QUALITY ASSURANCE PROJECT PLAN

AMBIENT AIR MONITORING FOR ASBESTOS DURING DEMOLITION OF SUBSTANDARD STRUCTURES IN CITY OF FORT WORTH, TEXAS (PROJECT XL)

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A1 QUALITY ASSURANCE PROJECT PLAN APPROVAL SHEET

AMBIENT AIR MONITORING FOR ASBESTOS DURING DEMOLITION OF SUBSTANDARD STRUCTURES IN CITY OF FORT WORTH, TEXAS (PROJECT XL)

Signature	Date
Brian Boerner, CHMM, Director Department of Environmental Management, City of Fort Worth, Texas	Date
Kathryn A. Hansen, Esquire, Project Manager Department of Environmental Management, City of Fort Worth, Texas	Date
Michael A. Gange, Technical Project Officer Department of Environmental Management, City of Fort Worth, Texas	Date
Shirley Hoover, Quality Assurance Officer Department of Environmental Management, City of Fort Worth, Texas	Date
Charles Boswell, Assistant City Manager City of Fort Worth, Texas	Date
Adele Cardenas, P.E., XL Coordinator U.S. EPA, Region VI	Date

APPROVAL SHEET (continued)

Todd Wingler, Chief, Asbestos Program Branch Texas Department of Health	Date
Roger C. Wilmoth, Chief, Multimedia Technology Branch National Risk Management Research Laboratory, U.S. EPA	Date
Tracy K. Bramlett, CIH, CSP, Principal Investigator/President Industrial Hygiene & Safety Technology, Inc.	Date
(To Be Determined), Microscopy Laboratory	Date
(To Be Determined), Demolition Contractor	Date

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A3 DISTRIBUTION LIST

Brian Boerner, Environmental Management Division, City of Fort Worth, Texas

Kathryn A. Hansen, Environmental Management Division, City of Fort Worth, Texas

Michael A. Gange, Environmental Management Division, City of Fort Worth, Texas

Shirley Hoover, Environmental Management Division, City of Fort Worth, Texas

Mike Camp, Code Compliance, Department of City Services, City of Fort Worth, Texas

Brian Haggerty, City Manager's Office, City of Fort Worth, Texas

Charles Boswell, Assistant City Manager, City of Fort Worth, Texas

Adele Cardenas, U.S. EPA, Region VI

Todd Wingler, Texas Department of Health

Roger C. Wilmoth, National Risk Management Research Laboratory (NRMRL), U.S. EPA

Tracy K. Bramlett, Industrial Hygiene & Safety Technology, Inc.

Demolition Contractor (To Be Determined)

Microscopy Laboratory (To Be Determined)

A4 PROJECT ORGANIZATION

Environmental Quality Management, Inc. (EQ) has been contracted by the City of Fort Worth, Texas, to design this Quality Assurance Project Plan (QAPP).[1] The QAPP was prepared to meet U.S. Environmental Protection Agency (EPA) requirements applying to projects that include environmental measurements and is written in the format specified by EPA.[(1)] The project organization chart showing the relationships and the lines of communication among project participants is contained in Figure A-1.

A.4.1 City of Fort Worth

Brian Boerner, CHMM, will serve as the Program Manager. He has overall administrative and technical responsibility for the project.

Kathryn A. Hansen, Esquire, will serve as the Project Manager. She has overall administrative responsibility for the project. As such, she will resolve any administrative problems that may occur and serve as the administrative contact with the Texas Department of Health, U.S. EPA, Industrial Hygiene & Safety Technology, Microscopy Laboratory (To Be Determined), Demolition Contractor (To Be Determined), and others.

Michael A. Gange will serve as the Technical Project Officer. He has overall technical responsibility for the project. He will ensure that Industrial Hygiene & Safety Technology, Inc.

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[1] Mr. Kominsky (Vice President/Director Industrial Hygiene & Safety, EQ) prepared this QAPP. He has more than 25 years of experience in the comprehensive practice of industrial hygiene and safety, of which 13 years were with the National Institute for Occupational Safety and Health (NIOSH). Since 1988, he has designed, implemented, and served as Project Manager/Principal Investigator on more than 15 asbestos research projects for EPA's National Risk Management Research Laboratory (NRMRL). Five studies (4 EPA and 1 commercial client) involved the determination of ambient concentrations of airborne asbestos in communities during demolition of buildings containing asbestos-containing materials (ACM) and landfill of the resultant asbestos-containing demolition debris, and other such projects involving fugitive emissions of asbestos. Mr. Kominsky has a Master's of Science Degree in Industrial Hygiene (University of Pittsburgh, 1973) and Bachelor of Science Degree in Chemical Engineering (University of Nebraska, 1971). He is a Certified Industrial Hygienist by the American Board of Industrial Hygiene, a Certified Safety Professional by the American Board of Certified Safety Professionals, and a Certified (Master Level) Hazardous Materials Manager by the Institute of Hazardous Materials Management. He is an Adjunct Associate Professor in the Department of Environmental Health at the University of Cincinnati. He has authored or co-authored more than 35 journal articles (11 articles related to asbestos) regarding occupational, environmental, and public health.

Figure A-1. Project Organization.

(IHST) implements the study in strict accordance with the QAPP and that the demolition contractor (To Be Determined) follows the *Fort Worth Method*. As such, he will resolve any technical difficulties with the contractors. He will also be responsible for resolving any technical difficulties associated with the laboratory analysis of the samples, data analysis and management, and preparation of the final project report.

A.4.2 Industrial Hygiene & Safety Technology, Inc.

Project Manager/Principal Investigator -- Mr. Tracy K. Bramlett (President, Industrial Hygiene & Safety Technology, Inc.) will serve as the Project Manager/Principal Investigator and maintain close communication with Ms. Hansen, Mr. Gange, and the demolition contractor. He will ensure that all IHST project personnel fully understand and strictly adhere to the QAPP. All IHST technical team members will be experienced professionals who possess the degree of specialization and technical competence required to effectively perform the required work.

Mr. Bramlett will coordinate and supervise implementation of the QAPP including site preparation, sample collection and documentation, data management and analysis, and preparation of the project report. He will coordinate the sampling staff, ensure all equipment is calibrated properly and measurements are made in accordance with the QAPP, review and validate field data (e.g., sampling data logs), review sample custody and traceability records, and coordinate submission of the samples to the laboratory. He will ensure that any problems or potential deviations from the QAPP reported by any of the project staff are addressed immediately and receive corrective and documented action, as necessary. Prior to effecting any deviations from the approved QAPP, the potential deviation will be discussed with and approval to deviate will be obtained from Mr. Gange.

A.4.3 Microscopy Laboratory

(To Be Determined) Laboratory will perform the transmission electron microscopy (TEM) analysis of all samples collected.

A.4.4 Demolition Contractor

(To Be Determined) Demolition contractor will perform the demolition of the facilities.

A5 PROBLEM DEFINITION/BACKGROUND

A.5.1 Background

In order to demolish substandard structures[2] that are not in danger of imminent collapse, the City of Fort Worth currently follows the requirements established by Asbestos National Emissions Standards for Hazardous Air Pollutants (NESHAP), 40 CFR §61.145. The City of Fort Worth proposes an alternative method, hereinafter referred to as the *Fort Worth Method*, for the demolition of "facilities" in lieu of the current Asbestos NESHAP requirements for the demolition of substandard structures that are not in imminent danger of collapse. If left standing, the substandard facilities will within several years become structurally unsound. Instead of waiting for these buildings to reach such a structural state, the City proposes to be proactive and demonstrate that facilities with regulated asbestos-containing material (RACM) left in-place is at least as protective as demolition of buildings with the RACM removed.[3] Based on the condition of the RACM, demolishing facilities while in substandard condition most likely is more protective of the public and environment than demolishing such facilities in danger of imminent danger of collapse.

Due to the requirements of Asbestos NESHAP, the City has only demolished facilities with RACM remaining in place when the facility is in imminent danger of collapse. Preliminary data generated by both phase contrast microscopy (PCM) and transmission electron microscopy (TEM) indicates that demolition of such structures using the *Fort Worth Method* does not generate significant airborne fiber levels.[(2)]

The *Fort Worth Method's* one primary difference from the existing Asbestos NESHAP is handling of the RACM. Prior to and during the course of demolition the facility is thoroughly wetted and demolition proceeds in a manner that allows the non-asbestos-containing building

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2 In the City of Fort Worth, a structure is considered substandard when it does not meet the standards or specifications established in the City's Minimum Building Standards Code, Ordinance No. 13743.

3 The City of Fort Worth proposes to demolish a facility without removal of RACM with certain exceptions. Spray-applied fireproofing and large quantities of thermal system insulation (>260 linear feet) will be removed using full-containment abatement procedures.

material (ACBM) to act as a barrier between the ACBM and the environment. By proper handling and wetting of the demolition debris, asbestos fiber release is controlled. A comparison of the Asbestos NESHAP and the *Fort Worth Method* is contained in Appendix A.

The *Fort Worth Method's* primary goal is to protect the public and the environment from the release of asbestos during the demolition of buildings containing in-place RACM. It's secondary goal is to provide a alternative method for controlling asbestos that creates a cost savings for municipalities performing demolition of nuisance buildings.

A.5.2 **Objective**s

The primary objectives of this project are:

2. Determine whether the airborne concentrations of asbestos upwind *(comparative environmental background*[4]) during demolition of buildings containing in-place RACM are statistically significantly different than those concentrations downwind.

3. Determine whether the airborne concentrations of asbestos upwind *(comparative environmental background*) during land filling of building demolition containing RACM are statistically significantly different than those concentrations downwind.

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[4] Environmental background is the airborne concentration of asbestos prevailing in this area that is upgradient (upwind) from the facilities being demolished or the demolition debris being landfilled.

A6 PROJECT DESCRIPTION

A.6.1 Technical Approach

The project will be performed in two phases: Phase I and Phase II.

Phase I--Phase I will gather data on the *Fort Worth Method's* ability to prevent or minimize the release of asbestos fibers during demolition of buildings that are either exempt from the Asbestos NESHAP requirements (residential buildings that have four or fewer dwelling units) or not subject to asbestos NESHAP.[5] The data from Phase I will be analyzed to determine whether the *Fort Worth Method* is equivalent to the NESHAP method; i.e., the airborne concentrations of asbestos upwind *(comparative environmental background*) during demolition of the facilities and land filling of the resultant demolition debris are not statistically significantly different than the respective concentrations downwind. If the Phase I data supports a finding that the *Fort Worth Method* is equivalent to the Asbestos NESHAP method, the City will proceed with Phase II. If the methods are not found to be equivalent, the project may end with Phase I.

Phase II--Phase II will gather data on various buildings subject to the Asbestos NESHAP. These buildings will include single or two-story commercial structures and/or multi-family residential structures. The ACBM that are likely to be present include, but not limited to resilient floor tile and mastic, Transite® panels, roofing materials, wallboard joint compound, wall and ceiling texture, thermal system insulation, and miscellaneous other materials. Prior to demolition of a structure, a thorough asbestos assessment of the facility will be conducted by a State of Texas Department of Health licensed Asbestos Inspector. The assessment will identify the type, quantity, location, and condition of ACBM. Prior to demolition of the facility, spray-applied fireproofing or large amounts of thermal system insulation will be removed by a State of Texas Department of Health licensed Asbestos Abatement Contractor. The type and quantity of ACBM remaining in the facility will be documented.

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5 Asbestos NESHAP regulations must be followed for demolitions of facilities with at least 260 linear feet of RACM on pipes, 160 square feet of RACM on other facility components, or at least 35 cubic feet off facility components where the amount of RACM previously removed from pipes and other facility components could not be measured before stripping.

A.6.1.1 Demolition of Buildings

The buildings will be demolished using heavy equipment only. A typical building demolition will include the following:

- One or more bulldozers for single-story buildings, and a combination of bulldozers, front-end loader, and track-hoes for multi-story buildings.

- Thoroughly and adequately wetting the structure using fire hydrant water applied with a variable rate 11-G (11 gpm) or 30-G (30 gpm) nozzle prior to, during demolition, and during debris loading. A water meter (or equivalent device) will be installed at the water hydrant to measure the volume of water used during demolition of the structure. The water will be delivered as a mist or concentrated stream. Direct high-pressure water impact of ACM will be prohibited.[6] The demolition debris will be adequately wet at all times and kept wet during handling loading into containers for transport to a licensed disposal site.

- Collapsing structures inward (majority of the walls and interior components will be leveled on top of the building foundation) and loading debris prior to removal of the concrete slab, if present.

- Segregation of demolition debris to the extent feasible to reduce the amount of contaminated debris that will be treated as asbestos-contaminated waste. Debris not contaminated by the ACBM will be treated as construction debris, while all other materials will be treated as asbestos-contaminated waste. The RACM debris will be transported to a licensed disposal site in lined and covered containers. Segregation of the waste will be the responsibility of an onsite Asbestos NESHAP trained individual.

- Grading of the site for future use.

A.6.1.2 Air Sampling During Demolition of Buildings

The first study objective (see Section A.5.2) will be addressed by collecting ambient air samples at ten locations for three to five consecutive days during demolition of a facility. Five sampling locations will be located both upwind (comparative environmental background level of asbestos) and downwind of the demolition area. Meteorological conditions (such as wind

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[6] Although experience demonstrates that building demolition projects typically have a minimal to moderate amount of water runoff depending on the site locations and site conditions, the City will utilize *Best Management Practices* to control water runoff and collect storm water on the project site. Storm drain inlet protection will be used in conjunction with on-site controls (such as natural and manmade drainage channels), as necessary.

direction and wind speed) will be determined explicitly to establish and ensure true upwind and downwind conditions during sampling (see Section B.1.1).

A.6.1.3 Air Sampling During Land Filling of Demolition Debris

The second study objective (see Section A.5.2) will be addressed by collecting ambient air samples at ten locations for two to three consecutive days during land filling of the demolition debris from each facility. The projected monitoring of two to three consecutive days during landfilling of the demolition debris is based on the amount of time required to landfill the debris from a given site. Five sampling locations will be located both upwind (comparative environmental background level of asbestos) and downwind of the land fill. Meteorological conditions (such as wind direction and wind speed) will be determined explicitly to establish and ensure true upwind and downwind conditions during sampling (see Section B.1.1).

A.6.2 Personnel

The environmental measurements (field samples and meteorological measurements) will be made by and at the direction of an ABIH-Certified Industrial Hygienist, Tracy Bramlett. He has more than 23 years of experience in the comprehensive practice of industrial hygiene with approximately 21 years of asbestos monitoring experience including ambient air monitoring for asbestos and licensed appropriately by the State of Texas as an air monitoring technician. Other field personnel will include industrial hygienists experienced in asbestos ambient air monitoring and related measurements.

A.6.3 Project Schedule

The tentative project schedule is presented in Figure A-2. The major activities are listed sequentially, and the expected duration of each activity is presented.

Figure A-2. Project Schedule.

A7 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

The overall quality assurance objective of this project is to implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide data to satisfy the *Primary Project Objective* (i.e., the objective that will lead to the development of scientifically valid conclusions in the final report). Specific procedures for sampling, chain-of-custody, laboratory analysis, field and laboratory audits, preventive maintenance of field equipment, and corrective actions are described in other sections of this QAPP.

A.7.1 Primary Project Objective

The primary project objective is to determine the concentrations of airborne asbestos upwind *(comparative environmental background*) and those concentrations that are present downwind of the demolition site and the demolition debris land fill.

A.7.3 Criteria for Acceptance

The criteria for acceptance of equivalency of the *Fort Worth Method* to the existing Asbestos NESHAPS Method will be achieved by meeting either of the following:

1. There is not a statistically significant difference in the airborne concentrations of asbestos upwind during demolition of buildings containing in-place RACM or upwind during land filling of this building demolition debris compared to those concentrations measured downwind of the respective sites. The statistical comparisons will be made at the 0.05 level of significance.

2. The downwind sample average is less than 70 asbestos structures per square millimeter; the AHERA (40 CFR 763) clearance criterion.

A.7.3 Statistical Power

The study is designed to detect a 5-fold difference in average concentration (e.g., a 5-fold difference between the airborne asbestos concentrations upwind and downwind from the demolition or land filling sites) with high probability if such a difference actually exists. A false-positive error rate[7] of 5 percent will be achieved by employing a statistical significance level of 0.05 (i.e., a confidence level of 95%). A false-positive error occurs if we determine that a significant difference between the upwind and downwind airborne asbestos concentrations exists when, in fact, it did not. The statistical power of the upwind-downwind comparison will depend on the number of days required to demolish the building or landfill the demolition debris (Table A-1). Assuming three days of demolition per facility and ten air samples collected each day (five locations upwind, five location downwind), a simple parametric comparison (e.g., t-test) between the upwind and downwind locations will have a false-negative error rate[8] of approximately 10% for a 5-fold difference between mean concentrations and approximately 1% for a 10-fold

Table A-1. Effect of Number of Days of Demolition or Land Filling and Between-Sample Variation on Statistical Power Calculations Assuming 5 Samples Upwind and 5 Samples Downwind from the Site

Number of Days	Difference	Coefficient of Variation, %			
		100	150	200	250
2 days	2-fold	0.42	0.28	0.16	0.17
	5-fold	0.98	0.85	0.78	0.68
	10-fold	>0.99	0.99	0.95	0.93
3 days	2-fold	0.62	0.41	0.26	0.26
	5-fold	0.99	0.98	0.95	0.89
	10-fold	>0.99	>0.99	0.99	0.99
4 days	2-fold	0.74	0.52	0.41	0.33
	5-fold	>0.99	0.99	0.97	0.95
	10-fold	>0.99	>0.99	>0.99	>0.99

7 A false-positive error rate is the probability of rejecting the null hypothesis when the null hypothesis is actually true.

8 A false-negative error rate is the probability of accepting the null hypothesis when the null hypothesis is actually false.

difference (or equivalently, there is a probability of 0.90 of detecting a 5-fold difference and a probability of approximately 0.99 of detecting a 10-fold difference between mean concentrations at the upwind and downwind locations). A false-negative error occurs if we determine that no difference in airborne asbestos concentration exists, when in fact the concentrations did differ.

The probability estimates assume a between-sample coefficient of variation (CV) of 250 percent, which is environmentally conservative, and were estimated by Monte Carlo simulation using log-normal random variables. Under more optimistic assumptions regarding the variability of measurements (e.g., a between-sample CV of 150 percent), the probability of detecting a 5-fold difference between the mean airborne asbestos concentrations upwind and downwind using a simple comparison (e.g., t-test) would be increased to approximately 98 percent.

A.7.4 Precision and Accuracy

The estimated false-negative error rates assume a between-sample coefficient of variation of 250 percent. This assumption is reasonable and environmentally conservative, and is based on measured concentrations of asbestos in ambient air at other locations.[3-5] The between-sample coefficient of variation is influenced by heterogeneity in the air being measured as well as sampling and laboratory performance used to collect and analyze the samples, respectively. If the overall target precision is not achieved, the false-negative error rate will increase. The data will ultimately be analyzed using analysis of variance (ANOVA) methods, rather than simple t-tests. The ANOVA methods will provide additional statistical power in detecting differences between sampling locations and, consequently, the false-negative error rates are expected to be lower than those stated in Section A.7.2.

In addition, duplicate field samples will be collected during each day of sampling and compared to results from co-located samples to evaluate the precision as well as serve as a combined check on the sample collection and analysis procedures.

A.7.5 Completeness

An overall measure of completeness will be given by the percentage of samples specified in the sampling design that yield usable “valid” data. Although every effort will be made to collect and analyze all of the samples specified in the sample design, the sample design is robust to sample loss. The loss of a small number of samples, provided that they are not concentrated at a single sampling site, will likely have little effect on the false-negative error rate. The project goal is to collect at least 95 percent of the samples specified in the sample design.

A.7.6 Representativeness

The sampling locations, sampling periods, and sample durations have been selected to assure reasonable representativeness. The five upwind sampling locations will be selected as locations that can be reasonably viewed as representing comparative environmental background conditions that are unaffected or influenced by activities of the demolition and land filling operations. The five downwind sampling locations will be selected as representative sites that would be influenced by potentially significant releases of asbestos from the demolition or demolition debris land filling operations. Samples will be collected each day (meteorological conditions permitting) of the demolition or land filling of demolition debris to provide estimates that are representative of the normal meteorological conditions in the area and to account for the potential day-to-day variability associated with ambient levels of airborne asbestos.

A.7.7 Comparability

Data collection using standard sampling and analytical methods (e.g., ISO Method 10312:1995, counting structures longer than and shorter than 5 μm in length, and PCM equivalent fibers[9]) maximizes the comparability of the results with both past sampling results (if such exist) and future sampling results.

A.7.8 Analytical Sensitivity

We have selected an analytical sensitivity (i.e., the concentration corresponding to the finding of one asbestos structure during a sample analysis) that corresponds to asbestos concentrations representative of general background concentrations in many areas of the United States. Data presented in Berman and Chatfield[(6)] indicate that an analytical sensitivity of 0.0005

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[9] A PCM (phase contrast microscopy) equivalent fiber is a fiber with an aspect ratio greater than or equal to 3:1, longer than 5 μm, and which has a diameter between 0.2 μm and 3.0 μm.

structure/cubic centimeters of air (s/cm^3) is likely sufficient to detect environmental background concentrations in many areas of the United States. The analytical sensitivity selected for the ambient air monitoring is 0.0005 s/cm^3 for all asbestos structures (minimum length of 0.5 Fm) and 0.0001 s/cm^3 for asbestos structures longer than 5 Fm (all widths). See Section B.4 "Analytical Method Requirements." Thus, the number of measurements (upwind and downwind) in which asbestos structures is not observed or detected among the data collected should be minimal.

A8 SPECIAL TRAINING REQUIREMENTS/CERTIFICATION

A.8.1 Field Personnel

The sampling (including equipment calibration, sample collection, and documentation) will be performed by and/or at the direction of an ABIH-Certified Industrial Hygienist (T. Bramlett). He has more than 23 years of experience in the comprehensive practice of industrial hygiene with approximately 21 years of asbestos monitoring experience including ambient air monitoring for asbestos. Other field personnel will include industrial hygienists experienced in asbestos ambient air monitoring and related measurements.

A.8.2 Laboratory Personnel

(To Be Determined) Laboratory is accredited by the National Institute of Standards and Technology (NIST) National Voluntary Laboratory Accreditation Program (NVLAP) to perform Airborne Asbestos Fiber Analysis. (To Be Determined) laboratory's NVLAP Laboratory Code No. is XXX (effective through XXX, 2000).

A9 DOCUMENTATION AND RECORDS

A.9.1 Field Operations Records

A.9.1.1 Air Sample Documentation

The following information will be recorded on a Sampling Data Form (Figure A-3):

- Names of persons collecting the sample
- Date of record
- Sampling site
- Location of sample
- Type of sample (e.g., high volume, duplicate, field blank)
- Unique sample number (identifies site, sample type, date, and sequence number)
- Rotameter number and air flow reading (start/stop)
- Linear regression equation and correlation coefficient for the calibrated rotameter
- Sample time (start/stop)
- Relevant notes describing site observations such as, but not limited to site conditions, demolition method/techniques and equipment, water application nozzle and hose diameter, water application technique (spray or concentrated stream) and approximate amount of time (e.g., hours) for each will be recorded on the reverse side of the Sampling Data Form (and on supplemental pages, as necessary).

The upwind and downwind air sampling locations will be identified on a drawing of the demolition site or land fill area.

At the end of each day, the samples which were collected and the corresponding data forms/drawings will be submitted to Tracy Bramlett. He will verify the data/information for completeness; any corrections will be noted and initialed on the form.

A.9.1.2 Meteorological Measurements

Meteorological measurements (wind direction, wind speed, relative humidity, and temperature) will be recorded on a Meteorologic Data Measurement Log (Figure A-4).

Figure A-3. Sampling Data Form.

Figure A-4. Meteorological Measurement Log.

A.9.1.3 Photo Documentation

A 35-mm photograph or digitized image will be taken of every sampling site. This will include the sampling station, visual debris on or in the soil. A 5-in. by 7-in. index card listing the sample number will be photographed to identify the sample and location. Other photographs or digitized images will be taken as necessary to thoroughly document the site conditions (such as "visible emissions," if such occurs) and activities. In addition, a camcorder will be used to videotape the demolition and demolition debris land filling operations.

A.9.2 Chain-of-Custody Records

Standard EQ sample traceability procedures described in Section B3 "*Sample Custody Requirements*" will be used to ensure sample traceability.

A.9.3 Laboratory Records

A.9.3.1 TEM Specimen Examination and Data Recording

Structure counting data shall be recorded on forms equivalent to the example shown in ISO 10312:1995 contained in Appendix B.

A.9.3.2 Test Report

The test report shall contain items (a) to (p) as specified in Section 11 "Test Report" of ISO 10312:1995. In addition, the files containing the raw data, in Microsoft Excel format, shall be submitted. The format of these files shall be as directed by the project manager, but shall contain the following items:

1. Laboratory Sample Number
2. Project Sample Number
   (4 Blank Lines For Project Manager to Insert Locations and Sampling Details)
3. Date of Analysis
4. Air Volume
5. Active Area of Sample Filter
6. Counting Magnification
7. Mean Grid Opening Dimension in mm
8. Number of Grid Openings Examined
9. Number of Primary Structures Detected

10. One line of data for each structure, containing the following information as indicated in Figure 7 “Example of Format for Reporting Structure Counting Data” of ISO 10312:1995, with the exception that the lengths and widths are to be reported in millimeters as observed on the screen at the counting magnification:

- Grid Opening Number
- Grid Identification
- Grid Opening Identification/Address
- Structure or Sub-structure Number
- Asbestos Type (Chrysotile or Amphibole)
- Morphological Type of Structure
- Length of Structure in millimeters in 1 mm increments (e.g., 32)
- Width of Structure in millimeters in 0.2 mm increments (e.g., 3.2)
- Any Other Comments Concerning Structure (e.g., partly obscured by grid bar)

B MEASUREMENT/DATA ACQUISITION

B1 SAMPLING DESIGN

B.1.1 Sampling Locations

Ambient air samples will be collected at 10 sampling locations each day of the demolition and each day that the respective demolition debris is placed in the landfill. Five sampling locations will be located both upwind (comparative environmental background level of asbestos) and downwind of the land fill. A wind rose for five years (1988 through 1992) of June winds (0000 to 2300 hours) is presented in Figure B-1. When considering a wind fetch of 135 degrees (from the southeast) through 202.5 degrees (from the south southwest), about 54 percent of the total hours of wind data over five months of June winds were from this 67.5 degree sector. Should the wind direction change outside of this 67 degree sector for more than a 60-minute period, the sampling will be terminated.

B.1.2 Air Sampling Strategy

The air sampling strategy is summarized in Table B-1. Air sampling will be conducted for 3-5 and 2-3 consecutive days during demolition and land filling of the demolition debris, respectively, if acceptable meteorological conditions exist. Acceptable meteorologic conditions include consistent upwind conditions for the environmental comparative background samples and no rain.

Two sets of air samples will be collected at each sampling locations: a high-volume and a low-volume sample. A high-volume sample will be collected to achieve the target air volume (such as 3,000 liters) over the period of the demolition or land filling activities, and a second sample (low-volume) will be collected to achieve one-half of the target air volume over the same period. The second sample will be collected in the event that the first sample with the higher air volume is overloaded with particulate,[10] which would preclude transmission electron microscopy

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[10] The direct transfer analytical method (ISO 10312:1995) should not be used if the general particulate loading of the sample collection filter exceeds approximately 10 Fg/cm^2 of filter surface, which corresponds to approximately 10 percent coverage of the collection filter by particulate.

Figure B-1. Wind Rose for June, City of Fort Worth.

TABLE B-1. AIR SAMPLING STRATEGY

Site	Sample Type	Sampling Day and Number of Samples					**Total Samples**
		1	2	3	4	5	
1	High volume	1	1	1	1	1	**5**
	Low volume	1	1	1	1	1	**5**
	Duplicate	1	0	0	0	0	**1**
	Open field blank	1	0	0	0	0	**1**
	Closed field blank	1	0	0	0	0	**1**
	Total Samples	**5**	**2**	**2**	**2**	**2**	**13**
2	High volume	1	1	1	1	1	**5**
	Low volume	1	1	1	1	1	**5**
	Duplicate	0	1	0	0	0	**1**
	Open field blank	0	1	0	0	0	**1**
	Closed field blank	0	1	0	0	0	**1**
	Total Samples	2	5	2	2	2	**13**
3	High volume	1	1	1	1	1	**5**
	Low volume	1	1	1	1	1	**5**
	Duplicate	0	0	1	0	0	**1**
	Open field blank	0	0	1	0	0	**1**
	Closed field blank	0	0	1	0	0	**1**
	Total Samples	2	2	5	2	2	**13**
4	High volume	1	1	1	1	1	**5**
	Low volume	1	1	1	1	1	**5**
	Duplicate	0	0	0	1	0	**1**
	Open field blank	0	0	0	1	0	**1**
	Closed field blank	0	1	0	1	0	**1**
	Total Samples	2	2	2	5	2	**13**

TABLE B-1 (continued)

Site	Sample Type	Sampling Day and Number of Samples					**Total Samples**
		1	2	3	4	5	
5	High volume	1	1	1	1	1	**5**
	Low volume	1	1	1	1	1	**5**
	Duplicate	0	0	0	0	1	**1**
	Open field blank	0	0	0	0	1	**1**
	Closed field blank	0	0	0	0	1	**1**
	Total Samples	2	2	2	2	5	**13**
6	High volume	1	1	1	1	1	**5**
	Low volume	1	1	1	1	1	**5**
	Duplicate	1	0	0	0	0	**1**
	Open field blank	1	1	0	0	0	**1**
	Closed field blank	1	0	0	0	0	**1**
	Total Samples	5	2	2	2	2	**13**
7	High volume	1	1	1	1	1	**5**
	Low volume	1	1	1	1	1	**5**
	Duplicate	0	1	0	0	0	**1**
	Open field blank	0	1	0	0	0	**1**
	Closed field blank	0	1	0	0	0	**1**
	Total Samples	2	5	2	2	2	**13**
8	High volume	1	1	1	1	1	**5**
	Low volume	1	1	1	1	1	**5**
	Duplicate	0	0	1	0	0	**1**
	Open field blank	0	0	1	0	1	**1**
	Closed field blank	0	0	1	0	0	**1**
	Total Samples	2	2	5	2	2	**13**

TABLE B-1 (continued)

Site	Sample Type	Sampling Day and Number of Samples					**Total Samples**
		1	2	3	4	5	
9	High volume	1	1	1	1	1	**5**
	Low volume	1	1	1	1	1	**5**
	Duplicate	0	0	0	1	0	**1**
	Open field blank	0	0	0	1	0	**1**
	Closed field blank	0	0	0	1	0	**1**
	Total Samples	2	2	2	5	2	**13**
10	High volume	1	1	1	1	1	**5**
	Low volume	1	1	1	1	1	**5**
	Duplicate	0	0	0	0	1	**1**
	Open field blank	0	0	0	0	1	**1**
	Closed field blank	0	0	0	0	1	**1**
	Total Samples	2	2	2	2	5	**13**

(TEM) analysis using the direct transfer method of sample preparation; otherwise, the second sample will be archived.

Duplicate "Co-Located" Samples -- Two high-volume duplicate air samples (one upwind, one downwind) will be collected during each day of sampling. Each high-volume duplicate sample will be analyzed.

Field Blanks -- Two open and two closed field blanks will be collected each day of sampling. Open field blanks are filter cassettes, that have been transported to the sampling site, opened for a short-time ($\leq$ 30 seconds) without any air having passed through the filter, and then sent to the laboratory. Closed field blanks are filter cassettes that have been transported to the sampling site and then sent to the laboratory without being opened. The two open field blanks will be analyzed and the closed field blanks will be archived. The closed field blanks will only be analyzed if the open field blanks show asbestos contamination.

B.1.3 Particulate Loading Pilot Test

One of the biggest difficulties associated with ambient air monitoring is the paramount requirement to achieve adequate analytical sensitivity with constraints placed on sampling and analysis. Briefly, analytical sensitivity is a function of the volume of air passed through a filter, the concentration or dilution attendant to filter preparation, and the area of the filter scanned for analysis. The volume of air that can be collected is primarily limited by the tolerable loading of total particulate collected per unit area of filter before the sample is unsuitable for analysis by the direct-transfer TEM method because of overloading.

A pilot sampling test will be performed to estimate the maximum sample air volume (with an acceptable particulate loading) to achieve the specified analytical sensitivity by counting the fewest grid openings. The pilot test will consist of collecting five sets of ambient air samples over an approximately 6-hour period to achieve the following total air volumes: 3500, 3000, 2500, 2000, and 1500 liters. The sample will be examined by an experienced electron microscopist to determine if the particulate loading of the sample exceeds the criterion specified in ISO Method 10312:1995.

B.1.4 Soil Sampling

The Asbestos content of the soil will be determined both before and after demolition of the structure. Two samples will be collected from each side of the structure yielding a total of eight samples before and eight samples after demolition of each building. The sampling locations will be randomly selected from a 5-ft by 5-ft grid system created around the building. The samples will be collected from the center of each selected grid square. The grid system will be prepared on a plot plan or similar drawing of the property. If two samples cannot be obtained from each side of the structure, samples will be obtained from the remaining sides to yield a total of eight samples.

Before and after samples will be collected from the same approximate locations. The sampling locations will be marked on the site drawing. In addition, a marker (e.g., fluorescent orange painted meter pipe) will driven into the ground to mark the location of the soil sample collected before demolition of the structure.

B.1.5 Moisture Content of ACM

To determine the effectiveness of the water application process on wetting the asbestos-containing materials in the structure, 10 representative bulk samples of the asbestos-containing materials will be collected. The ten bulk samples will be collected of the asbestos-containing materials after the structure has been demolished. The water (moisture) content of each sample will be determined. A water meter (or an equivalent device) will be installed at the hydrant to measure the volume of water used during demolition of the structure.

B.1.6 Water Used for Wetting Structure/Debris

The water used to wet the structure and resultant demolition debris will be sampled to determine the asbestos content. That is, each sample will be analyzed for asbestos fibers greater than 0.5 Fm in length; the AHERA (40 CFR 763) definition.

B2 SAMPLING METHODS REQUIREMENTS

B.2.1 Air Sampling

The samples will be collected on open-face, 25-mm-diameter 0.45-Fm pore size mixed cellulose ester (MCE) filters with a 5-Fm pore size MCE diffusing filter and cellulose support pad contained in a three-piece cassette with a 50-mm non-conductive cowl. This design of cassette has a longer cowl than the design specified in ISO 10312:1995, but it has been in general use for some years for ambient and indoor air sampling. Disposable filter cassettes with shorter conductive cowls, loaded with the appropriate combination of filter media of known and consistent origin, do not appear to be generally available. The filter cassettes will be positioned on tripods approximately 5 feet above the ground or at the elevation best suited to achieve an unobstructed representative air sample.

The filter assembly will be attached with flexible Tygon® tubing (or an equivalent material) to an electric-powered (110 VAC) 1/6-horsepower vacuum pump operating at an airflow rate of approximately 6.3 liters per minute to achieve the target air volume of 3,000 liters over an eight hours. Each pump will be equipped with a flow control regulator to maintain the initial flow rate of within +/- 10% throughout the sampling period. Although the pilot test described in Section B.1.3 will determine the optimal target air volume, it is anticipated that the air volume for each sample will be approximately 3,000 liters. If 110 VAC line power is not available, portable gasoline-powered generators will be used to power the sampling pumps.

B.2.2 Meteorological Monitoring

Meteorological data will be collected to support the determination of valid sampling periods. Data validity will be based primarily on wind directions which lend themselves to maintaining the monitors in an upwind and downwind orientation from the demolition site or landfill.

A combination of nearby National Weather Service (NWS) 12-hour wind direction forecasts, on-site meteorological data collection using continuous monitoring, and individual monitoring site qualitative collection data will be used to determine several monitoring objectives.

These objectives include the following:

1. Forecasting a valid upcoming sampling day.
2. Providing ongoing data collection to support final data validation.
3. Checking ongoing data throughout a sampling period overall and at specific sampling locations.

The primary specification for objectively determining monitored data validity and the determination of go/no-go on each sample day will be based on two meteorological conditions. The first is rainfall. If the NWS forecasts greater than a trace (0.1 inch) amount of rainfall for the upcoming 24-hour sampling period, the sampling day will be canceled. The second criterion for evaluating data validity and go/no-go situations will be wind direction. For June all winds coming from the 135E through 202.5E wind sectors (southeast through south through southwest) will be selected as valid wind flows. Wind directions prior to each sampling day will be estimated through NWS forecasts. Sampling will proceed whenever winds are generally forecast for the southwest through northeast (clockwise through northwest).

Prior to the start of each day's field activities, the NWS at the Dallas-Fort Worth International Airport will be contacted to obtain 12-24 hour wind direction and precipitation forecasts. If the conditions are acceptable, the sampling day will proceed.

For ongoing field activities after the decision has been made to proceed, both continuously recorded wind speed and direction will be collected as well as predetermined time spot checks at each monitoring site. A meteorological station will be installed at both the demolition site and landfill. Each station will consist of a Met One Instruments, Inc. Automet meteorological data system. It will include continuous wind speed and direction sampling and data logging over the duration of the sampling period. All data will be collected and archived in the data logger which can be checked on a routine basis with direct readout as well as downloading to a personal computer whereby related software will be used to assess hourly, daily, and period archived data. The wind station will be tripod mounted in an appropriate location away from all obstructions. The Automet sensors and their associated sensitivity are approved for use in *Prevention of Significant Deterioration Monitoring Projects* under U.S. EPA and will provide significant detail to the wind direction tabulations.

The meteorological station operator will also collect wind speed data using a hand-held Dwyer wind speed meter and wind direction data using a dark-colored ribbon attached to the top of a 6-foot wooden stick. Readings will be taken once every 30 minutes over a duration of about 1 minute using the 1-minute averages to represent the period. A logbook will be kept which notes these wind directions and wind speeds as well as those noted on the Automet system data logger for the same time period.

The manual measurement (wind speed and wind direction) made at meteorological station will also be made at one other upwind and two downwind sampling locations. They will also be at the same specified 1 minute of each 30-minute time period during sample collection. The wind speed and wind direction will be noted in a logbook at each sampling location.

Consistency between observations will be promoted through the use of identical hand-held instruments as well as previous training on proper observation techniques by each site attendant. If during sampling the wind directions fall outside of the acceptable range at the main meteorological station for 30 or more concurrent minutes, sampling activities will cease for the day. The samples will be archived or voided.

B.2.3 Soil Sampling

The soil samples will be collected using a clean metal scooping tool (e.g., a garden trowel). The samples will be collected from the center of the grid square (see Section B.1.4). To the extent feasible, each sample will represent the top 1 to 1½ inches of soil from a 4 inch by 4 inch area. The area will be delineated using a metal template with a 1½ inch vertical flange of sufficient strength to allow the flange to be pushed into the soil. The template will be constructed of galvanized sheet metal.

B.2.4 Water Sampling

One water sample will be collected from each water source (i.e., water hydrant) that will be used to wet the structure and resultant demolition debris. The sample container will be an unused, precleaned, screw-capped bottle of glass or low density (conventional) polyethylene and capable of holding at least 1 liter. (Ideally, water samples are best collected in glass bottles.) Prior to collecting the sample, allow the water from the water source to run to waste for a sufficiently long period to ensure that the sample collected is representative of fresh water. As an additional precaution against contamination, each bottle should be rinsed several times in the source water being sampled.

Two separate samples of approximately 800 milliliters each will be collected. An air space will be left in the bottle to allow efficient redispersal of settled material before analysis. The second bottle will be stored for analysis if confirmation of the results obtained from the analysis of the first bottle is required.

The samples will be transported to the analytical laboratory and filtered by the laboratory within 48 hours of each sample collection. No preservatives or acids will be added. At all times after collection, the samples will be stored in the dark and refrigerated at about 5° C (41° F) in order to minimize bacterial and algal growth. The samples will not be allowed to freeze, since the effects on asbestos fiber dispersions are not known.

B3 SAMPLE CUSTODY REQUIREMENTS

Chain-of-custody procedures emphasize careful documentation of constant secure custody of samples during field, transport, and analytical stages of environmental measurement projects. The sample custodian responsible for the proper chain-of-custody during this project is:

Tracy Bramlett, CIH, CSP
Industrial Hygiene & Safety Technology, Inc.
2235 Keller Way
Carrollton, Texas 75006
Phone: 972.478.7415; fax: 972.478.7615

B.3.1 Field Chain-of -Custody

Each sample will have a unique project identification number. This identification number will be recorded on a Sampling Data Form (Figure A-3) along with the other information specified on the form. After the labeled sample cassettes are recovered from the sampling trains, the sample custodian will complete an Analytical Request and Chain-of-Custody Form (Figure B-2). This form will accompany the samples, and each person having custody of the samples will note receipt of the same and complete an appropriate section of the form. Samples will be sent to Laboratory (To Be Determined) via Federal Express Standard Overnight Service.

B3.2 Microscopy Laboratory

The laboratory's sample clerk will examine the shipping container and each filter cassette to verify sample numbers and check for any evidence of damage or tampering, note any changes or indication of tampering on the accompanying chain-of-custody form, and then forward the form to Tracy Bramlett. The sample clerk will log in all samples and assign a unique sample identification number to each sample and sample set.

Figure B-2. Analytical Request and Chain-of-Custody Form.

B4 ANALYTICAL METHOD REQUIREMENTS

B.4.1 Air Samples

The 0.45-Fm pore size mixed-cellulose ester (MCE) filters will be prepared and analyzed using International Organization of Standardization (ISO) Method 10312:1995 (1st Ed.), "*Ambient Air - Determination of Asbestos Fibres - Direct-Transfer Transmission Electron Microscopy Method.*" A copy of the method is contained in Appendix B.

The principal objective of these analyses is to provide air concentration data of sufficient quality to support the development of conclusions regarding the effective of the *Fort Worth Method* to control the release of asbestos fibers during the demolition of substandard structures containing RACM

B.4.1.1 TEM Specimens Preparation

TEM specimens shall be prepared from the ambient air filters using the dimethylformamide (DMF) collapsing procedure of ISO 10312:1995, as specified for cellulose ester filters. DMF shall be used as the solvent for dissolution of the filter in the Jaffe washer. For each filter, a minimum of four TEM specimen grids shall be prepared from a one quarter sector of the filter, using 200 mesh indexed copper grids. The remaining part of the filter shall be archived until further notice, in the original cassette in clean and legally secure storage, to be possibly selected for quality assurance analyses.

B.4.1.2 Measurement Strategy

1. The minimum aspect ratio for the analyses shall be 3:1, as permitted by ISO 10312:1995.

2. The analyses shall be performed by a two-stage examination of the TEM specimens, as indicated in ISO 10312:1995, in order to provide data of sufficient precision for each of the structure size ranges of interest. The size ranges of structures that shall be evaluated, and target analytical sensitivities, for the anticipated collected air volume of 3000 liters, will be as shown in Table B-2.

Table B-2. Approximate Number of Grid Openings to Achieve Target Analytical Sensitivity Based on Air Volume of 3000 Liters (Direct-Transfer Preparation of TEM Specimens)

Size Range	Target Analytical Sensitivity s/cc	Approximate Magnification for Examination	Approximate Area Examined mm^2	Approximate Number of 0.01 mm^2 Grid Openings Required
All Structures (Minimum Length of 0.5 µm)	0.0005	20000	0.256	26
Longer than 5 µm, (All Widths)	0.0001	10000	0.256	26

3. The stopping point in the analysis for each of the examinations defined in 2 shall be 100 primary asbestos structures, or after the completion of the examination of the grid opening during which the target analytical sensitivity is achieved. A minimum of 4 grid openings shall be examined, in accordance with the specifications of ISO 10312:1995.

4. The structure counting data shall be distributed approximately equally among a minimum of 3 specimen grids, prepared from different parts of the filter sector.

5. The TEM specimen examinations at approximately 20,000 and 10,000 shall be performed as independent measurements.

6. Measurement of fiber dimensions is extremely important for accurate determination of aspect ratios. Lengths and widths of fibers shall be recorded in millimeters as measured on the fluorescent screen. Where the observed width of a fiber is lower than approximately 5 mm on the screen at either of the two magnifications used for the TEM specimen examinations, the measurement errors may seriously compromise the accuracy of the calculated aspect ratio. Accordingly, in this situation, the magnification shall be increased by a factor of approximately five times to obtain an accurate measurement of the width. For example, the width of a 1 mm wide fiber cannot be accurately estimated on the screen. A five-fold increase in the magnification increases the dimension to 5 mm, which can be estimated with sufficient accuracy for the purpose of this project.

B.4.2 Soil Samples

The asbestos content of the soil will be determined using a method developed by U.S. EPA, Region I: *Standard Operating Procedure for the Screening Analysis of Soil and Sediment Samples for Asbestos Content* (SOP:EIA-INGABED2-SOP, January 11, 1999). To more accurately quantify the amount of asbestos in the soil samples, the samples will be prepared using the procedure specified in the addendum to the method. A copy of the method is contained in Appendix C.

B.4.3 Moisture Content of ACM

The water (moisture) content of the bulk samples of asbestos-containing materials (ACM) will be determined in accordance with ASTM Standard Test Method D 4959-00 "Determination of Water (Moisture) Content of Soil by Direct Heating." The method will be modified (as necessary) to accommodate the ACM bulk samples. A copy of the method is contained in Appendix D.

B.4.4 Water Samples

The asbestos content of the water used to wet the structure and resultant demolition debris will be determined using EPA Method 100.1 "*Analytical Method Determination of Asbestos in Water.*" A copy of the method is contained in Appendix E.

Measurement of fiber dimensions is important. Dimension of fibers is recorded as length and width if greater than 0.5 Fm in length. Reference EPA Method 100.1 for counting and sizing rules for bundles, fiber aggregates, etc. The analysis may be stopped after 100 fibers have been counted or 20 grid openings have been examined. The sample grid will be examined in a transmissions electron microscope (TEM) at a magnification of about 20,000.

B5 QUALITY CONTROL REQUIREMENTS

The overall quality assurance objective is to provide defensible data of known quality meeting quality assurance objectives. To that end, procedures are developed and implemented for field sampling, chain-of-custody, laboratory analysis, reporting, and audits that will provide results which are scientifically valid and legally defensible in a court of law.

B.5.1 Field Quality Control Checks

Quality control checks for the field sampling aspects of this project will include, but not be limited to, the following:

- Use of standardized forms (e.g., Figures A-3, A-4, B-2) to ensure completeness, traceability, and comparability of the data and samples collected.
- Calibration of air sampling equipment including pre- and post-sample calibrations using a calibrated precision rotameter.
- Proper handling of air sampling filters to prevent cross contamination.
- Collection of field blanks; see Section B.5.2.2.
- Field cross checking of data forms to ensure accuracy and completeness.

B.5.2 Analytical Quality Control Checks

B.5.2.1 Quality Control Check of Filter Media

Before air samples are collected, a minimum of 2 percent of unused filters from each filter lot of 100 filters will be analyzed to determine the mean asbestos structure count. If the mean count for all types of asbestos structures is found to be more than 10 structures/mm^2, or if the mean fiber count for asbestos fibers and bundles longer than or shorter than 5 Fm is more than 0.1 fiber/mm^2, the filter lot will be rejected. By comparison, this criterion is more restrictive than that specified by EPA in AHERA (i.e., 18 structures/mm^2 of filter area).

B.5.2.2 Blank Contamination

To ensure that contamination by extraneous silicate mineral fibers during sample collection and specimen preparation is insignificant (see criteria in Section B.5.2.1) compared with the results reported on samples, a continuous program of blank measurements will be established. This will include filter lot blanks (see Section B.5.2.1), field blanks (open and closed), laboratory blanks, and laboratory clean area blanks.

Field Blanks -- Closed field blanks are filter cassettes that have been transported to the sampling site and sent to the laboratory without being opened. Open field blanks are filter cassettes, that have been transported to the sampling site, opened for a short time (≤ 30 seconds) without any air having passed through the filter, and then sent to the laboratory. The number of open and closed blanks that will be collected and analyzed is presented in Table B-1.

Laboratory Blanks -- Laboratory blanks are unused filters (or other sample device or container) that are prepared and analyzed in the same manner as the field samples to verify that reagents, tools, and equipment are free of the subject analyte and that contamination has not occurred during the analysis process. The laboratory will analyze at least one blank for every ten samples or one blank per prep series. Blanks are prepared and analyzed along with the other samples. If the blank control criteria (Section B.5.2.1) are not met, the results for the samples prepared with the contaminated blank are suspect and should not be reported (or reported and flagged accordingly). The preparation and analyses of samples should be stopped until the source of contamination is found and eliminated. Before sample analysis is resumed, contamination-free conditions shall be demonstrated by preparing and analyzing two blanks that meet the blank control criteria. Laboratory blank results shall be documented in the quality control log. Laboratory blank count sheets should be maintained in the project folder along with the sample results.

Laboratory Clean Area Blanks -- Clean area blanks are prepared whenever contamination of a single laboratory prep blank exceeds the criteria specified in Section B.5.2.1 or whenever cleaning or servicing of equipment has occurred. To check the clean area, an used filter is left open on a bench top in the clean area for the duration of the sample prep process. The blank is then prepared and analyzed using ISO Method 10312:1995. If the blank control criteria (see Section B.5.2.1) are not met, the area is cleaned using a combination of HEPA-filter vacuuming and a thorough wet-wiping of all surfaces with amended water. In addition, air samples should be taken in the sample prep room to verify clean air conditions. At least 2,500 liters of air should be drawn through a 25-mm-diameter 0.45-Fm pore size MCE filter using a calibrated air sampling pump. The samples should then be analyzed using ISO Method 10312:1995. If blank control criteria are not met, sample preparation shall stop until the source of contamination is found and eliminated. Clean area sample results shall be documented in the Clean Area Blank Log.

B.5.3 Analytical Precision and Accuracy

Quality control checks will be performed on a routine basis to verify that the analysis system is in control. Most laboratory Quality Control Programs include frequent quality tests for both accuracy and precision. Because of the difficulty of preparing quantitative asbestos standard materials, neither spiked samples nor known quantitative samples can be used on a routine basis for asbestos analysis accuracy testing. Therefore, routine quality control testing for asbestos focuses on precision checks, which involve a second count or multiple counts of a sample or a portion of a sample.

B.5.3.1 Replicate Analysis

The precision of the analysis is determined by an evaluation of repeated analyses of randomly selected samples. A replicate analysis will be performed on 5% of the samples analyzed to assess the precision of the counting abilities of the individual analysts. A replicate analysis is a second analysis of the same preparation, but not necessarily the same grid openings, performed by the same microscopist as in the original analysis.

The conformance expectation for the replicate analysis is that the count from the original analysis and the replicate analysis will fall within a 95% confidence interval for the average count, or as follows:

$$LCL < A_1 \ A_2 < UCL$$

where:

A_1 is the original count,

A_2 is the replicate count,

LCL is the lower confidence limit,

UCL is the upper confidence limit.

Should either the original or replicate count fall outside the acceptance range, the grid is re-examined to determine the cause of the count variation. The 95% confidence interval is based on the Poisson distribution. For average counts less than or equal to 20 structures, Table F-1 in ISO Method 10312:1995 (see Appendix C) should be used to derive the upper and lower 95% confidence limits. For average counts greater than 470 structures, a normal approximation can be used. The upper and lower confidence limits based on the normal approximation are calculated as follows:

LCL = F - 1.96 x %F

UCL = F + 1.96 x %F

where:

F is the average count,

%F is the definition of the Poisson standard deviation.

B.5.3.2 Duplicate Analysis

A duplicate sample analysis is also performed on 5% of the samples analyzed to assess the reproducibility of the analysis and quantify the analytical variability due to the filter preparation procedure. A duplicate analysis is the analysis of a second TEM grid preparation prepared from a different area of the sample filter performed by the same microscopist as the original analysis. The conformance expectation is similar to that for replicate analyses with one exception. That is, the count from the original analysis and the duplicate analysis should fall within a 95% confidence interval for the average count.

B.5.4 Verification Counting

Due to the subjective component in the structure counting procedure, it is necessary that recounts of some specimens be made by a different microscopist (i.e., a microscopist different than the one that performed the original analysis) in order to minimize the subjective effects. Verification counting will involve re-examination of the same grid opening by a different microscopist. Such recounts provide a means of maintaining comparability between counts made by different microscopists. These quality assurance measurements will constitute approximately 10 percent of the analyses. Repeat results should not differ at the 5% significance level.

B6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

B.6.1 Field Instrumentation/Equipment

Field equipment/instruments (e.g., sampling pumps, meteorological instrumentation) will be checked and calibrated before they are shipped or carried to the field. The equipment and instruments will be checked and calibrated at least daily in the field before and after use. Spare equipment, such as air sampling pumps, precision rotameters, and flow control valves will be kept on-site to minimize sampling downtime. Backup instruments (e.g., meteorological instrumentation) will be available within one day of shipment from a supplier.

B.6.2 Laboratory Equipment/Instrumentation

As part of the (To Be Determined) Laboratory's QA/QC Program, a routine preventive maintenance program is performed to minimize the occurrence of instrument failure and other system malfunctions of their transmission and scanning electron microscopes. The laboratory has an internal group and equipment manufacturer's service contract to perform routine scheduled maintenance, and to repair or to coordinate with the vendor for the repair of the electron microscope and related instruments. All laboratory instruments are maintained in accordance with manufacturer's specifications and the requirements of ISO Method 10312:1995.

B7 INSTRUMENT CALIBRATION AND FREQUENCY

B.7.1 Field Instrument/Equipment Calibration

B.7.1.1 Air Sampling Pumps

The air sampling pumps with a flow control valve will be evaluated to ensure that they are capable of maintaining a stable flow rate for a given static pressure drop; i.e., the pumps can maintain an initial volume flow rate of within +/- 10% throughout the sampling period. Prior to use the sampling pumps will be tested against the pressure drop created by a 25-mm-diameter, 0.45-Fm pore size MCE filter with a 5-Fm pore size MCE backup diffusing filter and cellulose support pad contained in a three-piece cassette with 50-mm cowl at a flow rate of approximately 6 liters per minute at STP.

B7.1.2 Airflow Calibration Procedure

A flow control valve will be used to regulate the flow rate through the sampling train during sampling. The airflow rate will be determined both before, at the mid-point, and after sampling using a calibrated precision rotameter (Manostat Model 36-546-215). The precision rotameter (a secondary calibration standard) will be calibrated using a primary standard airflow calibrator (Gilabrator electronic flow meter).

A detailed written record will be maintained of all calibrations. It will include all relevant calibration data, including the following elements:

- Gilabrator model and serial number
- Rotameter model and serial number
- Sampling train (pump, flow control valve, and filter)
- X- and Y- coordinate calibration data
- Intercept, slope, and correlation coefficient from a linear regression analysis of the calibration data, and resulting linear regression equation that will be used to determine the sampling flow rate
- Relevant calculations
- Dry bulb temperature and barometric pressure
- Name of person/affiliation that performed the calibration and linear regression analysis

B.7.2 Calibration of TEM

The TEM shall be aligned according to the specifications of the manufacturer. The TEM screen magnification, electron diffraction (ED) camera constant, and energy dispersive X-ray analysis (EDXA) system shall be calibrated in accordance with the specifications in ISO Method 10312:1995, Annex B (see Appendix B).

B8 INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

B.8.1 Air Sampling Filter Media

Please see Section B.5.2.1 regarding the quality control check of the filter media.

B9 DATA ACQUISITION REQUIREMENTS (NON-DIRECT MEASUREMENTS)

B.9.1 Precision

The performance goals stated in Section A.7 "*Quality Objectives and Criteria for Measurement Data*" assume a between-sample variability of 250% or less. The actual between-sample component of variability will be established from the data using standard variance component analyses. If the target precision is not achieved, the false-negative error rate will be greater than the target rate of 5% and failure to obtain a statistically significant result will not provide strong evidence against the null hypothesis being tested. If a statistically significant result is obtained, the false-negative error rate is of little concern, since it is clear that a false negative error has not occurred.

Laboratory precision (coefficient of variation), which is a component of between-sample variability, will be estimated from duplicate analyses of a subset of samples. This will provide a measure of the relative contribution of laboratory analysis to the total between-sample variability. This information will be useful for performing statistical power calculations for follow-up air monitoring surveys.

B.9.2 Completeness

An overall measure of completeness will be given by the percentage of samples specified in the study design that yield usable data. The quality control criterion is $\geq$ 95%.

B.9.3 Accuracy

Duplicate counts of a subset of randomly selected samples will be performed by having the same microscopist count two sets of grids prepared from the same sample. The results of the counts will be compared, and those which do not fall within the 95% confidence limits for a Poisson variable will be subjected to a further recount and/or a count of a third preparation in an attempt to resolve the discrepancy. A count by a second microscopist may also be employed.

In addition, it is expected that a subset of samples will be selected at random by the City of Fort Worth's Quality Assurance Manager to be analyzed by an outside "second" laboratory.

B10 DATA MANAGEMENT

Commercially available computer hardware and software used to manage measurement data is controlled to ensure the validity of the data generated. Controls include system testing to ensure that no computational errors are generated and evaluation of any proposed changes to the system before they are implemented. Commercially available software does not require testing, but validation of representative calculations are required using alternative means of calculations.

B.10.1 Data Assessment

Sample data will be reviewed by the laboratory during the reduction, verification, and reporting process. During data reduction, all data will be reviewed for correctness by the microscopist. A second data reviewer will also verify correctness of the data. Finally, the Laboratory Director (To Be Determined) will provide one additional data review to verify completeness and compliance with the project QAPP. The City of Fort Worth's Quality Assurance Manager, will also select a random sample of the data for the same purpose. Any deficiencies in the data will be documented and identified in the data report.

B.10.2 Data Management

Field and laboratory data will be entered into a Microsoft Excel spreadsheet to facilitate organization, manipulation, and access to the data. Field data will include information such as sampling date, sample number, sampling site, sample description and location, sample type, air volume, and sampling period. Laboratory data will include information such as sample number, sample date received and analyzed, type of analysis, magnification, grid location, grid square area, filter type, number of grids examined, number of asbestiform structures counted, structure type (fiber, bundle, cluster, or matrix), and structure length and width. An example format for reporting the structure counting data is contained in Figure 7 of ISO Method 10312:1995 (see Appendix B).

B.10.3 Statistical Analysis

The data collected during the building demolitions and at the landfill will be analyzed using standard analysis of variance (ANOVA) techniques. The ANOVA is a formal statistical procedure that tests whether two or more groups of data are significantly different, on average. The natural logarithm of each sample concentration will be used in the comparisons. Log-transformation is used to make the variances more equal and to provide data that are better approximated by a normal distribution. The use of a log-transformation is equivalent to assuming the data follow a log-normal distribution; the log-normal distribution is commonly assumed for asbestos measurements and other environmental contaminants. Sample results reported as non-detected will be replaced by the analytical sensitivity divided by two to calculate summary statistics and to perform all statistical analyses. All statistical comparisons will be made at the 0.05 level of significance.

C ASSESSMENT/OVERSIGHT

C1 ASSESSMENT AND RESPONSE ACTIONS

C.1.1 Performance and System Audits

C.1.1.1 Field Audits

The City of Fort Worth staff will be present during the study. The City's Technical Project Officer will conduct periodic field audits. The audit will include, but not limited to the examination of sample collection and equipment calibration procedures, sampling data and chain-of-custody forms, and other sample collection and handling requirements specified in the QAPP. The auditor will document any deviations from the QAPP so that they can be corrected in a timely manner.

The auditor will independently measure the flow rate of at least 50% of the air samplers in operation at the time of the audit. The relative accuracy (A%) of the audited flow rates will be established as follows:

$$A\% = 100\% - RE\%$$

where RE%, the relative error, is calculated as:

$$RE\% = (F-A) / A \times 100$$

where:

F = flow rate measured by the field crew
A = flow rate measured by the auditor.

The performance objective for the relative accuracy will be set between 90% and 110%. Prior to leaving the site, the auditor will debrief Tracy Bramlett regarding the results of the audit and any recommendations, if necessary. The results of the audit will be presented in a written report prepared by the auditor.

C.1.1.2 Laboratory Audit

Ms. Hoover (Quality Assurance Manager) or an independent laboratory quality assurance consultant selected by Ms. Hoover will conduct at least one quality assurance audit of the Laboratory (To Be Determined). The first audit will be conducted at the onset of the project to verify that all procedures specified in the QAPP are understood and are being followed.

C.1.2 Corrective Actions

Sampling and analytical problems may occur during sample collection, sample handling and documentation, sample preparation, laboratory analysis, and data entry and review. Immediate on-the-spot corrective actions will be implemented whenever possible and will be documented in the project record. Implementation of the corrective action will be confirmed in writing by completing a Corrective Action Report (Figure C-1).

Originator:	Date:
Project Name/Number:	Corrective Action Number:
Description of Problem (Give Date and Time Identified)	State Cause of Problem
State Corrective Action Planned (Include Persons Involved in Action)	QA Officer Comments:
Signatures	Project Manager Comments:
QA Officer	
Project Manager	
Originator	

Figure C-1. Corrective Action Report.

C2 REPORTS TO MANAGEMENT

Effective communication is an integral part of a quality system. Planned reports provide a structure to inform management of the project schedule, deviations from the approved QAPP, impact of the deviations, and potential uncertainties in decisions based on the data.

The IHST Project Manager (Tracy Bramlett) will provide verbal progress reports to the City of Fort Worth's Project Manager (Kathryn Hansen). These reports will include pertinent information from the data processing and report writing progress reports and corrective action reports, as well as the status of analytical data as determined from conversations with the laboratory. Mr. Bramlett will promptly advise Ms. Hansen on any items that may need corrective action.

A written report will be prepared for each field and laboratory audit. These reports will be submitted to the City of Fort Worth's Project Manager.

D DATA VALIDATION AND USABILITY

D1 DATA REVIEW, VALIDATION, AND VERIFICATION REQUIREMENTS

The data will be reviewed and validated by the City of Fort Worth's Quality Assurance Manager or by an independent quality assurance consultant (To Be Determined) selected by the City of Fort Worth.

D2 VALIDATION AND VERIFICATION METHODS

The analytical laboratory will perform in-house analytical data reduction and verification under the direction of the laboratory's quality assurance manager. The laboratory's quality assurance manager is responsible for assessing data quality and advising of any data rated as "unacceptable" or other notations which would caution the data user of possible unreliability.

The City of Fort Worth's quality assurance manager or an independent quality assurance consultant (To Be Determined) will conduct a systematic review of the data to verify compliance with the established quality criteria in the QAPP and ISO Method 10312:1995. The data review will identify any out-of-control data points and data omissions. Based on the extent of the deficiency and its importance in the overall data set, the laboratory may be required to re-analyze the sample. Included in the data validation of a sample set will be an assessment of chain-of-custody and analyses of field quality control samples (open and closed field blanks).

The precision of the data will be determined by calculating the coefficient of variation for the replicate and duplicate sample analyses as well as the analyses of the field duplicate samples.

D3 RECONCILIATION WITH DATA QUALITY OBJECTIVES

The proposed statistical methods to analyze the data and determine the significance of departures (positive and negative) from the assumptions established in the Data Quality Objectives are presented in Section B.10.

E1 REFERENCES

1. U.S. Environmental Protection Agency. EPA Guidance for Quality Assurance Project Plans – EPA QA/G-5. EPA/600/R-98/018, February 1998.

2. City of Fort Worth, Texas, Project XL Proposal "*Asbestos Management in the Demolition of Substandard Structures as a Nuisance Abatement*,"(September 30, 1999). Prepared by Department of Environmental Management, City of Fort Worth, Texas 76102.

3. U.S. Environmental Protection Agency. Ambient Airborne Asbestos Levels in Alviso, California. Prepared by John R. Kominsky and Ronald W. Freyberg. Contract No. 68-C0-0048, April 27, 1995.

4. U.S. Environmental Protection Agency. Ambient Air Monitoring at the Moss Landing Harbor District: Moss Landing, California. Prepared by John R. Kominsky and Ronald W. Freyberg. EPA Contract No. 68-D2-0058, October 17, 1990.

5. Kominsky, J.R., R.W. Freyberg, J.A. Brownlee, D.R. Greber. AHERA Clearance at Twenty Abatement Sites. EPA/600/52-91/028, August 1991.

6. Berman, D.W. and Chatfield, E.J. (1990). Superfund Method for the Determination of Asbestos in Ambient Air. Part 2: Technical Background Document. Prepared for the Environmental Services Branch of the U.S. Environmental Protection Agency. Washington, D.C. EPA/540/2-90/005b.

Appendix A

Comparison of the Asbestos NESHAP and the Fort Worth Method for the Demolition of Substandard Structures

Appendix B

ISO Method 10312:1995
Ambient Air - Determination of Asbestos Fibres --
Direct-Transfer Transmission Electron Microscopy Method

Appendix C

Standard Operating Procedure for the Screening Analysis of Soil and Sediment Samples for Asbestos Content

Appendix D

ASTM Standard Test Method D 4959-00
Determination of Water (Moisture) Content
of Soil by Direct Heating

Appendix E

EPA Method 100.1
Analytical Method for the
Determination of Asbestos Fibers in Water