, perimeter aggressive air sampling program, and the activity-based perimeter air monitoring/sampling program are outline below. The meteorological data will also be stored for later retrieval and use when evaluating the fixed laboratory data.

5.3.2.2 Background Sampling

A background air sample will be collected concurrent with all site activities on each day during which remediation activities are performed at the Site. A high flow rate air pump operated at a high flow rate (10 L/min), with an attached 25-millimeter (mm) diameter, 0.8 micrometer (µm) MCE filter cassette, will be mounted on a 4 to 5 foot-tall cassette tripod stand. The inlet cap of the filter cassette will be removed (so that it is open-face) during sampling activities; the cassette will be positioned downward and perpendicular to the wind direction. The flow rate of the air sampling

train created from this assembly will be measured before and after sample collection using a rotameter or primary flow meter. During flow rate measurement, both before and after sample collection, it is important to use the filter cassette for collecting the actual sample; this is especially important for the after-sample-collection flow rate measurement because loading of dust and other material during the sampling may have altered the flow rate.

Procedures for the collection of background samples are listed below:

1. Document the location of the sampling point in the field log book. Place a stake at the sampling location and mark the stake with the sample number.

2. To set up the sampling train, attach the air intake hose to the cassette base, and remove the cassette cap. The cassette should be positioned downward, perpendicular to the wind.

3. Record the following in a field logbook: date, time, location, sample identification number, pump number, flow rate, and cumulative time.

4. Turn the pump on. Should intermittent sampling be required, sampling filters must be covered between active periods of sampling. To cover the sample filter: turn the cassette to face upward, place the cassette cap on the cassette, remove the inlet plug from the cassette cap, attach a rotameter to the inlet opening of the cassette cap to measure the flow rate, turn off the sampling pump, place the inlet plug into the inlet opening on the cassette cap. To resume sampling: remove the inlet plug, turn on the sampling pump, attach a rotameter to measure the flow rate, remove the cassette cap, replace the inlet plug in the cassette cap.

5. Check the pump at sampling midpoint if sampling is longer than 4 hours. The generators may need to be re-gassed depending on tank size. If a filter darkens in appearance or if loose dust is seen in the filter, a second.

6. At the end of the sampling period, orient the cassette up, turn the pump off.

7. Check the flow rate. When sampling open-faced, the sampling cap should be replaced before post calibrating. Use the same cassette used for sampling for post calibration (increase dust/fiber loading may have altered the flow rate.

8. Record the post flow rate.

9. Record the cumulative time or run.

10. Remove the tubing from the sampling cassette. Still holding the cassette upright, replace the inlet plug on the cassette cap and the outlet plug on the cassette base.

11. Place a sample label on the cassette indicating a unique sampling number. Do not put sampling cassettes in shirt or coat pockets as the filter can pick up fibers. The original cassette box is used to hold the samples.

12. Wrap the cassette individually in a plastic sample bag. Each bag should be marked indicating sample identification number, total volume, and date.

13. The wrapped sampling cassettes should be placed upright in a rigid container so that the cassette cap is on top and cassette base is on bottom. Use enough packing material to prevent jostling or damage. Do not use vermiculite as packing material for samples.

Background air samples will be collected offsite (if practical and accessible) or at the Site perimeter and upwind at a distance sufficient to prevent real-time influence by the aggressive air and activity-based activities to be conducted at the Site. To the degree possible, the locations selected for the background air samples will be free of known asbestos contamination. The background air asbestos level should reflect the concentration of asbestos in the air for the environmental setting in the vicinity of the site and will be used to help evaluate whether a release from the Site has occurred during the proposed remediation activities. The background air asbestos level does not necessarily represent historical, pre-release conditions or conditions in the absence of influence from potential sources at the Site. A background air asbestos level may or may not be less than the analytical detection limit, and if it is greater than the detection limit (and therefore detectable), it will account for variability in local asbestos air concentrations.

5.3.2.3 Activity-Based Air Sampling

Activity-Based air sampling (ABS) will be conducted to simulate human exposure to asbestos during typical site activities. There will be three activity-based outdoor air sampling rounds. Environmental Response Team (ERT) guidance indicates that each ABS round should be repeated a minimum of three times in an area to expose trends and introduce variability in the way the activity is conducted. This can be accomplished by a single participant repeating an activity three or more times, or by conducting a single activity with three or more participants. The specific activity for each round will be determined in the field (see below). Each ABS event will occur over a 120-minute period.

During each activity, air samples will be collected from the breathing zones of event participants. The breathing zone can be visualized as a hemisphere approximately 6 to 9 inches around an individual's face. Breathing zone samples provide the best approximation of the concentration of contaminants in the air that an individual may actually breathe.

Each even participant, wearing the appropriate PPE, will be fitted with two sampling pumps, one set at a low flow rate (3.0 L/min) and the other set at a higher flow rate (10.0 L/min). The pumps will be contained within a backpack or harness, with the filter cassettes secured to the participants shoulder straps so that their inlets are within the participant's breathing zone. The both the high and low flow rate sampling trains will consist of an appropriate portable air sampling pump with an attached 25-mm diameter, 0.8 µm MCE filter cassette. The inlet caps of both the low and high flow rate filter cassettes will be removed (so that they are open-faced) during sampling and the cassettes will be positioned downward.

When two or more participants are involved in an activity-based outdoor air sampling round, each of the relieving participants will don appropriate PPE and will be ready to relieve the preceding participant from the activity before a personnel exchange is made. The original participant will stop the activity, remove the backpack or harness containing the sampling trains and pass it to the relief participant. The original participant should assist the relief participant with donning and adjusting the backpack (or harness) and adjusting the location of the filter cassettes so that they are within the new participant's breathing zone. The exchange should take less than 60 seconds, however, during the exchange, the pumps and event clock should be stopped until the activity resumes.

In addition to ABS of the personal breathing space of the participants, air samples will also be collected around the perimeter of each activity at upwind and downwind locations to assess the impact of the activity on outdoor air. Several sampling locations will be selected around the activity area and at each location there will be two sampling pump assemblies, one set at a low flow rate (3.0 L/min) and the other set at a higher flow rate (10.0 L/min). The flow rate sampling train for both pumps will consist of an appropriate portable air sampling pump with an attached 25-mm diameter, 0.8 µm MCE filter cassette. The inlet caps of both the low and high flow rate filter cassettes will be removed (so that they are open-faced) during sampling and the cassettes will be positioned downward and perpendicular to the wind direction. The low and high flow rate filter cassettes set up at each sampling location will be mounted as close to each other as possible on a 4 to 5-foot tall cassette tripod stand. Perimeter samples will be collected for the duration of each ABS event.

The flow rate of the air sampling trains created from these participant-worn and perimeter air sampling assemblies will be measured before and after sample collection using a rotameter or other primary flow meter. As indicated in section 5.3.2.2, it is important to use the filter cassette for collecting the actual sample during flow rate measurement before and after sample collection.

Once each ABS event and its associated air sampling are completed, bulk material samples (consisting of debris, soil, and [if present] pure or almost pure asbestos containing material [ACM]) will be collected as either grab or multi-point composite samples from within the area where the activity occurred. These samples may be collected from the piles of debris generated during the activity. If the piles are not generated, bulk material samples can be collected from the designated

area by digging at the ground surface. If there is not enough debris for collecting bulk material samples, grab or composite microvacuum dust samples may be collected instead.

ABS event and air sampling locations will be determined in the field. The proposed work and associated sampling will be conducted in accordance with EPA ERT SOP No. 2084. The following activities may be conducted in conjunction with the activity-based air sampling.

5.3.2.4 Raking

The raking scenario, also referred to as the generic scenario, is appropriate for all sites with soils potentially contaminated with asbestos. Generic ABS should be employed in a grid pattern to evaluate the potential for fiber release from soil over a portion of the site. If the analytical results are above the criteria that were derived for the site, then remediation or institutional controls should be implemented or additional site-specific ABS should be undertaken. If the analytical results are below the criteria that were derived, then no further action may be necessary. Raking for this event will occur on an area to be determined in the field that will consist of an open area devoid of tall vegetation and with exposed soil. In this activity or simulation a participant will rake a lawn or garden area to remove debris such as rocks, leaves, thatch, and weeds using a leaf rake with a rake width of approximately 20 to 28 inches. Participants should strive to disturb the top half-inch of soil with an aggressive raking motion. However, the depth may vary based on the objective of the scenario. A grab or multi-point composite bulk material sample of the raked dust/soil/debris will be collected after the round of raking activity is completed; if there is not enough swept dust/soil/debris to collect a bulk material sample, then a grab or composite microvacuum dust sample will be collected from the raked surface using microvacuuming techniques.

The raking will be conducted by following these steps:

1. Each raking participant will don the appropriate PPE and the personal sampling pumps contained in a backpack or harness. The open-face inlets to the filter cassettes attached to the participant will be oriented within the participant's breathing zone and the pumps will be turned on.
2. Personnel will then proceed to rake a predetermined plot in an arched motion from the left to their right to remove debris for a minimum of 2 hours (flow rate and sensitivity level dependent).
3. The participants will rake the debris towards themselves facing one side of the square for 15 minutes then the participant will turn 90 degrees clockwise and begin a new side.
4. Participants will continue to rake each side of the square and rotate 90 degrees. Once several small piles of debris have been made, the participant shall pick up the debris and place it in a trashcan
5. The sequence of raking, rotating and picking up debris shall be repeated for the duration of the sampling period. The participant should stay in the same plot for the

entire sampling period (120 minutes).

5.3.3 Additional Bulk Sampling

In addition to the soil and ACM samples that are proposed in association with each of the rounds of aggressive air and activity-based air sampling planned for this field event, additional bulk material samples may also be collected to verify the extent of the asbestos material at the Site. Sampling locations for any additional samples will be determined in the field through reconnaissance and observation. Bulk material and ACM samples will be collected as either a grab or multi-point composite samples by digging at the ground surface using either a spoor or a hand auger (see Section 5.3.1.1.

5.4 REPLICATE SAMPLES

Replicate samples will be collected per analytical batch (no more than 20 field samples) per sampling batch per matrix. The replicate samples will be analyzed for the same components as the field samples to which they are associated. Each replicate sample will be assigned a unique number in the field such that all replicate samples are blind to the laboratory.

5.5 CONTAINERS, PRESERVATION AND HOLDING TIMES

Each sample container will be clearly identified using standard container labels. Sample labels should include, at a minimum, the Site name, a unique Sample ID, sample date and time, and the laboratory analyses to be conducted on the sample. An example of a standard blank sample label is included as **Figure 4**. The containers to be used, the preservation technique to be employed and the applicable holding times for solid samples are presented in **Table 4** Containers, Preservation and Holding Times for Solid Samples.

5.6 CHAIN-OF-CUSTODY PROCEDURES

Chain-of-Custody Procedures are covered extensively in Section 6.0, Sample Custody.

5.7 SAMPLE TRANSPORTATION AND STORAGE

The sample containers will be shipped from the laboratory to the field. After filling the sample containers, the containers will be packed and shipped via overnight courier to the laboratory. Precautions will be taken whenever glassware is transported to minimize the possibility of breakage. The laboratory will be prepared to receive any weekend shipments of samples.

5.8 PREVENTION OF CROSS-CONTAMINATION

Cross-contamination of field samples will be prevented through the use of dedicated or disposable equipment and/or decontamination procedures. Wherever possible, samples will be collected using equipment dedicated to the sampling location or equipment which is disposable. Where dedicated equipment is unavailable or impractical, decontamination procedures will be used in accordance with

the SOP provided in Section 5.3.

5.9 DOCUMENTATION OF SAMPLING ACTIVITIES

Proper documentation of all activities at the Zonolite Road Site will be made by the field staff. Water-resistant field log books will be maintained to record pertinent information at each sample location. The field logbooks will be bound with consecutively numbered pages. All pages will be signed and dated by the person recording the information. Any blank spaces in the books will be crossed through. Any works, sketches, or phrases that are recorded but deemed incorrect will be marked through in such a way as to still be legible, yet obviously struck from the text. All mark-throughs will be initialed and dated by the person striking the item. Information recorded in these books will include name and exact location of site, date and time of arrival and departure, name of person keeping the log, names of all on-site personnel, purpose of visit, location of sampling points, field instrument calibration information, number of samples collected, serial numbers for any equipment used in the collection of a sample, matrix of sample and volume of samples taken, method of sample collection and any factors that may affect the quality of the data collected, sample identification numbers using unique sample labels, description of sample collected, weather conditions during the previous 48 hours and any other observations deemed pertinent (Refer to Section 5.3).

5.10 INVESTIGATION DERIVED WASTE (IDW) MANAGEMENT

All investigation derived solid wastes, which include gloves, acetate liners, paper towels, baggies, tyvek suites, etc. will be placed in plastic bags and combined with the material generated during removal action activities at the Site and transported to the landfill for disposal.

6.0 SAMPLE CUSTODY

6.1 FIELD

A sample will be considered to be in the custody of a person if it is in his or her possession, in his or her sight or secured by that person in an approved location accessible only to authorized personnel.

The chain of custody will begin with the shipment of sample containers from the laboratory. For all sampling, appropriately prepared containers and blank water will be shipped in custody-sealed containers with a chain of custody form. An example of an acceptable chain of custody form is provided in **Figure 5** Chain of Custody. When overnight couriers are utilized, the airbill will become part of the chain of custody record. The receiver will verify that all chain of custody seals are intact. Any shipping containers that show evidence of tampering will be returned unused to the shipper. Any deviations from the original shipment documents will be noted on the chain of custody form and the receiver will accept custody for all or part of the shipment by an exchange of signatures with the delivering agent. Containers will then be secured in an approved location accessible only to authorized personnel until they are needed in the field.

When a sample has been taken in the field, the sampling technician will complete the chain of custody form provided by the laboratory. The sample will be secured in a shipping container by the sampler and must remain in his or her possession until it is secured in an approved location accessible only to authorized personnel or until custody is transferred by an exchange of signatures to another person.

Each sample container will be clearly identified using standard container labels. It is imperative that information on the chain of custody form and the container label matches in every respect. The sample container labels will be small enough that they will fit short VOA water bottles, which are the smallest bottles that are normally used. The label is printed in blue on waterproof, self-adhesive stock. All labels in a set have the same ID No. Labels with the same ID No. will be used on the various bottles that usually constitute a single sample. An example of a standard blank sample label is included as **Figure 4**.

Following are definitions for some of the terms on the labels:

- ID No. This field consists of a distinctive code, which allows for clear and precise identification of the sample. All labels in a set have the same ID No. The label set will be applied to each bottle within one sample and to the corresponding forms or notebooks. The purpose of the ID No. is to provide a single, unique identifier to distinguish the sample from all

others and to simplify data management. Because the ID No. is dependent on the sample sequence number, if two or more sampling crews are used to collect samples on the same day, each crew should be given a range of sequence numbers to use for that date so that unique ID Nos. are maintained. Refer to the Removal Action Work Plan, Soil and Groundwater Sampling and Analysis Plans, Sections 10.2 and 10.3, respectively.

- Site The site is the name of the overall area from which the sample was taken. It is the largest area of concern in a project (i.e., it is the name used for the area of the entire project). A single name or abbreviation will be used by samplers.

6.2 LABORATORY

Transfer of custody to the analytical laboratory and sample custody within the laboratory are addressed in the laboratory's QAM. Upon completion of analysis, samples will be maintained at the laboratory under chain of custody for a period of six months. Thereafter, all remaining samples will be released for proper disposal.

7.0 CALIBRATION PROCEDURES AND FREQUENCY

7.1 FIELD INSTRUMENTS

A calibration program will be implemented to ensure that routine calibration is performed on all field instruments. Field team members familiar with the field calibration and operations of the equipment will maintain proficiency and perform the prescribed calibration procedures outlined in the Operation and Field Manuals accompanying the respective instruments. All air sampling pumps will need to be calibrated using air flow gauge(s) calibrated with a primary air flow standard. Flow rate measurements will be obtained periodically during air sampling to ensure proper pump operation, as well as before and after air sample collection. During flow rate measurement, both before and after sample collection, it is important to use the filter cassette for collecting the actual air sample; this is especially important for the after-sample-collection flow rate measurement because loading of dust and other material during the sampling may have altered the flow rate.

Calibration records for each field instrument used on the project will be maintained in the on-site field trailer and a copy will be kept in the contractor's project files. Calibration records will consist of the daily calibration logs as well as notes on any repairs and/or modifications made to the instruments. Calibration records for the field instruments will be cataloged by the instrument type and by the individual serial numbers of each of the field instruments. Field instruments to be utilized during the Removal Action include:

- Gillian Aircon-2 High Volume Air Sampler (or similar specification)
- SKC-224 pcxr8 air pump (or similar specification)

7.2 LABORATORY INSTRUMENTS

Laboratory calibration procedures are addressed in detail in individual standard operating procedures, found in the laboratory's QAM.

8.0 ANALYTICAL PROCEDURES

8.1 LABORATORY

Laboratory analytical procedures will be taken from EPA Asbestos Sampling SOP 2015, and 40 CFR, pt. 136. Specific analytical methods for the analyses of soil and air samples are listed in **Table 5** "Methods for the Analyses of Soil and Air Samples." The laboratory will maintain and have available for the appropriate operator's standard operating procedures relating to sample preparation and analysis according to the methods stipulated in the tables referenced above. Copies of the laboratory Standard Operating Procedures for the analyses of asbestos bulk and air samples have also been included as an attachment to this QAPP.

Specific laboratory procedures are provided in the laboratory's QAM.

9.0 INTERNAL QUALITY CONTROL (QC) CHECKS

9.1 FIELD QC CHECKS

Field QC checks are provided to ensure accuracy and precision of the measurements and samples collected during field activities. In order to maintain QC, a minimum of one duplicate sample, per medium, per container type, per field day, should be collected. Documentation of the field QC checks will be maintained in the daily site field sample logs, and will be stored in the on-site field trailer.

9.1.1 Replicates

The collection of replicate samples provides for evaluation of the field sampler's collection techniques and the laboratory's performance by comparing analytical results of two samples of the same matrix from the same location. One replicate sample will be collected for each analytical batch for each sample matrix sampled. If more than 20 samples of a single matrix are collected, then a frequency of one replicate sample per 20 samples should be collected. **Table 2** Summary of Data Quality Objectives lists the expected number of replicate samples to be collected based on the proposed number of samples.

The duplicate or replicate samples will be assigned unique identification numbers so that they exist as blind samples to the laboratory.

9.1.1.1 Solid Matrix

Obtaining replicate samples of a soil or sediment matrix requires homogenization of the sample aliquot prior to filling the sample containers. Moisture content, particle size and absorption properties of various soils, sediments, and waste materials may inhibit the ability to achieve complete mixing prior to filling sample containers. The material will be composited by placing it in a stainless-steel bowl. The material will then be thoroughly mixed and transferred to the remaining containers using a stainless-steel trowel, scoop or spoon.

9.2 LABORATORY QC CHECKS

Internal QC checks are documented in the laboratory's QAM. All laboratory internal QC checks will conform to those required by the methodologies noted in the tables provided in Section 8 of this QAPP, and the laboratory's SOPs provided in the laboratory's QAM.

10.0 DATA REDUCTION, VALIDATION AND REPORTING

10.1 DATA REDUCTION

The laboratories QAM will also provide detailed information pertaining to data reduction internal to the laboratories. All field and office data reduction procedures are described in the following sections.

10.1.1 Field

Data reduction will occur for the field measurements at the point of sampling. At the point of sampling, the sampling data will be reported in the field notebooks as well as on any forms required for the project. All field notebooks will be stored in the on-site field trailer.

10.1.2 Office

After the field event, the data may be further reduced to data tables, contour maps or trend analysis tables or graphs.

Upon the return of the analytical results from the laboratory and after data validation, the data will be further reduced to data tables, graphs and images. The data tables will contain the following information:

- The date and number of the most current revision,
- Information identifying exactly the samples represented on the tables (e.g. sample location, matrix, depth, etc.),
- The compounds for which the samples were tested,
- The results for each compound, and
- The data flags as applied by the laboratory and the data validators.

10.2 DATA VALIDATION

The SOPs for validation of each type of data generated will be provided upon request and the data validation SOPs are on file in the URS office. In general terms, these SOPs will provide a summary validation of the analytical data based on USEPA functional guidelines. Data reviewers will review summary form information for each of the required steps of the guidelines using appropriate acceptance criteria and USEPA data flagging protocols. The items reviewed will be:

- Calibration failures,
- Blank contamination,
- Surrogate, matrix spike, and QC Check Sample failures for organics, and
- Matrix spike and Laboratory Control Sample failures for inorganics.

In addition, if any data point identified in the validation displays a gross or widespread indication of QA/QC failure, a further review of the data will be required. This decision will be made by the Project Manager in association with the project QA Officer.

The validation SOP is applicable to laboratory generated data which are of Level III or Level II data quality. Specifically, these SOPs are not applicable to field measurements, soil gas survey measurements, field health and safety measurements or other types of screening measurements. It is applicable to chemical analysis according to known protocols and requires deliverables capable of supporting the validation process.

The output from the data validation process will be a validation report which contains a review of the deficiencies identified in the data, a set of data sheets with flags identifying biases and unreliable data and assessments of laboratory performance, overall precision and accuracy, representativeness and completeness of the data set.

10.3 IDENTIFYING OUTLIERS

Data generated during this investigation will be evaluated to identify outlying data points.

10.3.1 Field

The principle investigator responsible for field activities will order any suspicious measurement data re-measured. Field duplicates will be taken until at least two of the current field measurements agree with each other.

10.3.2 Laboratory

Detailed procedures for the laboratory identifying outliers are found in the QAM. The laboratory's results, including their identification of outliers, will be verified through the data validation process.

10.4 DATA REPORTING

Laboratory analytical data for the asbestos bulk and air samples, and the confirmatory soil samples, will be submitted to the appropriate authorities as part of a Removal Action Report.

11.0 PERFORMANCE AND SYSTEM AUDITS

11.1 FIELD AUDITS

The Project QA Officer will conduct periodic audits of the operations at the Site to ensure that work is being performed in accordance with the work plan and associated standard operating procedures. A checklist appropriate to the activities scheduled during the audit will be used. The audit will cover, but not necessarily be limited to, such areas as:

- Conformance to SOPs
- Completeness and accuracy of documentation
- Chain of custody procedures
- Compliance with the Health and Safety Plan
- Construction specifications

These audits will occur at least once per month or at the start or end of each significant phase of the project, whichever is more frequent. Documentation of the audits and their findings will be maintained in the on-site field trailer.

11.2 OFFICE AUDITS

The Project QA/QC Supervisor or his/her designated representative will also conduct periodic audits of the case files. These audits will determine the completeness of the files and verify that all of the appropriate information is included in the files.

11.3 LABORATORY AUDITS

In addition to any audits required by the Project Manager or Project QA Officer may choose to audit the laboratory. These additional audits may take the form of Performance Evaluation samples or on-site inspections of the laboratory. Performance evaluation samples may be either blind samples or known to the laboratory. Reasonable notice will be provided if the audit is to include an on-site inspection of the laboratory.

12.0 PREVENTATIVE MAINTENANCE

12.1 FIELD

The air monitoring subcontractor will be responsible for preventative maintenance of all field instruments associated with the air monitoring. The field sampling personnel will protect the instruments by placing them in portable boxes and/or protective cases.

All field equipment will be subject to a routine maintenance program, prior to and after each use. The routine maintenance program for each piece of equipment will be in accordance with the manufacturer's operations and maintenance manual. All equipment will be cleaned and checked for integrity after each use. Necessary repairs will be performed immediately after any defects are observed, and before the item of equipment is used again. Spare parts and commonly replaced items will be stored in the on-site field trailer (or in an otherwise secure on-site location) in the event repairs are necessary in the field. Equipment parts with a limited life (such as membranes and some electronic components) will be periodically checked and replaced as necessary according to the manufacturer's specifications.

Arrangements will be made prior to the commencement of work for the repair or replacement of equipment which becomes inoperable. The equipment manufacturer’s facility is the designated repair facility. The Field Manager will keep an address list of the manufacturers associated with the equipment to be used at the site.

Preventative maintenance is important since it provides for a longer useful life of the equipment and helps to ensure a successful field sampling and testing program. Each piece of field equipment will have its own log sheet which contains the equipment identification and the type of maintenance performed. Since most equipment is used on an irregular basis, all equipment will be properly stored when not in use.

12.2 LABORATORY

The laboratory's preventative maintenance procedures are provided in the laboratory's QAM.

13.0 ASSESSING DATA PRECISION, ACCURACY AND COMPLETENESS

13.1 PRECISION

"Precision" is defined as the degree of mutual agreement among individual measurements of the same property under similar conditions, and is expressed as relative percent difference (RPD).

$$RPD = \left(\frac{Rep1 - Rep2}{(Rep1 + Rep2)/2} \right) \times 100$$

The precision objectives are noted in Section 4 of this QAPP. The Project Director will be responsible for monitoring the precision objectives. Should any of the data fail the precision criteria, corrective action will be taken in accordance with Section 14 of this QAPP.

13.1.1 Field Measurements

If duplicate measurements fail to meet precision objectives, two additional measurements will be taken until acceptable precision is obtained.

13.1.2 Laboratory Analytical Measurements

The mechanisms for internal review of data for conformance to those specifications, and corrective actions required in cases of failure to meet precision specifications, are given in the laboratory QAM. Independent data validation will also be provided as a further check on laboratory performance (see Section 10 for more information on the data validation procedures).

13.2 ACCURACY

"Accuracy" is defined as the degree of agreement between a known value and a measured value.

$$ACCURACY = \frac{MEASURED VALUE}{KNOWN VALUE} \times 100$$

The accuracy objectives are noted in Section 4 of this QAPP. The Project Director will be responsible for monitoring the accuracy objectives. Should any of the data fail the accuracy criteria, corrective action will be taken in accordance with Section 14 of this QAPP. Calibration failures will be corrected by either having the equipment repaired as per manufacturer's specifications and/or replacement with correctly functioning equipment. In the event of blank contamination detections, a new lot of cassettes will be ordered from the analytical laboratory. Use of the contaminated lot will be discontinued and it will be removed from the Site.

13.2.1 Field Measurements

Accuracy objectives for air monitoring will require that the manufacturer's specifications for the sensors will be noted and a measurement against a known air quality taken by the principle investigator responsible for field activities. A failure of accuracy will result in the return of the instrument to the manufacturer and the acquisition of an accurate instrument. Accuracy failures will result in the re-calibration of the instrument when possible or the return of the instrument to the manufacturer when re-calibration is not possible. Additional measurements will be taken until acceptable accuracy is achieved.

13.2.2 Laboratory Analytical Measurements

The mechanisms for internal review of data for conformance to those specifications and corrective actions required in cases of failure to meet the accuracy specifications are given in the laboratory's QAM. Independent data validation will also be provided as a further check on laboratory performance (see Section 10 for more information on the data validation procedures).

13.3 COMPLETENESS

"Completeness" is a measure of the amount of valid data obtained compared to the expected amount of data to be obtained under normal conditions.

$$COMPLETENESS = \frac{QUANTITY\,OF\,RELIABLE\,DATA}{TOTAL\,QUANTITY\,OF\,DATA} \times 100$$

The completeness objectives are noted in Section 4 of this QAPP. The Project Director will be responsible for monitoring the completeness objectives. Should any of the data fail the completeness criteria, corrective action will be taken in accordance with Section 14 of this QAPP.

13.3.1 Field Measurements

All applicable samples will be measured for this parameter.

13.3.2 Laboratory Analytical Measurements

The objective for completeness is 95 percent. Certain highly contaminated samples and certain media historically do not yield normal precision and accuracy, or may require modifications of established protocols to achieve meaningful results. It is necessary, however, that these problem samples/analyses be identified and discussed with the QA officer while they are in the analytical process and that corrective actions taken or deficiencies accepted are deliberately arrived at and carefully documented.

14.0 CORRECTIVE ACTION

The following procedures have been established to ensure that non-conforming conditions, such as malfunctions, deficiencies, deviations and errors are promptly investigated, documented, evaluated and corrected.

14.1 FIELD

When a significant non-conforming condition is noted at the site, laboratory, or contractor location, the cause of the condition will be determined and corrective action taken to preclude repetition. Condition identification, cause, reference documents and corrective action planned to be taken will be documented and reported at a minimum to the Project Manager, QA officer, and involved contractor management. Implementation of corrective action is verified by documented follow-up to the QA officer. All project personnel have the responsibility, as part of their normal work duties, to promptly identify, solicit approved correction and report non-conforming conditions. Project management and staff such as field investigation teams, quality assurance auditors, document and sample control personnel and laboratory groups must monitor ongoing work performance in the normal course of daily responsibilities.

Work is audited at the site, laboratories and subcontractor locations by the QA officer or designated auditors. Items, activities, or documents ascertained to be non-compliant with QA requirements will be documented and corrective actions mandated through audit finding sheets attached to the audit report. Audit findings are logged, maintained, and controlled by the QA officer. The periodic QA report (see Section 15) will contain the audit report.

A Corrective Action Recommendation (CAR), as shown in **Figure 6**, should be used to identify the adverse conditions, reference document(s), and recommended action(s) to be administered. The CAR is directed to the Project Manager. The Project Manager returns the requested response promptly to the Project QA officer. The CAR is returned only after the Project Manager affixes his or her signature and date to the action block and stating the cause of the condition(s) and action(s) to be taken. The Project QA officer maintains the log for status control of CARs and responses, confirms the adequacy of the intended action(s), and verifies its implementation. The Project QA officer will issue and distribute copies of completed CARs to the originator, Project Manager, Project Director, and the involved contractor(s) if any. CARs are transmitted to the project file for the records.

14.2 LABORATORY

The laboratory's QAM contains a detailed discussion of corrective actions to be taken if established criteria fail during laboratory analysis.

15.0 QA REPORTS TO MANAGEMENT

The laboratory will provide all analytical results for all samples, field-generated and laboratory blanks, and spiked samples to the W.R. Grace Representative or its designate. One copy of the analytical results will be sent to the Project Manager and one set of results will be sent directly to the Project QA Officer. The Project QA Officer will review the results and report the findings to the Project Manager as soon as possible.

Periodic reports from the Quality Assurance Manager will address:

- Overview of activities and significant events related to QA/QC
- Summary of audit results
- Review of corrective action request status
- Laboratory QA/QC report
- Data validation QA/QC report
- Summary of significant changes in procedures or QA/QC programs
- Recommendations

Reports will be submitted to the Project Manager.

Upon project completion, a Final QA Report will be issued, assessing the overall degree of project conformance to specifications and the impact of any non-conforming conditions on data quality that may affect management decisions.

The nature of the laboratory's Quality Assurance reports is provided in their QAM.

The final storage location of the files will be designated by W.R. Grace. The files will be stored in locked cabinets protected from fire and flood for a period of at least three years.

TABLE 1 Summary of Analyses

AIR	SOIL
Asbestos by NIOSH 7400	Asbestos by USEPA 600

TABLE 2 Summary of Data Quality Objectives

Task	Data Quality Level	Deliverables Level	Field Samples	Equipment Blanks	Replicates	Total Samples
Soil Sampling Program Air Monitoring Program	II II	III III	7 TBD	1 TBD	1 TBD	7 TBD
Total Samples			TBD	TBD	TBD	TBD

Notes: The total number of shipments may increase from the quantity shown here.

TABLE 3 Quality Assurance Objectives for Soil and Air Samples

Sample Type	Parameter	Method Reference[1]	Accuracy/ Precision (+/- %)	Completeness (%)
Soil	Asbestos	PLM	0.25	95
Air	Asbestos	PCM	0.25	95

Notes: PLM = Polarized Light Microscopy
PCM = Phase Contrast Microscopy

TABLE 4 Containers, Preservation and Holding Times for Soil and Air Samples

Organic Parameters	Containers	Preservation	Holding Times
Asbestos PLM EPA 600	G	NA	NA NA
Asbestos PCM NIOSH 7400	MCEF Cassette	NA NA	NA NA

Containers:

G-Glass
MCEF-Mixed Cellulose Ester Membrane Filter
Cassette-50mm Conductive Cowl on Cassette

TABLE 5 Methods for the Analysis of Soil and Air Samples

Medium	Parameter	Reference	Analytical	Detection Limits
Soil	Asbestos	PLM	USEPA 600	CARB 435 Level A 0.25% Target Analytical Sensitivity
Air	Asbestos	PCM	NIOSH 7400	0.25% Target Analytical Sensitivity