QUALITY ASSURANCE PROJECT PLAN

BUILDING DEMOLITION EVALUATION FOLLOW-UP STUDY OF THE ALTERNATIVE ASBESTOS CONTROL METHOD FOR BUILDING DEMOLITION

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Contract No. EP-C-05-058
Task Order No. 0029

A.1. QUALITY ASSURANCE PROJECT PLAN APPROVAL SHEET

BUILDING DEMOLITION EVALUATION FOLLOW-UP STUDY
OF THE
ALTERNATIVE ASBESTOS CONTROL METHOD
FOR BUILDING DEMOLITION

Contract No. EP-C-05-058
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A.2. ACKNOWLEDGMENT AND DISTRIBUTION LIST

A.2.1. Acknowledgment

The following individuals participated in preparation of this Quality Assurance Project Plan.

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A.3. PROJECT TASK/ORGANIZATION

A.3.1. Project Organization

The U.S. EPA's Office of Research and Development (ORD) and U.S. EPA Region 6 are cooperatively conducting this research project. The Cadmus Group, Inc. (Cadmus) is the prime contractor on the project and will have overall responsibility to ensure that the project is conducted in accordance with the approved Quality Assurance Project Plan (QAPP). The Louis Berger Group, Inc. (Berger) will assist Cadmus in developing the parameters of this study in conjunction with U.S. EPA personnel.

The overall project organization is presented in Figure 1. It graphically shows the functional organization structure and lines of communication for this project. The project structure along with the technical personnel selections are designed to provide efficient management and a high level of technical competence to accomplish this research project. The roles and responsibilities of key project personnel are summarized in Table 1.

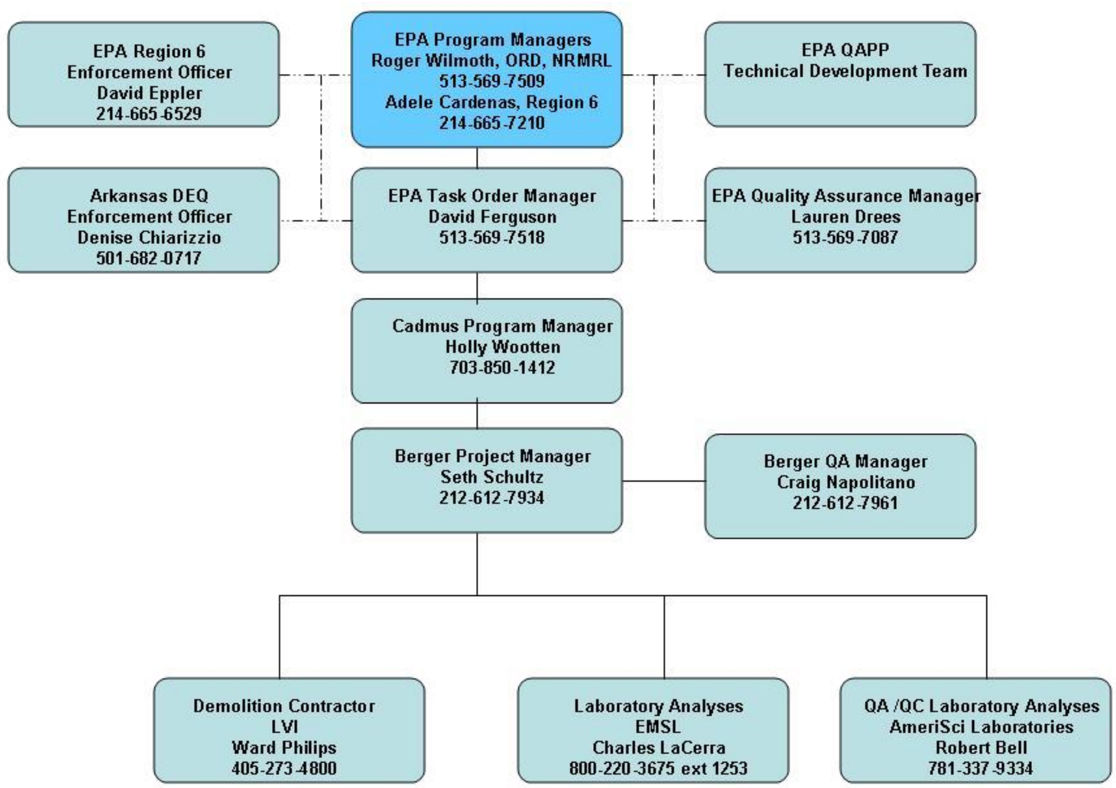

Figure 1. Project organizational structure.

Table 1. ROLES AND RESPONSIBILITIES OF KEY PROJECT PERSONNEL

Personnel	Role and Responsibility
Roger Wilmoth, U.S. EPA, ORD, NRMRL	*Program Manager*, will have overall administrative and technical responsibility for this program.
David Ferguson, U.S. EPA, ORD, NRMRL	*Task Order Manager (TOM)*, will direct the project and ensure that it is proceeding on schedule and within budget. Point of contact for Cadmus.
Lauren Drees, U.S. EPA, ORD, NRMRL	*QA Officer*, will provide QA oversight to ensure that the planning and plan implementation are in accordance with the approved QAPP. In addition, ORD's QA Officer will oversee a field audit and laboratory audit.
Holly Wootten, Cadmus	-*Overall Project and Task Order Lead*, will have overall administrative responsibility for the Cadmus Team and to serve as the primary client interface to ensure continuity between EPA, the Cadmus Team and all subcontractors (listed below) in working towards stated project objectives.
Seth Schultz, LBG	*Berger's Project Manager*, will have overall administrative and technical responsibility for Berger on this project. Will also have overall administrative and technical responsibility for Berger and its sub-contractors to ensure that data collection and analysis and the technical report meet the planned study objectives.
Craig Napolitano, LBG	*Quality Assurance Manager* to ensure compliance with final QAPP and study objectives. Will oversee laboratory analysis and perform data validation.
Ward Phillips, LVI	Will Perform AACM demolition
Charles LaCerra ,EMSL	Will provide primary laboratory analysis of asbestos samples
Amerisci Laboratories, Inc.	Will provide quality assurance (QA) secondary sample analysis

A.4. PROBLEM DEFINITION/BACKGROUND

A.4.1. Background

The Clean Air Act provides the EPA with the authority to promulgate a "*work practice standard*" if it is not feasible to establish an emission standard. Under Section 112 of the Clean Air Act, asbestos is determined to be a hazardous air pollutant and is regulated under EPA's asbestos National Emission Standard for Hazardous Air Pollutants (NESHAP), 40 CFR Part 61, Subpart M.

The asbestos NESHAP (*a work practice standard*) requires the removal of all regulated asbestos-containing material (RACM)[1] prior to demolition of the facility. The asbestos NESHAP specifies emission control procedures [§61.145(c)] and waste disposal requirements [§61.150] that must be followed during demolition of a facility that contains asbestos above the threshold amount.[2] Section §61.150 of the asbestos NESHAP requires owners to "discharge no visible emissions to the outside air" during demolition and renovation activities, including collection, processing, packaging, or transporting activities. If a facility is being demolished because it is structurally unsound and is in danger of imminent collapse, RACM is not removed prior to demolition, but the RACM must be kept adequately wet during demolition. All of the contaminated debris must be kept adequately wet until disposal and must be disposed of as ACM.

The EPA will perform a controlled demonstration as a follow-up study to a side-by-side comparison of the AACM and the NESHAP on identical buildings at Fort Chaffee Redevelopment Authority (Wilmoth et al, 2007). The buildings in the first study had positive asbestos –containing wall systems and vinyl asbestos floor tile. This current follow-up study is intended as an evaluation of the environmental impacts using the AACM for building demolition on a building that contains asbestos in the form of transite siding. These data would then be used in conjunction with data obtained during the initial study involving evaluations on environmental impacts during implementation of two demolition processes (one using the AACM) and the other following NESHAP to help EPA determine whether it is appropriate to include an alternate method in the current asbestos regulations contained in 40 CFR part 61 subpart M. The AACM,

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1 "Under Asbestos NESHAP [61.141], RACM means (a) friable asbestos material, (b) Category I nonfriable ACM that has become friable, (c) Category I nonfriable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading, or (d) Category II nonfriable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material on the course of demolition or renovation operations regulated by this subpart."

2 Asbestos NESHAP [§61.145(a)] requires that if the following amounts of RACM are present in a facility, these materials must be removed prior to demolition: (1) At least 260 linear feet on pipes; or (2) at least 160 square feet on other facility components; or (3) where the amount of RACM on pipes or other components could not be measured before stripping, a total of at least 35 cubic feet from all facility components in a facility being demolished. Also, under 40 CFR 61.145 (c) ACM has to be removed if: (1) it is Category I nonfriable ACM that is in poor condition and is friable or (2) it is Category II nonfriable ACM and the probability is low that the materials will become crumbled, pulverized, or reduced to powder during demolition. (These regulations may be supplanted by more stringent local governmental [state, city, etc.] regulations that govern such activities).

if determined to be equally environmentally acceptable to the current regulations, may have the benefit of allowing municipalities to demolish abandoned buildings that otherwise would remain standing until they were in danger of imminent collapse.

Previous studies indicated that there were situations where undesirable releases of asbestos were documented from demolition activities. These studies included both demolitions conducted by the NESHAP process and ones conducted under imminent danger of collapse situations. (Wilmoth et al 1993, Wilmoth et al 1994, City of Saint Louis 2004).

The AACM requires that certain RACM (such as thermal system insulation and fireproofing) be removed before demolition in accordance with the asbestos NESHAP; other RACM (such as transite, wallboard joint compound, resilient flooring/mastic, glazing compound) may remain in place. The AACM varies from the existing Asbestos NESHAP in the use of an amended-water wetting process, type of demolition equipment, and demolition techniques. Once the required RACM is removed, the demolition proceeds using amended water suppression before, during, and after demolition to trap asbestos fibers and minimize the potential release to the air. The RACM is less likely to become friable when the wetting process and demolition techniques specified in the AACM are used. Wastewater generated during the demolition is collected and filtered, and all debris is disposed of as asbestos-containing waste. Soil in the affected area is excavated and disposed as asbestos-containing waste. Appendix A contains the AACM developed by EPA Region 6, the EPA ORD, and with input from the EPA QAPP Technical Development Team.

The purpose of this research project is to gather additional data to document the environmental and cost-effectiveness of the AACM. This research project will assist EPA in considering modification of the practices of the Asbestos NESHAP.

A.4.2. Objective

The goal of this research study is to collect data on the environmental effectiveness and cost of the AACM for demolition of buildings that contain transite. The AACM will be considered for modification to the asbestos NESHAP as an additional tool to safely demolish asbestos-containing structures. All of the data collected during this follow-up study will be evaluated and considered, as appropriate.

Emissions must be inferred from measured concentrations in receptors (air, soil, water, dust, and personal monitoring). Because of the complex nature of the potential emissions from building demolition, it is difficult to state in advance precisely how these data will be evaluated, but all the data and observations obtained will be used to document environmental releases, time requirements, and costs.

A.4.2.1. Primary Objective

1. To determine the airborne asbestos concentrations during the demolition of the transite building by the AACM process and compare to background concentrations.

A.4.2.2. Secondary Objectives

The following secondary objectives will provide additional information to further characterize the interrelationships among several multimedia parameters to enhance the understanding of the process and to further the science. These data will also be considered in a holistic sense in assessing the effectiveness of the demolition method:

AIR

1. To document visible emissions during the AACM demolition.

2. To determine total fibers in air (phase contrast microscopy (PCM)) during the AACM demolition and compare to background concentrations.

DUST

3. To determine the settled dust asbestos concentrations during the demolition of the transite building by the AACM process and compare those to background concentrations.

WORKER

4. To determine worker breathing zone fiber concentrations (PCM) during the AACM.

5. To determine worker breathing zone asbestos concentrations (TEM-transmission electron microscopy) during the AACM.

PAVEMENT

6. To determine the asbestos concentration in post-cleanup pavement (TEM) from the AACM demolition and compare those to pre-demolition pavement concentrations and to background asbestos concentrations.

WATER

7. To measure the asbestos concentrations in the source water, the amended water during demolition and the surface water from the AACM demolition.

TIME

8. To document the time required for all activities related to the demolition by the AACM.

COST

9. To document the cost required for all activities related to the demolition by the AACM and to compare those with estimated costs for demolition of the building by the NESHAP process.

CONTAINMENT

10. To document the effectiveness of constructing a barrier in close proximity to the building in preventing migration of asbestos from the demolition

Regulatory Requirements for Lead:

In addition, worker exposure sampling will be conducted for lead in accordance with 29 CFR §1926.62, which applies to all demolition activities involved in this study.

A.5. PROJECT/TASK DESCRIPTION

Note: Site assessment sampling and analyses for air, pavement, soil and water were conducted per "**QAPP – AACM Evaluation (Phase 2) – Site Assessment Sampling and Analysis.**" The results are presented in Table 2.

Table 2. SITE ASSESSMENT SAMPLE RESULTS

Parameter	Mean	Max	Min
Hydrant Water	ND (<0.05 ms/L)	ND (<0.05 ms/L)	ND (<0.05 ms/L)
Air	ND (<0.0005 s/cm^3)	ND (<0.0005 s/cm^3)	ND (<0.0005 s/cm^3)
Pavement Surface	1.2x10^6 s/cm^2	2.7x10^6 s/cm^2	500 s/cm^2

ms/L =million asbestos structures per liter

A.5.1. Site/Building Preparation

The site selected is building #235 at the Fort Chaffee Redevelopment Authority site in Fort Smith, Arkansas (Figure 2). The building was determined by the City of Fort Smith Building Department to be structurally unsound and in imminent danger of collapse. The City issued a demolition order June 11, 2007 to the Fort Chaffee Redevelopment Authority to demolish the building by December 31, 2007. The building is partially covered by about 978 square feet of residential grade transite siding and which contains 30-percent chrysotile asbestos. The building is approximately 32' x 48' x 14'.

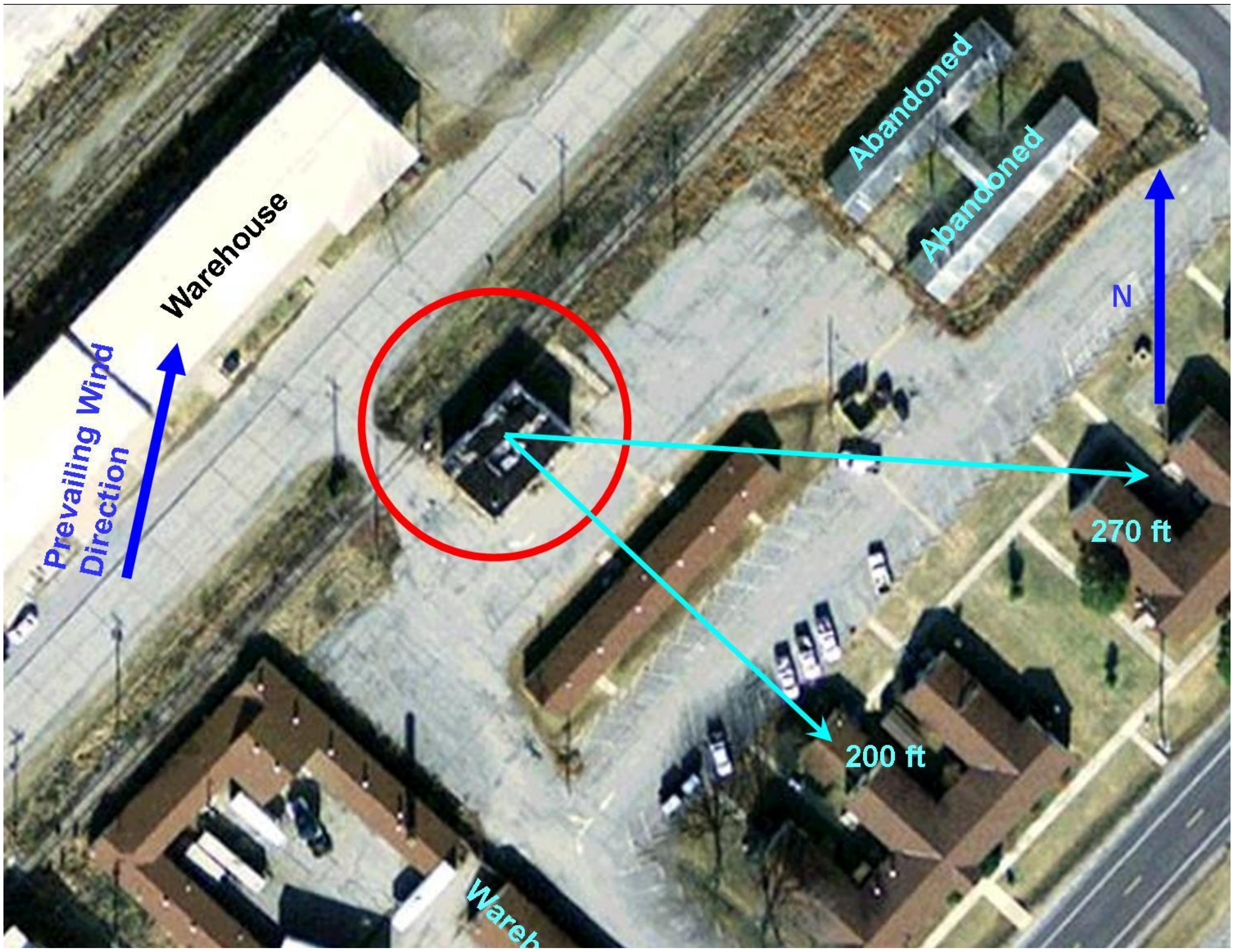

Figure 2. Aerial view of the site.

A.5.2. Building Modifications

The building has areas with partial wood siding and windows that have been boarded up. It has been determined that the amount of transite on the structure qualifies the building as a NESHAP structure. To enhance the transite quantity to assure a worse-case scenario, the project includes the addition of commercial-grade transite panels on the exterior windows and doors. The outside plywood walls and the areas on the existing structure that were currently not covered with transite were sided with weathered transite obtained from shower buildings at the Fort Hood Army Base near Killeen, Texas and shipped to Fort Chaffee. The transite removed from these buildings was used to cover the exterior areas not currently covered with transite siding of building #235 prior to demolition. Approximately 1800 sq ft of transite were added to the building, with approximately 1550 sq ft on the exterior and 250 sq ft transite from Fort Hood was placed inside the building. The additional transite from Fort Hood are commercial grade four-ft by four-ft panels which also contain 30-percent chrysotile asbestos. The original transite is off-white in color with the Fort Hood transite being green, light brown and gray. The building with the added transite is shown in Figure 3 and Figure 4. In total, the building is covered on the exterior with about 2528 sq ft of transite with an additional 250 sq ft on the inside of the structure.

In order to simulate demolition situations where the adjacent buildings are virtually beside the structure to be demolished, a barrier wall will be constructed on the side of the building adjacent to the railroad tracks. This barrier wall will be comprised of scaffolding that will extend laterally to the edges of the transite building (to simulate row houses) and will extend vertically about ten feet above the height of the existing building to prevent splashing. The barrier wall will be placed between four and six feet from the wall of the structure to be demolished to further simulate row housing-type conditions (close proximity). The barrier wall will be covered with plastic sheeting.

Since the northwest and southwest faces of the building have gravel rather than pavement, these gravel surfaces will be covered with plastic during the demolition for surface water collection and to prevent water runoff and debris from penetrating the gravel.

Figure 3. Street Side View of Building 235.

Figure 4. Back View of Building 235.

A.5.3. Building Inspections

A.5.3.1. Asbestos Inspection of Building

A comprehensive pre-demolition inspection will be conducted in accordance with the Asbestos Hazard Emergency Response Act (AHERA) (40 CFR 763) to identify the type, quantity, location, and condition of Asbestos-Containing Materials (instead of only RACM) in the buildings (61.145 (a)). Under the EPA-NESHAP 40 CFR 61.145 (a), not only RACM must be identified prior to demolition or renovation but also Category I and Category II Non-friable Asbestos-Containing Materials. The results of this inspection will be included here when available.

A.5.3.2. Lead Paint Inspection of Buildings

The building will be surveyed for inorganic lead to characterize the potential for occupational exposure during demolition.[3] Representative composite bulk samples of the lead-containing building materials will be analyzed to determine the leachable lead content (EPA SW-846 Method 1311, *Toxicity Characteristic Leaching Procedure*). The results of this inspection will be included here when available.

A.5.4. Demolition of Building and Site Management

The AACM building will be demolished using the demolition practices specified in the "*Alternative Asbestos Control Method*" contained in Appendix A.

The amended water will be applied to the AACM Building with two variable rate 15-gpm nozzles or with one 15-gpm nozzle and one 30-gpm nozzle, as conditions require. A water meter (or equivalent device) will be installed at the hydrant to measure the volume of water applied to the building. The surfactant used to create the amended water will be applied using an in-line eductor. The surfactant is known as NF-3000 produced by National Foam. The surfactant will be diluted 50 percent with the hydrant water and mixed at one percent by volume (0.5-percent surfactant) through the eductor to create the amended water. The conductivity of the water will be measured at the beginning of the demolition to ensure proper mixing. The conductivity will also be checked every two hours during the demolition. The concentration of the wetting is not nearly as significant as the presence of the wetting agent, i.e., it is imperative to assure that wetting agent is being applied. The presence of the wetting agent can be easily determined visually by the presence of foam as the spray impacts the structure.

Two areas directly adjacent to the demolition site will be covered with plastic to ensure that any airborne contamination does not settle on those areas. The first area is the warehouse building directly south east of building 235. The other area is the gravel and railroad tracks on the northwest side of the building. Plastic will cover an area approximately 30 ft by 75 ft beginning four feet from building 235 and continuing along the length of the rail road tracks for about 75 ft.

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[3] The OSHA Lead Standard (29 CFR §1926.62) does not define lead-paint based on the amount of lead present. That is, the standard does not specify a minimum amount or concentration of lead that triggers a determination that lead is present and the potential for occupational exposure exists. It is theoretically not possible to exceed the OSHA permissible exposure limit of 50 $\mu g/m^3$, 8-hour time-weighted average (TWA) if the lead-content is $\leq$600 ppm (equivalent to 0.06%). Accordingly, exposure monitoring must be conducted when the lead content of the material is $\geq$ 600 ppm to determine if a worker is being exposed to lead at or above the action level of 30 $\mu g/m^3$ 8-hour TWA.

A.5.5. Monitoring

Air, dust, worker, water, and pavement samples will be collected and analyzed to evaluate the impact of the AACM at this site. Specific requirements for monitoring are described in Section Monitoring During Demolition.

A.5.6. Weather Restrictions

The demolition will not be conducted during rain or snow conditions. For this study, if sustained wind speeds of 15 mph (60-minute average) or gusts above 20 mph are encountered, demolition and monitoring will pause until the wind speed is less than these conditions. The maximum limits were established to attempt to prevent the higher winds speeds from excessively modifying the micrometeorology. Operations will resume upon the winds returning to stable conditions for 15-minutes minimum allowable within the confines of the test, or will be delayed until satisfactory conditions exist. Wind conditions at the selected site will be continuously monitored by the onsite weather stations.

A.5.7. Costs

All costs associated with the demolition process, including cost of the demolition work scope, the health and safety plan and implementation, the costs of any abatement involved, the demolition itself, and the hauling/disposal aspects, will be independently documented and tallied, both for the AACM and the NESHAP (estimated).

A.5.8. Personnel

The key project personnel are identified in Table 1.

A.5.9. Project Schedule

Table 3 includes the major milestones.

Table 3. MAJOR PROJECT MILESTONES

ID	Task Description	Completion Date
1	Kick Off Conference Call – (Site Selected)	5/7/2007
2	Site Visit	5/10/2007
3	Site Assessment Sampling	6/1/2007
4	Draft QAPP for Review	6/1/2007
5	Site Preparation & Building Modifications	6/15/2007
6	Site Assessment Laboratory Analysis	6/30/2007
7	Finalize QAPP	7/15/2007
8	Conduct AACM Demo	7/28/2007
9	Laboratory Audit	8/6/2007
10	Data Analysis & Preparation of Draft Report	10/1/2007
11	Review Draft Report	10/31/2007
12	Final Report	11/30/2007

A.6. QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

The overall quality assurance objective of this project is to implement procedures for field sampling, laboratory analysis, and reporting that will provide data for the development of scientifically valid conclusions and support decision making regarding the project objectives identified in Section A4.2. EPA has developed a seven-step Data Quality Objective (DQO) procedure designed to ensure that data collection plans are carefully thought out and to maximize the probability that the results of the project will be adequate to support decision-making (EPA QA/G-4, August 2000, EPA/600/R-96/055). This seven-step decision process has been applied to the Primary Project Objective.

A.6.1. Primary Objective

To determine the airborne asbestos concentrations during the demolition of the transite building by the AACM process and compare to background concentrations.

A.6.1.1. Step 1: State the Problem

The asbestos NESHAP (40 CFR Part 61, Subpart M) requires the removal of all RACM prior to demolition of the facility. Asbestos removal in accordance with NESHAP can account for a significant portion of the total demolition cost. Because of the abatement cost for these types of buildings, demolition is not occurring in many cases. Demolition of asbestos-containing buildings that have been declared to be unsafe for entry could result in the release of asbestos to the environment.

The EPA will perform a controlled demonstration as part of the Agency's effort to evaluate the effectiveness of the AACM. The AACM, if successful, would likely accelerate the demolition of many orphaned buildings around the nation that remain standing and present a variety of potentially serious risks to nearby residents.

A.6.1.2. Step 2: Identify the Decision

Is the airborne concentration of asbestos during demolition of a building and debris loading using the AACM greater than the background asbestos concentration?

A.6.1.3. Step 3: Identify Inputs to the Decision

Information that is required to resolve the decision statement:

1. Accurate and representative measurements of airborne asbestos concentrations released during demolition of the building using the AACM.
2. An analytical sensitivity that is sufficiently low to detect an anomalies when using the AACM.
3. Accurate and representative measurements of the wind speed and wind direction during demolition of the building.
4. Accurate and representative background data for use in distributional testing.

A.6.1.4. Step 4: Define the Study Boundaries

1. *Spatial boundary of the decision statement*: This decision related to the air concentration of asbestos is defined as the area within the sampling ring around the building. This ring is approximately 25 to 35 feet from the walls of the building. Further, decisions regarding the air matrix apply to air within the breathing zone of potentially exposed individuals engaged in demolition and debris handling at the Fort Chaffee site.

2. *Temporal boundary of the decision statement*: Weather conditions such as freezing temperatures will impede the demolition contractor's ability to adequately wet the structure. Rain conditions may influence the transport and deposition of asbestos fibers released from demolition and debris handling. The study will not be conducted during rain or snow conditions. Sustained wind speeds of 15 mph (60-minute average) or gusts above 20 mph may affect the transport and dispersion of asbestos fibers; i.e., the asbestos concentration would be inversely proportional to the wind speed. To ensure that this does not occur, demolition and sampling will cease when the wind speed in the area exceeds these values. To ensure adequate conditions to detect any visible emissions that are visually detectable without the aid of instruments, the demolition will be conducted during daylight hours (07:00 to 17:00 hours).

3. *Practical constraints on data collection:*

- Loading of particulate on a single sample filter collected over the entire one-day period of the demolition and debris loading activities could prevent the direct preparation of the filters for TEM analysis.[4] To minimize the probability of such an occurrence, the air sampling flow rate has been selected to achieve acceptable filter loading during the sampling period. As an additional safeguard, low volume air samples will be collected at the same locations as the high volume samples. These samples will be archived. Although undesirable, should overloading occur on most filters, an indirect TEM method will be used for analysis (ISO 13794:1999).

- The number and placement of stationary air monitors could be affected by demolition and debris handling activities. This is particularly applicable on the southeast side of the buildings where the demolition excavator is located and debris loading activities will occur. Physical constraints for demolition equipment access may necessitate the movement of some samplers as the physical conditions require.

A.6.1.5. Step 5: Develop a Decision Rule

Decision rules will be used to quantify the degree of difference between various characteristics of the demolition and background data distributions. All hypotheses are set up as one-sided with the *alternative hypothesis that some characteristic of the demolition distribution (e.g. mean, median, quantile) is greater than the corresponding characteristic from the background distribution*. The result from each of these tests is a *p*-value, which represents the probability of obtaining the observed difference in the distributional characteristic of interest (e.g. the mean) under the assumption of the null hypothesis that the demolition and background data sets both arise from the same underlying distribution. If the *p*-value is small, then the assumption that the demolition and background data sets both arise from the same underlying distribution is rejected, and the alternative hypothesis as stated above is concluded.

A.6.1.6. Step 6: Tolerable Limits on Decision Errors

A suite of background comparison tests (this suite of background comparisons was originally developed in the early 1990s by Dr. Richard Gilbert at Pacific Northwest National Laboratory) will be used to compare the demolition and background data distributions. Each test compares a somewhat different (although correlated) characteristic of the demolition and background data distributions. For each test, if the *p*-value is small enough (e.g. less than a significance level of 0.05) the null hypothesis is rejected, and the conclusion is drawn that the demolition data are greater than the background in the context of the characteristic tested. If the

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[4] The direct transfer TEM method (ISO 10312:1995) should not be used if the general particulate loading of the sample collection filter exceeds approximately 10 μg/cm^2 of filter surface, which corresponds to approximately 20 percent coverage of the collection filter by particulate.

p-value is much greater than 0.05 then the demolition and background data distributions are considered similar, or the background data are greater than demolition data, which might instead indicate a comparability problem with the background data set.

The background comparison suite of inferential tests, *t*, Gehan, Quantile Q(.80) and Slippage, consists of a single parametric and three non-parametric tests. A parametric test makes assumptions about the underlying distributions, whereas a non-parametric test does not. Distributions are uniquely characterized by parameters (e.g. mean and standard deviation) and hence the name "parametric test." For example, the *t*-test, which quantifies the observed difference between the means of two distributions, is a parametric test that requires the assumption of normality. The results of the *t*-test are relatively robust to departures from normality; however for extremely skewed or bimodal distributions, the results of the *t*-test may be suspect. The non-parametric analog of the *t*-test is the Gehan test, a generalization of the Wilcoxon Rank Sum test that accommodates multiple detection limits through an ordering algorithm. The Gehan test quantifies the degree of difference between the medians of two distributions. As a non-parametric test, the Gehan test is less prone to the effects of very extreme data. Statistical tests that evaluate normality (e.g. D'Agostino & Pearson) will be used to determine the appropriateness of applying the *t*-test.

Two additional non-parametric tests will be used to assess differences that may exist in the tails of the two distributions. Specifically, the Quantile test is used here to determine if there are an anomalously large number of demolition data that exceed the 80^{th} percentile of the background distribution. This test is performed using combinatorial counting techniques under the assumption that both the demolition and background data arise from the same underlying distribution. If there are an anomalously large number of demolition data greater than the 80^{th} percentile of the background distribution, then it is concluded that, with respect to statistical significance, the 80^{th} percentile of the demolition data distribution is greater than the 80^{th} percentile of the background data distribution. Effectively this means the tail of the demolition distribution is "fatter" than that of the background distribution; there is a statistical difference in the tails of the distributions. The Slippage test will be used to see if there are an anomalously large number of demolition data that exceed the maximum of the background data. This test is similar in function to the Quantile test. If there are an anomalously large number of demolition data greater than the maximum of the background data, then it is concluded that, with respect to statistical significance, the maximum data of the demolition distribution are greater than the maximum of the background distributions.

If any of the *p*-values from the four hypothesis tests are less than the nominal alpha level of 0.05, the conclusion from that test will be used for the overall result. The *t*-test will be included only if the assumptions of normality and homogeneity of variance are met. If these assumptions are not met, the conclusion for the overall result will be based on the three nonparametric inferential tests.

In addition, exploratory data analysis plots such as box plots, histograms, *q*-*q* plots and cumulative distribution plots, will be used as qualitative assessment of the form of the distributions for both demolition and background data. Displays meet the need to see the behavior of the data, to reveal unexpected features, such as outliers; and confirm or disprove assumptions, such as the distributional assumptions of normality and homogeneity of variance required for the *t*-test. In the event an observation(s) is outside the main body of the data, records will be reviewed for an assignable cause(s) and the data value(s) corrected if appropriate. Even if there is no assignable cause(s), the value(s) will be included in all analyses and appropriate measures will taken to meet inferential test assumptions if necessary (i.e., data transformation to meet normality or homogeneity of variance assumptions).

In the first Fort Chaffee demonstration there were a high proportion of non-detects. In the event the number of non-detects in this demonstration is greater than 80% in either group, the suite of four background comparison tests, will be replaced by the binomial test for proportions. The binomial test will be used to evaluate the null hypothesis that the proportion of non-detects from the two populations are equivalent.

A.6.1.7. Step 7: Optimize the Design for Obtaining Results

Using the data from the first Fort Chaffee demonstration (Wilmoth et al, 2007) to estimate the standard deviation for the various matrices effect size differences were calculated using a two sample *t*-test. An approximation to the standard deviation was used, the range divided by four, due to the number of non-detects. The approximation was used in order to avoid the controversy surrounding which is the “best” method for calculating summary statistics when data are censored. For each standard deviation estimate where censored data were encountered, zero was used as the minimum value. This was done to provide a conservative estimate of the standard deviation.

Effect size estimates are based on the proposed sample sizes in Section B1.2, a Type I Error rate of 0.05, power of 0.90, and using either a two sample independent *t*-test. The Type I Error rate is the probability of rejecting the null hypothesis when it is actually true and the power is the probability of rejecting the null hypothesis when it is actually false. The effect size is the smallest mean difference that is statistically significant under the proposed sample sizes and based on the assumption the observed standard deviations are no larger than the estimated. The effect sizes are displayed in **Table 4.**

Table 4. EFFECT SIZES FOR TYPE I ERROR RATE = 0.05, POWER = 0.9,BASED ON A TWO-INDEPENDENT SAMPLE t-TEST

Primary Objective: To determine the airborne asbestos concentrations during the AACM demolition process and compare to background concentrations.		
Background Air	***AACM Air***	***Air Effect Size***
Sample size = 6 [a]SD = 0.00024 s/cm^3	Sample size = 18 [a]SD = 0.00095 s/cm^3	0.00074 s/cm^3
Secondary Objective 2: To determine total fibers in air (phase contrast microscopy (PCM) during the AACM demolition process and compare to background concentrations.		
Background Air (PCM)	***AACM Air (PCM)***	***Air Effect Size (PCM)***
Sample size = 6 [a]SD = 0.0031 f/cm^3	Sample size = 18 [a]SD = 0.0083 f/cm^3	0.0071 f/cm^3
Secondary Objective 3: To determine the settled dust asbestos concentrations during the demolition of the transite building by the AACM process and compare those to background.		
Background Dust	***AACM Dust***	***Dust Effect Size***
Sample size = 6 [a]SD = 2,300 s/cm^2	Sample size = 18 [a]SD = 11,000 s/cm^2	8,300 s/cm^2
Secondary Objective 6: To determine the asbestos concentration in post-cleanup pavement (TEM) following the AACM demolition process and compare to pre-demolition pavement concentrations and to background asbestos concentrations.		
Background Pavement (TEM)	***AACM Pavement (TEM)***	***Pavement Effect Size (TEM)***
Sample size = 8 [b]SD = 7,400 /cm^2	Sample size = 8 [b]SD = 130,000 /cm^2	140,000 s/cm^2

[a]SD = Approximate standard deviation (determined as the difference between the minimum and maximum concentrations divided by four). Minimum and maximum concentrations were generated during Phase 1. Ring 2 AACM data used as background, if available; otherwise, NESHAP data used for background.
[b]SD = Approximate standard deviation (determined as the difference between the minimum and maximum concentrations divided by four). Minimum and maximum concentrations were generated during site assessment for this study.

A.6.1.8. Analytical Sensitivity

The target analytical sensitivity will be 0.0005 structure/cubic centimeter of air (s/cm^3) for all asbestos structures (minimum length of $\geq$0.5 µm).

An analytical sensitivity of 0.0005 s/cm^3 was selected for the following reasons: 1) It is near concentrations that have been reported as a background level of asbestos in ambient air (EPA 1986), and 2) It has been used in other EPA ambient air studies (Wilmoth et al, 2007,Stewart 2003; California Environmental Protection Agency 2003; Wilmoth et al 2004; Wilmoth et al 1990; Kominsky and Freyberg 1995; and "*Contaminants of Potential Concern Committee of the World Trade Center Indoor Air Task Force Working Group"* (May 2003)). This analytical sensitivity was also used in the Phase 1 study.

Achieving the analytical sensitivity for asbestos in air samples is generally dependent on two factors: the volume of air collected through the filter and the area of the filter analyzed; i.e., the number of grid sections analyzed multiplied by the area of the grid sections analyzed. The required analytical sensitivity will be achieved for each collected air sample by collecting as large a volume of air as practical and by increasing the filter search areas, as needed.

A.6.1.9. Data Quality Indicators (DQI)

A.6.1.9.1. Sample Collection DQI

- Precision is the absolute value of the difference of the two analyses, divided by the square root of the sum, which is an estimate of the standard deviation of the difference based on a Poisson counting model. Precision criteria for co-located samples are presented in Table 25. If these criteria are not met the effect on project conclusions will be evaluated.

- Completeness is defined as follows:

$$\%Completeness = \frac{V}{N} x100$$

where V is the number of measurements judged valid, and N is the number of measurements planned. 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 few samples, provided they are not concentrated at a set of contiguous sectors, 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. If completeness objectives are not met the effect on conclusions will be evaluated.

- Representativeness is a subjective measure of the degree that the data accurately and precisely represent the sample collection conditions of the environment. Representative sample collection depends on the expertise and knowledge of the personnel to make sure the samples are collected in a manner that reflects the true concentration in the environment. The sampling locations, number of samples, sampling periods, and sampling durations have been selected to ensure reasonable representativeness.

- Comparability is a qualitative term that expresses the measure of confidence that one data set can be compared to another and combined for the decision to be made. Data collection using a standard sampling and analytical method (e.g., ISO 10312:1995, counting structures longer than and shorter than five µm in length, and PCME (PCM equivalent fibers[5]) maximizes the comparability of the results with both past sampling results (if such exist) and future sampling results.

A.6.1.9.2. Sample Analysis DQI

Analysis of identical image fields as measured by the primary analytical laboratory EMSL will determine the precision data quality indicator. Precision in number of asbestos fibers and asbestos fiber dimensions from the same filters and image fields from selected tests will be measured. Filters loaded with asbestos collected by air filtration have an inherent variability that is exacerbated by the exceedingly small area analyzed by TEM. Although the variability cannot be mitigated by sampling strategies or sampling preparation strategies, it can be quantified, and if factors exist that are artificially magnifying the variability, those factors can in theory be isolated and identified. The best approach to this is through interlaboratory re-preparation and re-analysis of filters and intra-laboratory re-preparation and re-analysis of filters. Interlaboratory re-analysis establishes that the variability is not caused by the laboratory's sample preparation and analytical techniques. If the laboratory was improperly preparing the samples and was causing the results to consistently bias high or low, then the second laboratory's analysis of numerous samples should reveal this trend. If the samples had exceedingly high variability across the filter (or if the lab was causing artificial variability through sample preparation and analysis techniques), then this would be revealed by re-preparation and analysis of the filter by the same laboratory.

Because no reference materials are available to assess the accuracy of the TEM measurements, the best approach is to establish consensus standards through duplicate analysis of precise sub-samples. This is accomplished through a procedure called "verified counting," which is documented in a National Institute of Standards and Technology (NIST) technical guide and used by asbestos analytical laboratories. Two laboratories (in this case the primary analytical laboratory and the QC laboratory) analyze precise identical areas of the sampling filter, and compare their results, which consist of numbers of asbestos structures and drawings and dimensions of each asbestos structure. In this fashion, they can mutually agree on the concentration of asbestos in the sub-sample, and can verify that each is following the very specific guidelines for asbestos structure counting by TEM. Any lack of precision or presence of bias can be readily established and quantified.

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[5] 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 and 3.0 µm.

A.7. SPECIAL TRAINING REQUIREMENTS/CERTIFICATION

A.7.1. Field Personnel

Field leaders must have extensive experience in conducting asbestos-related field research studies including those related to building demolitions. An ADEQ-licensed Asbestos Abatement Consultant with training in the Asbestos NESHAP (40 CFR Part 61, Subpart M) will be on site during demolition and debris loading activities to document the release of any visible emissions as well as oversee the demolition process. Other field personnel will also have experience in asbestos ambient air monitoring, occupational exposure monitoring, related environmental measurements, and data recording. The field personnel will be trained in the requirements of the site-specific Health and Safety Plan (HASP). All personnel involved in the demolition of Building 235 will be State of Arkansas licensed asbestos abatement supervisors and/or workers.

A.7.2. Laboratory Personnel

Laboratory personnel must be familiar with the analytical methods and reporting requirements outlined in the QAPP. EMSL is a National Voluntary Laboratory Accreditation Program (NVLAP)-accredited lab for the analysis of airborne asbestos.

A.8. DOCUMENTATION AND RECORDS

A.8.1. Field Operations Records

A.8.1.1. Sample Documentation

The following information will be recorded:

- Name(s) of person(s) collecting the sample;
- Date of record;
- Description of sampling site (e.g., Building 235);
- Description of sample including a photographic image showing the sample number;
- Location of sample documented on site map with GPS coordinates, as applicable;
- Type of sample (e.g., area, personal, settled dust, water, duplicate, field blank);
- Unique sample number that identifies the sampling site, sample type, date, and sequence number;
- Flow meter number and airflow reading (start/stop);
- Sample time (start/stop) recorded in military time;
- A pre-printed sheet of sample labels (two identical labels per sample number) will be prepared. One label will be attached to the sample container before sample collection period begins, and the other matching label will be attached to the field data sheet that records relevant data on the sample being collected.
- Relevant notes describing site observations such as, but not limited to, site conditions, weather conditions, demolition and debris handling equipment, water application technique (spray or concentrated stream), equipment problems, etc. The notes will be recorded in a bound notebook.

Example data forms are presented in Table 5 through Table 13. At the end of each day, all samples and the corresponding Sampling Data Forms will be submitted to the Team Leader at the demolition site. The Team Leader will verify 100% of the information recorded on the Sampling Data Form for completeness and that all samples are in custody; any discrepancy will be resolved and corrections will be noted, initialed, and dated on the form.

Table 5. SAMPLE LOCATION SKETCH FORM

CLIENT: ____________________ DATE: ____________________

SITE: ____________________ MONITOR: ____________________

SITE ADDRESS: ____________________ PROJ. MANAGER: ____________________

____________________ LBG PROJ. #: ____________________

WORK AREA(S): ____________________

SAMPLE LOCATION SKETCH (PER EACH SHIFT)

Legend:

X INSIDE WORK AREA SAMPLE LOCATION (IWA) Comments:

O OUTSIDE WORK AREA SAMPLE LOCATION (OWA)

Table 6. DAILY INSPECTION LOG SHEET

(Use of form is optional- Information must be in bound notebook)

<table>
<tr><td>CLIENT:</td><td colspan="3"></td><td colspan="3">PROJECT MANAGER:</td></tr>
<tr><td>SITE :</td><td colspan="6">PAGE ______ OF ______</td></tr>
<tr><td>INSPECTOR:</td><td></td><td>SIGNATURE:</td><td colspan="2"></td><td>DATE:</td><td></td></tr>
<tr><td colspan="7">CONTRACTOR:</td></tr>
<tr><td colspan="7">Type of Work being performed:</td></tr>
</table>

TIME (Military)	**CONSTRUCTION ACTIVITIES** **(Narrative Description of Activities)**

Table 7. CONTRACTOR WORKERS/ VISITORS LOG

CONTRACTOR WORKERS/ VISITORS LOG		**DATE** ___________
CLIENT:		PROJECT MANAGER:
SITE :		PAGE ______ OF ______
CONTRACTOR**:**		
Type of Work Performed:		

NAME		TITLE (Circle one)	**CERTIFICATE & LICENSE** **ADEQ Cert #**		**LICENSE EXPIRATION DATE**	**MISC. EXPIRATION DATE**	**TYPE OF RESP.**
		SUPERVISOR					1 2 3
		HANDLER					4 5
		SUPERVISOR					1 2 3
		HANDLER					4 5
		SUPERVISOR					1 2 3
		HANDLER					4 5
		SUPERVISOR					1 2 3
		HANDLER					4 5
		SUPERVISOR					1 2 3
		HANDLER					4 5
		SUPERVISOR					1 2 3
		HANDLER					4 5
Notes:						Key: 1. Half Face Resp. 2. Full Face Respirator 3. PAPR 4. Type “C” espirator 5 Type C Supplied Air	

Table 8. WORKER LEAD CHAIN OF CUSTODY FORM

LOUIS BERGER GROUP, INC.	WORKER LEAD SAMPLE LOG/CHAIN OF CUSTODY	PAGE ______ OF ______

PROJ. NO.:		DATE:	
CLIENT:		TECHNICIAN:	
SITE:		PROJ. MANAGER:	

THE LOUIS BERGER GROUP, INC. TELEPHONE # : (212) 612-7900 **FAX #: (212) 425-1618** ADDRESS: 199 Water Street 23rd Floor, New York, NY 10038	RESULTS TO: EMAIL TO:	TURNAROUND TIME: ☐ 1 HR ☐ 4 HR ☐ 6 HR ☐ 24 HR ☐ _______

SAMPLE ID	DESCRIPTION / LOCATION	TIME		FLOW RATE (L/MIN)		VOLUME (L)
		START/END	MINUTES	START/END	AVERAGE	
SAMPLE #						
PUMP #						
SAMPLE #						
PUMP #						
SAMPLE #						
PUMP #						
SAMPLE #						
PUMP #						
SAMPLE #						
PUMP #						
SAMPLE #						
PUMP #						
SAMPLE #						
PUMP #						
SAMPLE #						
PUMP #						

TECHNICIAN'S LOG

CASSETTE	ROTOMETER		TYPE OF SAMPLING		
☐ PCM ☐ TEM	ID #:	CALIB. DATE:____/_____/_____	☐ BACKGROUND	☐ POST ABATEMENT	☐ PERIODIC
☐ ___________	[ALL GIVEN FLOW RATES INCORPORATE THE CALIBRATION FACTOR]		☐ PRE-ABATEMENT	☐ AMBIENT	☐ _____________
			☐ DURING ABATEMENT	☐ OSHA	

CHAIN OF CUSTODY		DATE	TIME	LABORATORY INFORMATION
Relinquished by (print)	(Sign)	/ /	Am/Pm	LAB NAME:_______________________
Received by (print)	(Sign)	/ /	Am/Pm	ANALYZED BY:____________________
Relinquished by (print)	(Sign)	/ /	Am/Pm	DATE: / / TIME: Am/Pm
Received by (print)	(Sign)	/ /	Am/Pm	QC BY:__________________________
Relinquished by (print)	(Sign)	/ /	Am/Pm	DATE: / / TIME: Am/Pm
Received by (print)	(Sign)	/ /	Am/Pm	

NOTES/COMMENTS

Table 8. WORKER LEAD CHAIN OF CUSTODY FORM (CONT)

EMSL ANALYTICAL CHAIN OF CUSTODY LEAD

SAMPLE #	LOCATION	Air volume, L Area, in^2	LAB #

@ Relinquished By: (Person) ______________________ Date: __________

Received at EMSL By: ______________________ Date: __________

Received at EMSL By: ______________________ Date: __________

Note: Please duplicate this form and use additional sheets if necessary.

@ The individual signing and relinquishing these samples to the laboratory attests to the accuracy of the information reported on this chain of custody.

Table 9. ASBESTOS PAVEMENT SAMPLE CHAIN OF CUSTODY FORM

LOUIS BERGER GROUP, INC.	ASBESTOS PAVEMENT SAMPLE LOG/CHAIN OF CUSTODY	PAGE ______ OF ______

PROJ. NO.:		DATE:	
CLIENT:		TECHNICIAN:	
SITE:		PROJ. MANAGER:	

THE LOUIS BERGER GROUP, INC. TELEPHONE # : (212) 612-7900 **FAX #: (212) 425-1618** ADDRESS: 199 Water Street 23rd Floor, New York, NY 10038	**RESULTS TO:** **EMAIL TO:**	**TURNAROUND TIME:** ☐ 1 HR ☐ 4 HR ☐ 6 HR ☐ 24 HR ☐ _______

SAMPLE ID	DESCRIPTION / LOCATION	TIME		FLOW RATE (L/MIN)		VOLUME (L)
		START/END	MINUTES	START/END	AVERAGE	
SAMPLE #						
PUMP #						
SAMPLE #						
PUMP #						
SAMPLE #						
PUMP #						
SAMPLE #						
PUMP #						
SAMPLE #						
PUMP #						
SAMPLE #						
PUMP #						
SAMPLE #						
PUMP #						
SAMPLE #						
PUMP #						

TECHNICIAN'S LOG

CASSETTE	ROTOMETER		TYPE OF SAMPLING		
☐ PCM ☐ TEM	ID #:	CALIB. DATE:____/_____/_____	☐ BACKGROUND	☐ POST ABATEMENT	☐ PERIODIC
☐ ___________	[ALL GIVEN FLOW RATES INCORPORATE THE CALIBRATION FACTOR]		☐ PRE-ABATEMENT	☐ AMBIENT	☐ _____________
			☐ DURING ABATEMENT	☐ OSHA	

CHAIN OF CUSTODY		DATE	TIME	LABORATORY INFORMATION	
Relinquished by (print)	(Sign)	/ /	Am/Pm	LAB NAME:_______________________	
Received by (print)	(Sign)	/ /	Am/Pm	ANALYZED BY:____________________	
Relinquished by (print)	(Sign)	/ /	Am/Pm	DATE: / /	TIME: Am/Pm
Received by (print)	(Sign)	/ /	Am/Pm	QC BY:__________________________	
Relinquished by (print)	(Sign)	/ /	Am/Pm	DATE: / /	TIME: Am/Pm
Received by (print)	(Sign)	/ /	Am/Pm		

NOTES/COMMENTS

Table 10. ASBESTOS AIR/WORKER SAMPLE CHAIN OF CUSTODY FORM

LOUIS BERGER GROUP, INC.	ASBESTOS AIR SAMPLE LOG/CHAIN OF CUSTODY	PAGE ______ OF ______

PROJ. NO.:		DATE:	
CLIENT:		TECHNICIAN:	
SITE:		PROJ. MANAGER:	

THE LOUIS BERGER GROUP, INC. TELEPHONE # : (212) 612-7900 **FAX #: (212) 425-1618** ADDRESS: 199 Water Street 23rd Floor, New York, NY 10038	RESULTS TO: EMAIL TO:	TURNAROUND TIME: ☐ 1 HR ☐ 4 HR ☐ 6 HR ☐ 24 HR ☐ _______

SAMPLE ID	DESCRIPTION / LOCATION	TIME START/END	TIME MINUTES	FLOW RATE (L/MIN) START/END	FLOW RATE (L/MIN) AVERAGE	VOLUME (L)
SAMPLE #						
PUMP #						
SAMPLE #						
PUMP #						
SAMPLE #						
PUMP #						
SAMPLE #						
PUMP #						
SAMPLE #						
PUMP #						
SAMPLE #						
PUMP #						
SAMPLE #						
PUMP #						
SAMPLE #						
PUMP #						

TECHNICIAN'S LOG

CASSETTE	ROTOMETER		TYPE OF SAMPLING		
☐ PCM ☐ TEM	ID #:	CALIB. DATE:____/_____/_____	☐ BACKGROUND	☐ POST ABATEMENT	☐ PERIODIC
☐ ___________	[ALL GIVEN FLOW RATES INCORPORATE THE CALIBRATION FACTOR]		☐ PRE-ABATEMENT	☐ AMBIENT	☐ _____________
			☐ DURING ABATEMENT	☐ OSHA	

CHAIN OF CUSTODY		DATE	TIME	LABORATORY INFORMATION	
Relinquished by (print)	(Sign)	/ /	Am/Pm	LAB NAME:________________________	
Received by (print)	(Sign)	/ /	Am/Pm	ANALYZED BY:____________________	
Relinquished by (print)	(Sign)	/ /	Am/Pm	DATE: / /	TIME: Am/Pm
Received by (print)	(Sign)	/ /	Am/Pm	QC BY:___________________________	
Relinquished by (print)	(Sign)	/ /	Am/Pm	DATE: / /	TIME: Am/Pm
Received by (print)	(Sign)	/ /	Am/Pm		

NOTES/COMMENTS

Table 11. WATER CHAIN OF CUSTODY FORM

EMSL Analytical, Inc. Chemistry Lab 307 West 38th Street, N.Y., N.Y. TEL: (212) 290-0051 FAX: (212) 290-0058	Chain of Custody / Analysis Request Form Print ALL Information. Put N/A in blanks not applicable	EMSL Project #____________ Account Rep:____________ Indicate State where samples collected: ________________
REPORT RESULTS TO:	**SEND INVOICE TO:**	**TURNAROUND TIME**
Name:	Name: PO#:	Date Results needed by:____________
Company:	Company	*Standard 6-10 days or 2 weeks ☐ *11-15 days or 3 weeks☐ *16-21 days or 4 weeks ☐
Address	Address	The following turnaround times require lab approval:
City	City	☐ *4-5 days or 1week ☐ 72 Hrs ☐48 Hrs
State ZIP	State ZIP	☐ 24 Hrs Approved by____________
TEL: FAX:	TEL: FAX:	*same price and tat for weeks or days
Sampled by: (Signature)	# of Samples in Shipment:____________	Date of Sample Shipment:____________

Failure to complete shaded areas will hinder processing of samples.

					MATRIX					Method Preserved					Sampling		List Test Needed						
	Sample Number	Station Location /Sample ID	COMP	GRAB	WATER	SOIL	AIR	SLUDGE	OTHER	HCL	HNO3	H2SO4	ICE	OTHER	DATE	TIME							
1.																							
2.																							
3.																							
4.																							
5.																							
6.																							
7.																							
8.																							
9.																							
10.																							

Released By Signature	Date & Time Released	Delivery Method	Received By Signature	Agency	Date & Time Received	Condition Noted

Comments:

Please indicate reporting requirements: ☐1. Results Only ☐2. Results and QC ☐3. Reduced Deliverables ☐4. Disk Deliverable

Table 12. WEATHER STATION MEASUREMENT LOG
(Use of form is optional- Information must be in bound notebook)

Date: _______________					**Page _______ of _______**	
Time	**Wind Speed MPH**	**Wind Direction**	**Barometric Pressure, in Hg**	**Temperature ^{0}F**	**Relative Humidity %**	**Entries By**

Table 13. SETTLED DUST ASBESTOS BULK CHAIN OF CUSTODY

ASBESTOS BULK CHAIN OF CUSTODY

PAGE ___ OF ___

PROJECT NO.: ______	LOCATION(S) SURVEYED: ______
CLIENT: ______	PROPOSED PROJECT: ______
PROJECT SITE: ______	DATE(S) OF INSPECTION: ______
Project Manager: ______	Inspector(s): ______

THE LOUIS BERGER GROUP, INC. TELEPHONE NO.: (212) 612-7900 FAX NO.: (212) 425-1618 ADDRESS: 199 Water Street 23rd Floor, New York, NY 10038	RESULTS TO: ______ Please stop at 1st Positive in any Homogeneous Group	TURNAROUND TIME: ☐ 4 HR. ☐ 12 HR. ☐ 24 HR. ☐ 48 HR.

HA	SAMPLE NO.	SAMPLE LOCATION	MATERIAL DESCRIPTION	APPROX. QUANTITY (LF/SF)	Start/ Stop Time
			______		
			______		
			______		
			______		
			______		
			______		
			______		
			______		
			______		
			______		
			______		
			______		

CHAIN OF CUSTODY

[illegible]	[illegible]			[illegible]	[illegible]			[illegible]	[illegible]		
[illegible]	[illegible]			[illegible]	[illegible]			[illegible]	[illegible]		

A.8.1.2. Meteorological Measurements

Met One Instruments, Inc or equivalent, meteorological stations will record temperature, barometric pressure, relative humidity, wind speed, and wind direction at five-minute averages. The data files will be downloaded by using an on-site personal computer. These same metrics will also be noted from the instrument's visual display and recorded on a Meteorologic Data Measurement Log (Table 12) at least hourly.

A.8.1.3. Photo Documentation

A digitized image will be taken of every sampling location. This will include the sampling station and visual debris on the pavement. A five-inch by seven-inch index card (or equivalent) listing the sample number will be photographed to identify the sample and location. Other digitized images will be taken as necessary to thoroughly document the site conditions (such as "visible emissions," if such occur) and activities. In addition, a camcorder will be used by EPA staff to videotape the demolition and demolition debris removal operations.

A.8.2. Chain-of-Custody Records

Standard sample chain-of-custody procedures will be followed. Details can be found in section B3.

A.8.3. Laboratory Records

Complete data packages will be submitted for all sample analyses (i.e., asbestos and total fibers, as applicable) for all matrices (air, settled dust, pavement, and water). This information will be submitted in sufficient detail to allow the subsequent verification of the reported analyses. Alternative forms routinely used by the laboratories may be substituted for those forms specified in the referenced methods.

TEM Reporting

Specifically for TEM analysis the following is required:

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

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
3. Date of Analysis
4. Air Volume
5. Active Area of Sample Filter
6. Analytical Magnification
7. Mean Grid Opening Dimension in mm^2
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 (fiber, bundle, matrix, cluster)
    - Length of Structure in 1-mm increments (e.g., 32)
    - Width of Structure in 0.1-mm increments (e.g., 3.2)
    - Any Other Comments Concerning Structure (e.g., partly obscured by grid bar)

B. MEASUREMENT/DATA ACQUISITION

B.1. EXPERIMENTAL DESIGN

B.1.1. Air Dispersion Modeling

This section presents the modeling approach used to assist in the placement of ambient air monitors that will be used to measure the concentration of airborne asbestos fibers during the demolition. Results of the modeling were used as a predictive tool to evaluate possible monitoring locations, both laterally (x, y) as well as vertically (z), around the building.

B.1.1.1. Source Identification

The sources identified for purposes of this modeling consist primarily of two major operations taking place during the demolition activities: 1) the actual demolition of the building itself and 2) the loading of the truck bed with demolition debris. These two operations will be occurring simultaneously and have the potential to release dust and other airborne particulate matter to the atmosphere. Therefore, both were included in the modeling analysis to account for their potential contributions. The following describes in further detail the characterization of these sources.

B.1.1.1.1. Source No.1: AACM Building #235 Demolition

The building is approximately 32 feet wide, 48 feet long and 14 feet high. A demolition grappler will be used to remove finite sections of the building and then transfer the debris to a large open-bed truck. The demolition process will start at one end of the building and work its way down along the length of the building. The source defined in this case is associated with the extraction of sections of the building being demolished by the grappler prior to loading the debris onto the truck.

B.1.1.1.2. Source No. 2: Transfer of Building Demolition Debris into Truck Bed

Figure B-1 is a photograph of a grappler loading extracted material from a demolition site into a truck bed. As shown in the figure, the grappler has extracted a section of a building and is unloading the debris into the back of a truck. The source defined in this case is associated with the potential emissions resulting from the transfer of the extracted material into the bed of the truck.

Figure 5. Transfer of building debris to truck bed.

B.1.1.1.3. Model Selection

Two U.S. EPA-approved models, SCREEN3 and the Industrial Source Complex Model, Version 3, in its short-term mode (ISCST3), were considered for use in this analysis. Both models are based on a steady-state Gaussian plume algorithm, and are applicable for estimating ambient impacts from point, area, and volume sources out to a distance of about 50 kilometers.

B.1.1.1.4. Source Characterization

Due to the nature and extent of the building demolition process, both of these sources are most appropriately modeled as volume sources. A volume source is used to model emissions that initially disperse three-dimensionally with no plume rise. These sources can either be surface based, structure based (elevated sources on or adjacent to a structure), or elevated (elevated sources not on or adjacent to a structure). Typical volume sources include side or roof building vents, conveyor transfer points, emissions from a crusher or screen, and emissions from loading and unloading trucks.

The inputs for modeling a volume source include the following:

- Emissions rate (g/s)
- Initial lateral dimension of the volume source (σyo)
- Initial vertical dimension, initial depth of the volume source (σzo)
- Release height (m).

Table 14 summarizes these inputs for the building demolition and truck loading activities.

B.1.1.1.5. SCREEN3 Model

SCREEN3 was the U.S. EPA's regulatory screening model for many New Source Review (NSR) and other air permitting applications. The SCREEN3 model utilizes a predefined matrix of meteorological conditions that cover a range of wind speeds and stability categories (A through F), where the maximum wind speed is stability-dependent. The model is designed to estimate the worst-case impact based on a defined meteorological matrix for use as a "conservative" screening technique.

Table 14. SUMMARY OF SELECTED VOLUME SOURCE MODELING PARAMETERS

Parameter	**Source**		**Basis/Comment**
	Bldg. Demolition[1]	**Truck Loading[2]**	
Emission Rate (g/s)	1 g/s	1 g/s	Unit Emission Rate
Init. Lateral Dim. (σyo)	0.70 ft	0.70 ft	Defined based on model guidance for ISCST[3]
Init. Vertical Dim. (σzo)	6.98 ft	1.4 ft	
Release Height (m)	14 ft	-	Avg. Height of Bldg.
	--	7, 12, 15 ft	Based on multiple drop distances to truck bed.

[1] Parameters based on size of grappler (assuming 3 ft x 3 ft) and a building height of 15 ft.

[2] Parameters based on size of grappler (assuming 3 ft x 3 ft), height of side wall of truck bed, and a release height evaluated at 7 ft, 12 ft, and 15 ft.

[3] U.S. EPA, *User's Guide for the Industrial Source Complex (ISC3) Dispersion Models: Volume 2 – Description of Model Algorithms*, September 1995 (EPA-454/B-95-003b), Table 6-1 "Summary of Suggested Procedures for Estimating Initial Lateral Dimensions and Initial Vertical Dimensions for Volume and Line Sources". Refer to the following assumptions described below:

Initial Lateral Dimension for both sources:
Based on size of grappler (assuming 3 ft x 3 ft), where for single volume source, is equivalent to length of side divided by 4.3. Thus σy_o = 3 ft / 4.3 = 0.70 ft for both source types.

Initial Vertical Dimension for both sources:
Building Demolition: For an elevated source on or adjacent to a building, the initial vertical dimension is equivalent to the building height divided by 2.15. Thus σz_o = 14 ft / 2.15 = 6.51 ft.

Truck Loading:
For an elevated source not on or adjacent to a building, the initial vertical dimension is equivalent to the vertical dimension of the source divided by 4.3. Thus σz_o = 3 ft / 4.3 = 0.70 ft (Assuming the vertical dimension of the grappler is 3 ft). Add the release height of 12 ft =12.7 ft; therefore the average height (12.7+6.5)/2= 9.6ft.

In order to determine the relative extent of impact due to these operations, the SCREEN3 model was used to assess the impacts from the building demolition and truck loading sources defined previously. In lieu of actual emissions data, a unit emission rate of 1 g/s was assigned to each of the two sources. Impacts from these sources were modeled from the source origin out to a distance of 1,000 feet. Receptors were spaced every 5 feet out to 100 feet, then every 100 feet thereafter until reaching a distance of 1000 feet. In addition to the ground level impacts, SCREEN3 has the capability to model elevated (free standing) receptors, called flagpole receptors. Therefore, to assess the potential impacts from these sources at elevations above ground level, flagpole receptors were modeled at heights of 5, 10, and 15 feet.

Results of the SCREEN3 modeling associated with the building demolition activities for each of the flagpole heights are shown in Figure 6 and Figure 7. Figure 6 shows the resulting change in concentration as a function of distance from this source out to a distance of 1000 feet. As shown in Figure 6, peak concentrations occur within the first 50 feet of the source and rapidly taper off as distance from the source increases. Figure 7 presents the same profile from the source out to 100 feet. Figure 7 shows that the peak concentration from the building demolition source is predicted to occur within 10 feet of the source.

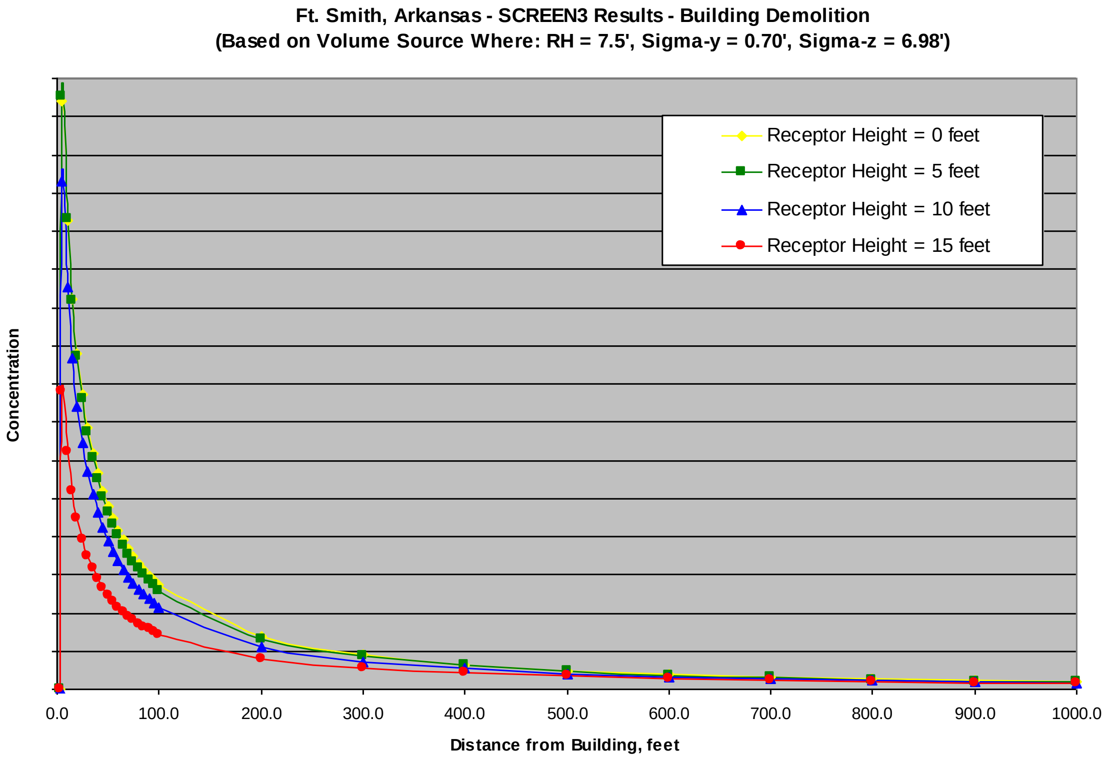

Figure 6. SCREEN3 Results for Building Demolition Source (0 to 1,000 feet).

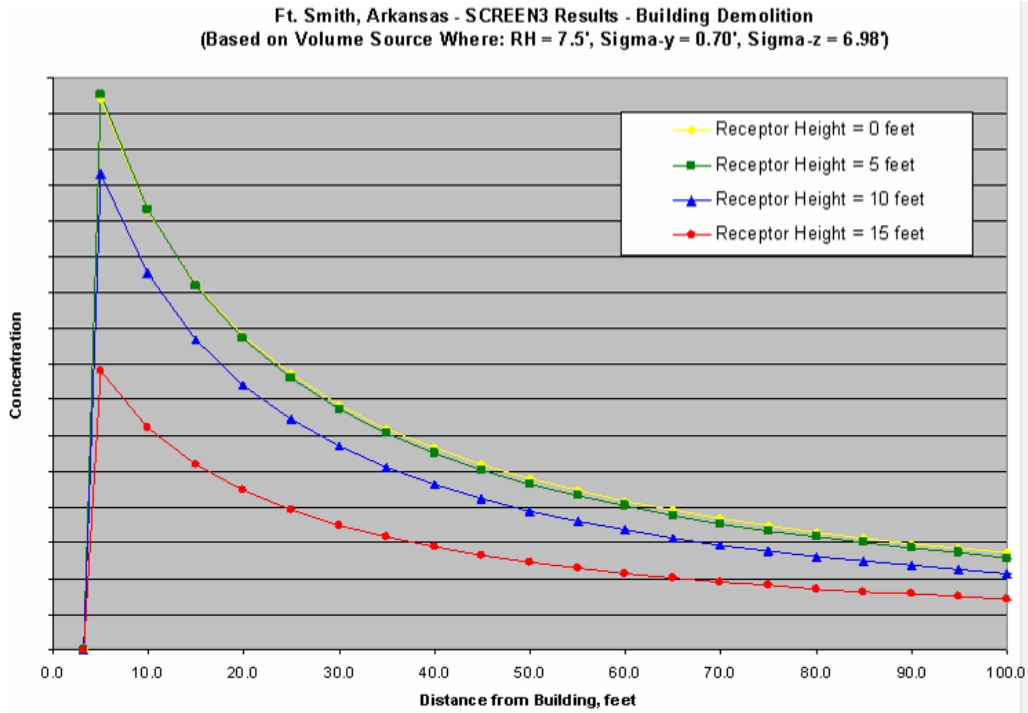

Figure 7. SCREEN3 Results for Building Demolition Source (0 to 100 feet).

A similar procedure was used to assess the SCREEN3 results for the truck loading source. Figure 8 and Figure 9 display the predicted concentration profiles as a function of distance for source release heights of seven and 15 feet. Multiple source release heights were evaluated because as the bed of the truck becomes full, the distance that the material will drop can change. The data from these figures also shows that the maximum/peak concentrations, regardless of release height, occur within 15 feet of the source origin.

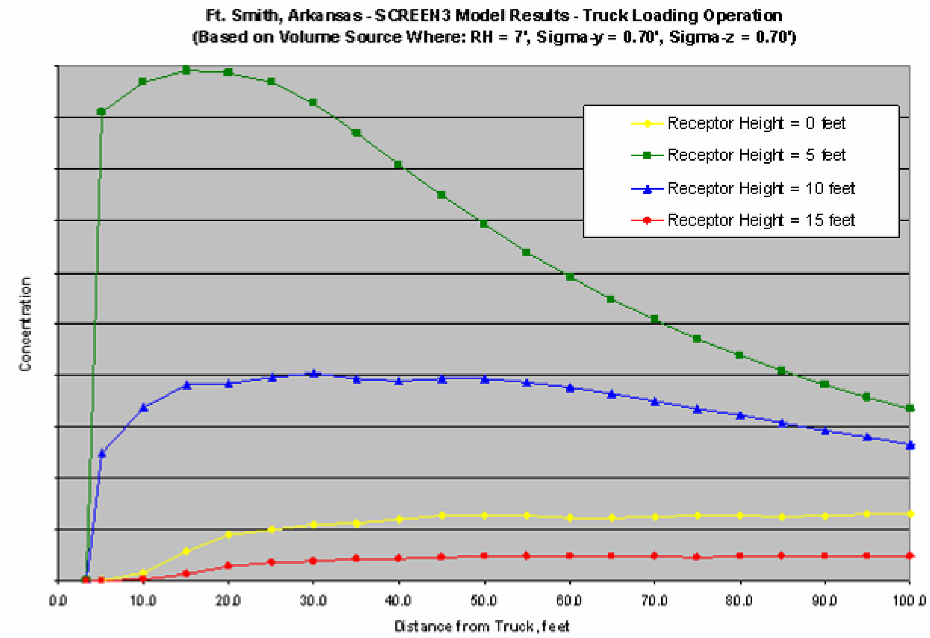

Figure 8. SCREEN3 Results for Truck Loading Source (Release Ht =7 ft).

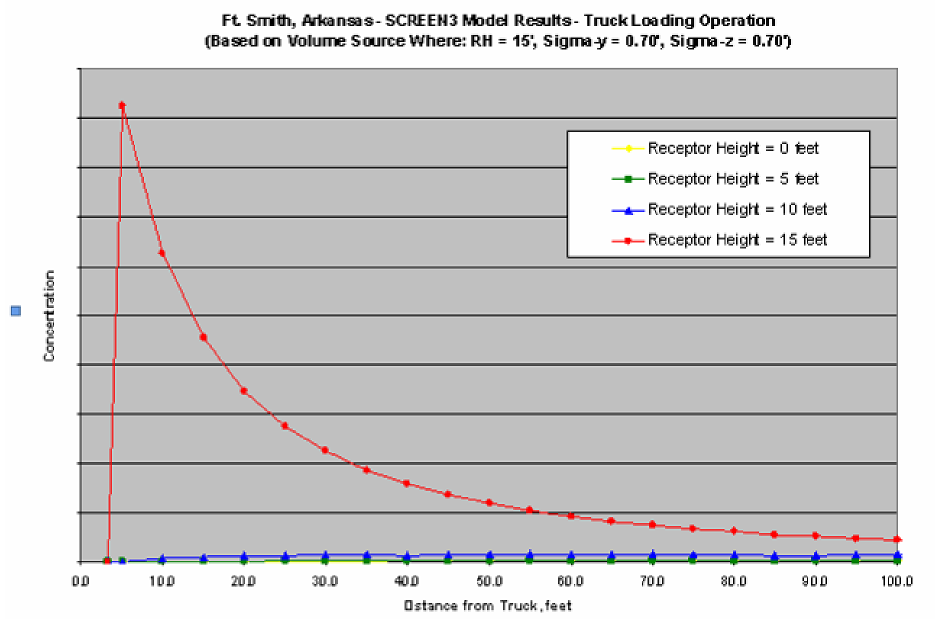

Figure 9. SCREEN3 Results for Truck Loading Source (Release Ht =15 ft).

B.1.2. Monitoring During Demolition

It was determined during the previous evaluation at Ft. Chaffee that the wind direction varies at the site. Hence, it was concluded that the air and dust sampling design should be based on a concentric ring approach rather than on an upwind to downwind approach. This study design is consistent with the primary objective of this project: i.e., to compare the effectiveness of the AACM to control asbestos emissions during demolition and compare this to the asbestos background levels for air.

It is expected that demolition and debris/gravel removing/site cleanup will take approximately four to five hours.

B.1.2.1. Background Air and Surface Monitoring

Background air monitoring will be conducted at a minimum of 500 feet upwind of the demolition activity. Potential sites for various wind conditions will be GPS located and documented. The location of the background samplers will depend on the wind direction the day of the sampling. The background sampling will be conducted during the demolition.

Asbestos air monitoring will be conducted. Six background air samples will be collected at a height of five feet and at an air flow rate of eight liter/min for approximately four to five hours to achieve a target air volume of 1,920 to 2,400 liters. Air samplers will be spaced at a minimum of three feet apart at the background sampling site.

Asbestos in dust will also be monitored. Settled dust collectors will be placed at the same locations as the background air samples. The dust collectors will be placed five feet above ground.

Pavement dust asbestos levels will also be monitored to enable comparisons with the pre-demolition and post-cleanup pavement dust asbestos concentrations. Four microvac samples will be taken in a parking lot that is unaffected by transite building materials nearby.

B.1.2.2. Perimeter Air Asbestos Monitoring

Modeling conducted using the EPA dispersion models SCREEN3 indicates that the maximum airborne asbestos concentrations during demolition and loading of debris will most likely occur approximately between ten and 25 feet from the building and during loading activities at a height between ten to 15 feet above the ground. Therefore, the air monitors will be placed approximately 25 feet from the face of each building. The 25-ft distance was chosen based upon lessons learned during the first study at Fort Chaffee where some evidence of splashing was observed at the 15-ft distance from the loading process. *Note:* On the southeast side of the building the monitors in the primary ring will be positioned approximately 35 feet from the face of the building to accommodate the space needed for disposal truck or equivalently approximately 20 feet from north face of truck (see Figure 10). The monitors will be placed at even intervals around each building. The perimeter air monitors will be placed immediately outside of the containment berm at a ten-ft height above the ground except for three monitors that will be placed on the top of the barrier wall that will be constructed on the rail-track side of the building..

The perimeter air monitoring network will consist of a single concentric ring around the building. It is assumed that the demolition, construction debris, and cleanup will be completed in one day. All primary air samples will be collected at an air flow rate of eight liter/min for approximately four to five hours to achieve a target air volume of 1,920 to 2,400 liters. Additionally, low volume samples will be collected at a flow rate of four liter/min for approximately four to five hours to achieve an air volume of 960 to 1200 liters. These samples will be archived and analyzed only if the primary samples are overloaded. All stationary monitors will be activated shortly before demolition activities begin, and will continue until demolition/cleanup activities cease for that day. The estimated number of air samples to be collected and analyzed for asbestos (including background) is summarized in Table 15.

Table 15. Air MONITORING SAMPLES FOR ASBESTOS ANALYSIS[a]

Sample Type	Number of Samples	Total Samples
High-Volume Perimeter Asbestos (1,920-2,400 L)		
4-5 hr period	21	
Duplicates	2	
Field blank	2	
Total Samples		**25**
Low-Volume Perimeter Asbestos (960-1,200 L)		
4-5 hr period	21	
Duplicates	2	
Field blank	2	
Total Samples		**25** [b]
High-Volume Background Asbestos (1,920-2,400 L)		
4-5 hr period	6	
Field blank	2	
Total Samples		**8**
TOTAL NUMBER OF ASBESTOS SAMPLES ANALYZED		**33**
TOTAL NUMBER OF ASBESTOS SAMPLES COLLECTED		**58**

[a] Samples will be analyzed both for asbestos (ISO 10312:1995) and total fibers (NIOSH 7400, A Rules).
[b] These samples will not be analyzed unless the 1,940-2,400 liter samples are overloaded.

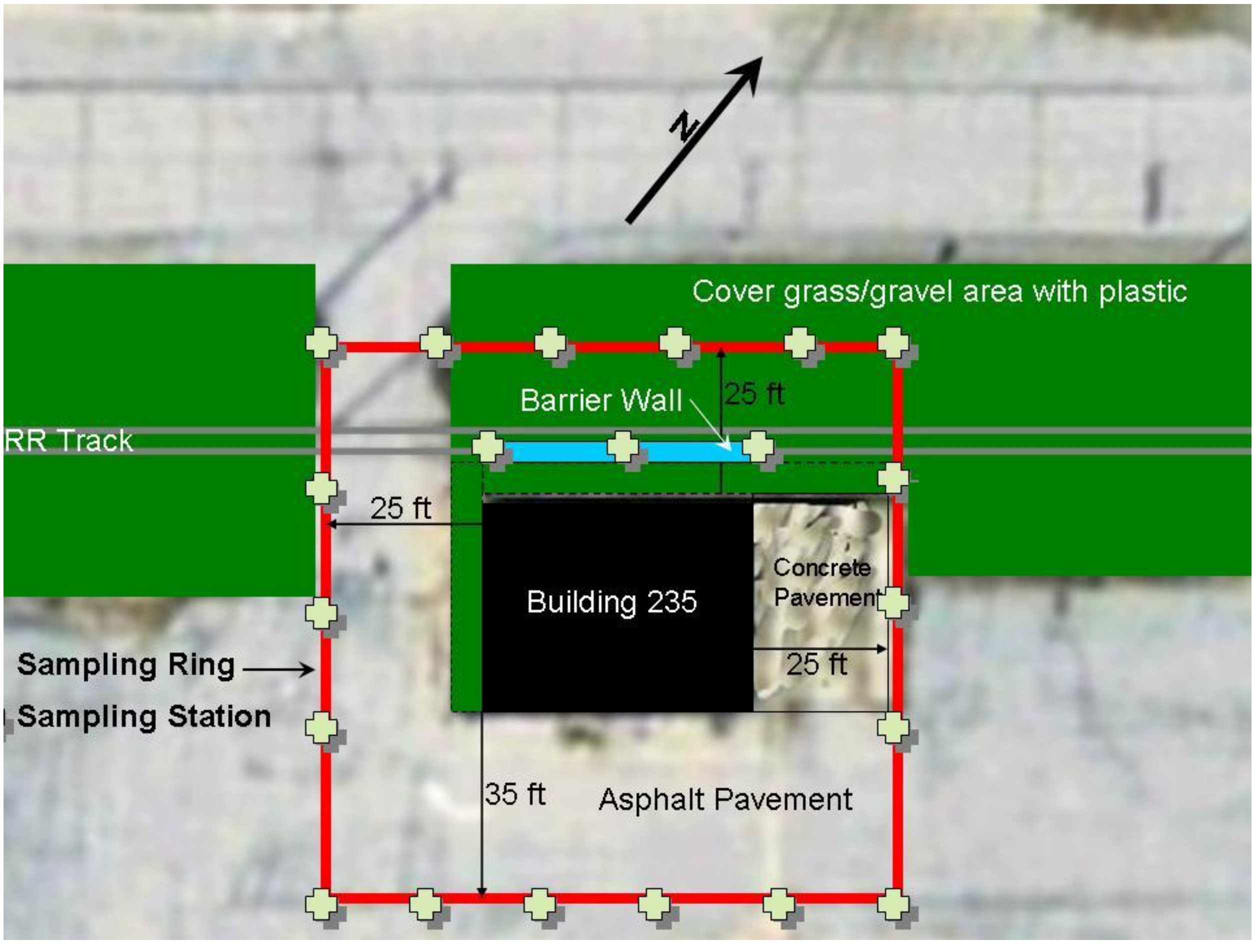

Figure 10. Sampler placement.

B.1.2.3. Worker Personal Breathing Zone Monitoring

Personal breathing zone samples will be collected from all workers directly involved with the demolition of the building, and the handling of the resultant construction debris. Samples for asbestos/total fibers and lead will be collected and the time-weighted average concentration will be calculated for comparison to the OSHA Permissible Exposure Limit for Asbestos (29 CFR §1926.1101) and Lead (29 CFR §1926.62). In addition, this monitoring will provide a reasonable characterization of the asbestos and lead concentrations in air closest to the source of any potential release; i.e., building demolition and debris loading.

Each worker will be fitted with two personal sampling pumps to collect samples that represent the entire demolition activity. The samplers will run the entire time the individual is performing the specific assigned task. The estimated number of air samples to be collected and analyzed for asbestos, total fibers, and lead is presented in Table 16.

Table 16. WORKER BREATHING ZONE MONITORING SAMPLES FOR ASBESTOS AND LEAD

Worker	Number of Samples
Asbestos[a]	
Excavator Operator	1
Hose Operators (2)	2
Laborers (4)	4
Truck Operators (3)	3
Duplicate	2
Field Blank	2
Total Samples	**14**
Lead	
Excavator Operator	1
Hose Operators (2)	2
Laborers (4)	4
Truck Operators (3)	3
Field Blank	1
Total Samples	11

[a] Samples will be analyzed both for asbestos (ISO 10312:1995) and total fibers (NIOSH 7400, A Rules).

B.1.2.4. Impact on Pavement from Demolition

The potential impact on the pavement will be evaluated by comparing the asbestos concentrations on the pavement before demolition ("pre-demolition") to that after final site cleanup and also to asbestos concentrations in similar parking lot areas that are unaffected by the presence of nearby transite.

Pre-demolition pavement samples will be collected prior to demolition of the transite building in areas where no visible deteriorated debris exists. Then, after excavation and site cleanup which includes rinsing the impervious area with amended water, an additional set of pavement samples will be collected (post-cleanup).

Eight microvac samples will be collected on the asphalt/concrete pavement; four within five ft of the building and four approximately 20-25 ft from the building. Two of the samples will be collected at approximately 20-25 ft from the building on the southwest and northeast sides of the building, two of the samples will be collected at within five ft from the building on the southwest and northeast sides of the building, two at approximately 20-25 feet from the building on the southeast side of the building, and two within five feet of the building on the southeast side.

The estimated number of pavement samples to be collected and analyzed for asbestos is presented in Table 17.

Table 17. PAVEMENT SAMPLES FOR ASBESTOS[a] ANALYSIS

Sample Type	Number of Samples
Background	
Background	4
Field Blank	1
Perimeter	
Pre-Demolition	8
Field Blank	1
Post-Cleanup	8
Field Blank	1
Total Samples	**23**

[a] TEM only

B.1.2.5. Settled Dust from Demolition

If any asbestos-containing dust is released during the demolition of the building and associated debris-loading activities, it could settle on nearby surfaces. Settled dust collectors will be placed at the same locations as the perimeter air samples. The dust collectors will be placed five feet above ground at 20-degree intervals at each air sampling monitor location on the sampling ring. All stationary dust containers will be activated by removing the cover shortly before demolition activities begin, and will continue for one hour after demolition activities cease.

The estimated number of settled dust samples for asbestos analysis, including background samples, is presented in Table 18.

Table 18. SETTLED DUST SAMPLES FOR ASBESTOS[a] ANALYSIS

Sample Type	Number of Samples
Background	
Four-to five- hr period	6
Field blanks	1
Total Samples	7
Perimeter	
Four- to five- hr period	21
Duplicates	2
Field Blanks	2
Total Samples	25
Total Samples	**32**

[a]TEM only

B.1.2.6. Source and Surface Water

Source Water—Samples of the source water (i.e., fire hydrant water) applied during the AACM will be collected for asbestos analysis at both the commencement and completion of the building demolition. Samples of the amended water used will also be collected and analyzed for asbestos at both the commencement and completion of the building demolition.

Surface Water— As described in Section A6.1.2, containment berms will be used to trap water runoff during demolition and debris loading. Representative samples of surface water will be collected during the duration of the demolition activity. Drainage channels or berms will be constructed to direct water runoff for collection in basins located within the containment berm. The sampling of the collected runoff water will be spaced over the duration of the demolition activity. Sample collection volumes will be noted as a function of time and as a function of the progression of the demolition.

The estimated number of water samples that will be collected for asbestos analysis is presented in Table 19.

Table 19. SOURCE AND SURFACE WATER SAMPLES FOR ASBESTOS [a] ANALYSIS

Sample Type	Number of Samples			Total Samples
	Source		Surface	
	Hydrant	Amended		
Water	2	2	3	7
Duplicate	1	1	1	3
Field Blank	1	0[b]	1	2
Total Samples	**4**	**3**	**5**	**12**

[a] TEM only
[b] Same field blank as source water

B.1.2.7. Summary of Field Samples for Asbestos

The total number of samples collected for asbestos analysis is presented in Table 20.

Table 20. SUMMARY OF FIELD SAMPLES TO BE COLLECTED FOR ASBESTOS ANALYSIS BY TEM

Source Table	Air[a]	Water	Pavement	Settled Dust	QC	Total Samples
Perimeter air demolition site	21	-		-	4	25
Worker during building demolition	10	-		-	4	14
Pavement		-	20	-	3	23
Perimeter settled dust	-	-		21	4	25
Surface run-off water	-	3		-	2	5
Source water (hydrant and amended)	-	4		-	3	7
Background	6	-	4	6	4	20
Total Samples	**37**	**7**	**24**	**27**	**24**	**119**

[a] Samples will also be analyzed for total fibers (NIOSH 7400, A Counting Rules).

B.1.3. Amended Water Application and Monitoring

Amended water is water to which a surfactant (wetting agent) has been added to improve the penetrating capability of water. The surfactant reduces the surface tension of the water which allows it to penetrate a material where water might normally run off, to reach interior spaces of materials. For this study, the chosen surfactant is Kidde Fire Fighting NF-3000 Class “A” Foam Concentrate, as shown on Figure 11. Foaming ingredients give water the ability to adhere to vertical surfaces, which allows the water longer contact with the surface. This wetting agent is similar to Kidde Fire Fighting product Knockdown® that is used by firefighters to aid in extinguishing a fire and is the same wetting agent used in the first AACM study at Fort Chaffee.

The NF-3000 wetting agent will be added to achieve a target application strength of one-half- percent concentration. According to the manufacturer, the surfactant is effective at significantly lower concentrations. Optimizing the application concentration is not a research goal of this project. It is important for the project to assure that at least 0.25-percent concentration is present at all times in the water applied during the demolition activities.

Figure 11. Wetting agent supply tank for the AACM demolition.

The system layout will consist of a flush hydrant equipped with a water meter, nitrile rubber weave construction fire hose, ball shutoff nozzle, and in-line foam eductor system. The proportioning with the eductor system will be investigated prior to the demolition to assure adequate delivery at the one-half percent amended concentration.

The wetting agent application system that will be used during the pre-wetting of the building consists of a single 30-gpm high-foaming nozzle and matching eductor. This system provides the best foam quality, but has less application range, which is not a problem at this site. The maximum reach of the foam from the 30-gpm nozzle is approximately 30 feet.

The wetting agent application system to be used during demolition will employ two matched 15-gpm non-aspirating variable-pattern nozzles and matching in-line eductor (15 gpm at 200-psi design pressure).

Wetting agent proportioning will be verified by performing periodic conductivity measurements of the application flow throughout the duration of the AACM demolition process. According to the National Fire Protection Association (NFPA) Standard for Low-, Medium, and High-Expansion Foam (NFPA 11, 2005 Edition), there are two acceptable methods for measuring the wetting agent concentrate in water: (1) Refractive Index Method and (2) Conductivity Method. Both methods are based on generating a baseline calibration curve comparing percent concentrations (of pre-measured foam solutions) to the instrument reading. The method selected for the NF-3000 solution concentration determination for this study was the conductivity method.

As stated previously, the target application strength of the NF-3000 wetting agent is approximately one-half percent. Therefore, following the procedures contained in the NFPA 11 Standard using the Conductivity Method, three standard solutions will be prepared using the hydrant water and the foam concentrate from the application system. The percent concentrations for the three standards are 0.25, 0.5, and 1.0 based on a target concentration of one-half percent. The conductivity of each foam solution standard will then be measured and a plot created of the foam concentration versus conductivity. Figure 12 shows the plot serving as the baseline calibration curve for the first Fort Chaffee AACM study which used a foam concentration of one percent.

Throughout the duration of the AACM demolition activities, the concentration of the wetting agent will monitored by taking conductivity measurements at a minimum of every two hours. Sample collection will take place after water flowed for enough time to assure a good sample. The real-time sample conductivity measurements will be compared with the baseline calibration curve (conductivity versus concentration) as illustrated in Figure 12.

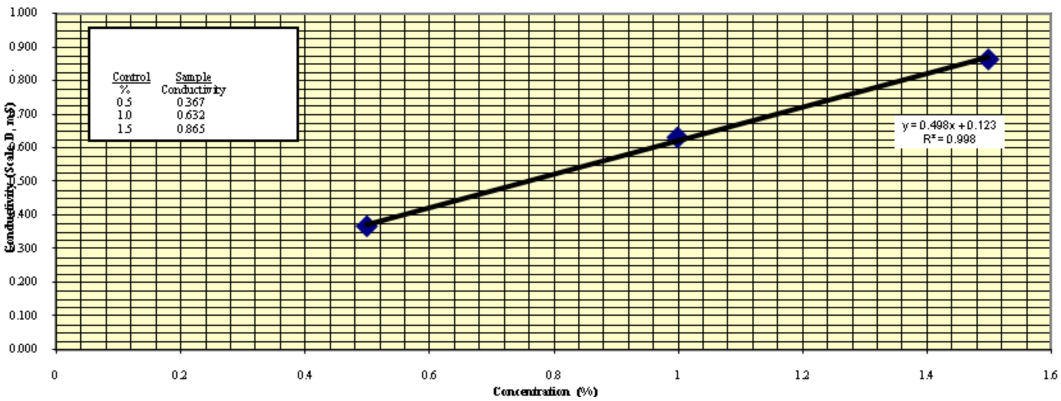

Figure 12. Calibration Curve for the NF-3000 Wetting Agent.

B.2. SAMPLING METHOD REQUIREMENTS

B.2.1. Air Sampling For Asbestos

The samples for both asbestos and total fibers analysis will be collected on the same open-face, 25-mm-diameter 0.45-µm pore size mixed cellulose ester (MCE) filters with a five-µm pore size MCE diffusing filter and cellulose support pad contained in a three-piece cassette with a 50-mm 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 face will be positioned at approximately a 45-degree angle toward the ground. At the end of the sampling period, the filters will be turned upright before being disconnected from the vacuum pump and then stored in this position.

The filter assembly will be attached with flexible Tygon® tubing (or an equivalent material) to an electric-powered (110-volt alternating current) 1/10-hp vacuum pump operating at an airflow rate of approximately eight liter/min. An air volume of 1,920 to 2,400 liters is targeted for all samples. Lower volume samples (960-1,200 liters) from the same locations will also be collected and archived.

B.2.2. Personal Breathing Zone Sampling for Asbestos and Lead

Asbestos—Personal breathing zone samples will be collected on open-face, 25-mm-diameter 0.8-µm pore size MCE filters with a cellulose support pad contained in a three-piece cassette with a 50-mm conductive cowl. The filter assembly will be attached to a constant-flow, battery-powered vacuum pump operating at a flow rate of two liters per minute. An air volume of approximately 480 to 900 liters will be targeted for all samples.

Lead—Personal breathing zone samples were will be collected on closed-face, 37-mm-diameter 0.8-µm pore size MCE filters with a cellulose support pad contained in a three-piece cassette. The filter assembly will be attached to a constant-flow, battery-powered vacuum pump operating at a flow rate of two liter/min. An air volume of 480 to 900 liters is targeted for all samples.

B.2.3. Meteorological Monitoring

A portable meteorological station manufactured by Met One Instruments, Inc., and equipped with AutoMet Sensors (or equivalent instruments) will be used to record five-minute average wind speed and wind direction data, as well as temperature, barometric pressure, and relative humidity. The data files will be downloaded and archived using an on-site personal computer. Periodic (at least hourly) direct readout of the data will be recorded on a Meteorological Measurement Log.

B.2.4. Pavement / Surface Sampling

Pre-demolition pavement samples will be collected prior to demolition of the transite building. Then, after debris removal and site cleanup, an additional set of pavement samples will be collected (post-cleanup). Following collection, a nail will be driven into the pavement to denote the sampling location. Pavement samples will also be collected to document background asbestos concentrations and these will be collected in areas where the parking lots are seemingly unaffected by nearby structures with transite siding.

The pavement area will be sampled for asbestos using ASTM Method D 5755 – 03 entitled "Standard Test Method for Microvacuum Sampling and Indirect Analysis of Dust by Transmission Electron Microscopy for Asbestos Structure Number Surface Loading." Per the method, 10-cm x 10-cm areas will be sampled with the microvac. The sampling will be conducted with 0.45-micron filters for two-minute duration at a rate of two liter/min. The samples will be collected with the center of the sampling template about 10-cm away from the nail which denoted the pre-demolition sampling location.

B.2.5. Settled Dust Sampling

Settled dust samples for asbestos analysis will be passively collected using ASTM Method D 1739-98 *"Method for Collection and Measurement of Dustfall (Settleable Particulate Matter)."* The collection container is an open-topped cylinder approximately six inches in diameter with a height of 12 inches. The container will be fastened to the same sampling pole as the air samples at a height of five feet above the ground. The sampling time for the ASTM protocol will be extended one hour beyond the end of demolition activity. Upon completion of sampling the dust collection container will be capped and sealed for shipment to the laboratory.

B.2.6. Water Sampling—Source, Amended Water, and Pooled Surface Water

The sample container is an unused, one-liter pre-cleaned, screw-capped amber glass bottle. Prior to sample collection, the water from the water source will be allowed to run for a sufficient period to ensure that the sample collected was representative of the source water.

Approximately 800 milliliters of water for each sample will be collected. An air space will be left in the bottle to allow efficient re-dispersal of settled material before analysis. A second bottle will be collected and 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 laboratory and filtered by the laboratory within 48 hours of each sample collection. No preservatives or acids are added. At all times after collection, the samples will be stored in the dark at about 5° C (41° F) in order to minimize bacterial and algal growth. The samples will not be allowed to freeze because the effects on asbestos fiber dispersions are not known. On the same day of collection the samples will be shipped in a cooler at about 5° C (41° F) to the lab for analysis via one-day courier service.

B.2.7. Costs

All costs associated with all aspects of the demolition will be documented and later analyzed to clearly assign the appropriate cost element to the individual demolition activity. Ultimately, the total costs per unit operation will be obtained and finally summarized.

Information that is required to be collected includes but is not limited to:

- Obtain contractor estimates on the cost of all labor, materials, and supplies to perform the abatement and demolition of the Building as if the NESHAP Method was going to be used. These costs include: preparation of asbestos abatement specifications by a licensed Asbestos Project Designer; removal of the RACM by a licensed asbestos abatement contractor; oversight of the abatement, worker, Personal Breathing Zone monitoring (asbestos and lead), and clearance testing by a licensed asbestos consultant; transportation and disposal of the RACM to a licensed asbestos disposal facility.

- Accurate and reliable information on the cost of all labor, materials, and supplies to demolish the AACM Building. These costs include: pre-demolition wetting of the structure; demolition of the structure using asbestos-trained workers and NESHAP-trained observers; personal protective equipment and OSHA-mandated monitoring for asbestos and lead; transportation and disposal of all construction debris as asbestos-containing waste at a licensed landfill.

- Accurate and reliable information on the cost of all federal, state, and local enforcement activities relative to each method of demolition and disposal.

B.3. SAMPLE CUSTODY REQUIREMENTS

Chain-of-custody procedures emphasize careful documentation of constant secure custody of samples during the field, transport, and analytical stages of environmental measurement projects.

B.3.1. Field Chain-of-Custody

Each sample will have a unique project identification number. A unique sample identification system will be developed for the samples collected at the demolition site as shown in Table 21. This identification number will be recorded on a Sampling Data Form (Table 5 and Table 6) along with the other information specified on the form. After the labeled sample cassettes and containers are inspected, the sample custodian will complete an Analysis Request and Chain-of-Custody Record (**Table 7**). 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 the appropriate Laboratory (see Section A8.2) via Federal Express Overnight Service.

Table 21. SAMPLE NUMBERING SCHEME

Location	Sample Type	Monitor Station	Flow Rate, liter/min	Duplicates	Blanks
BG	DUST	M01-M06		DUP	BL
	AIR	M01-M06	8L	DUP	BL
	PAVE	01-04	2L	DUP	BL
TB	HW	01-02		DUP	BL
	AW	01-02		DUP	BL
	AWSURF	01-03		DUP	BL
	DUST	M01-M21		DUP	BL
	WORK	NAME	2L	DUP	BL
	AIR	M01-M21	2L,8L	DUP	BL
	PAVEPRE	01-08	2L	DUP	BL
	PAVEPOST	01-08	2L	DUP	BL

Where:
BG=Background
TB=Transite Building
PAVE= Pavement
HW=Water from Hydrant
AW=Amended Water Source
AWSURF=Amended Water Collected from Surface
WORK=Worker
NAME= Last Name of Worker
POST=Post

As an example of the sample numbering scheme, sample TB-AIR-M07-8L-DUP designates the duplicate air sample from the transite building monitor number 07 at the eight-liter/min flow rate. Another example would be TB-WORK-DREES-2L, which would be the worker Drees at the two-liter/min flow rate.

B.3.2. Analytical Laboratory

The laboratory's sample clerk will examine the shipping container and each sample cassette or sample container to verify sample numbers and check for any evidence of damage or tampering. The chain of custody form is checked for completeness and signed and dated to document receipt. Any changes will be recorded on the original chain-of-custody form and then the form will be forwarded to the Berger Project Manager. The sample clerk will log in all samples and assign a unique laboratory sample identification number to each sample and sample set. Chain-of-custody procedures will be maintained in the analytical laboratory.

B.4. ANALYTICAL METHOD REQUIREMENTS

B.4.1. Air Samples (TEM)

Perimeter Samples—The 0.45-µm pore size MCE air sampling filters will be prepared and analyzed using ISO Method 10312:1995, *Ambient Air - Determination of Asbestos Fibres - Direct-Transfer Transmission Electron Microscopy Method.*" Note: After TEM analysis, a sector from the same filter will then be analyzed using PCM.

Personal Samples— The 0.8-µm pore size MCE air sampling filters will be prepared and analyzed using ISO Method 10312:1995, *Ambient Air - Determination of Asbestos Fibres - Direct-Transfer Transmission Electron Microscopy Method.*" Note: After TEM analysis, a sector from the same filter will then be analyzed using PCM.

B.4.2. TEM Specimen Preparation

TEM specimens will be prepared from the air filters using the collapsing procedure of ISO 10312:1995, as specified for cellulose ester filters. Acetone will be used as the solvent in place of dimethylformamide (DMF). For each filter, a minimum of three TEM specimen grids will be prepared from a one-quarter sector of the filter by using 200 mesh-indexed copper grids. The remaining part of the filter will be archived in the original cassette in clean and secure storage.

B.4.3. Measurement Strategy

1. The minimum aspect ratio for the analyses will be 3:1, as permitted by ISO 10312:1995. As required in the ISO method, any identified compact clusters and compact matrices will be counted as total asbestos structures, even if the 3:1 aspect ratio was not met.

2. Table 22 presents the size ranges of structures that will be evaluated, and target analytical sensitivities for each TEM method. The laboratories will adjust individual numbers of grid openings counted based upon the counting rules and the amount of material prepared for each sample.

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

4. The TEM specimen examinations will be performed at approximately 20,000 magnification.

5. PCM-equivalent asbestos structures, as defined by ISO 10312:1995, will also be determined.

6. The type of structure will be specified. In addition to classifying structures as one of the six NESHAP-regulated asbestos types, any other amphibole mineral particles meeting the aspect ratio of ≥3:1 and lengths ≥0.5 µm) will be recorded, (e.g., winchite, richterite), but not included in the total asbestos concentration calculation. Reference to or implication of either use of the term cleavage fragments and/or discriminatory counting does not apply.

Table 22. TARGET ANALYTICAL SENSITIVITY

Method	Structure Size Range	Target Analytical Sensitivity	Approximate Magnification for Examination
ISO 10312:1995 Perimeter Air Direct Preparation	All Structures (minimum length of 0.5 µm; aspect ratio ≥3:1)	0.0005 s/cc	20,000
ISO 10312:1995 Worker Air Direct Preparation	All Fibers (minimum length of 0.5 µm; aspect ratio ≥3:1)	0.005 f/cc	10,000
Modified ASTM D 5755-03 –Settled Dust	All Structures (minimum length of 0.5 µm; aspect ratio ≥3:1)	250 s/cm^2	20,000
ASTM D 5755-03 –Pavement Dust	All Structures (minimum length of 0.5 µm; aspect ratio ≥3:1)	1000 s/cm^2	20,000
EPA 100.2 Water, Flush Hydrant, and Pooled Surface Water	All Structures (minimum length of 0.5 µm; aspect ratio ≥3:1)	0.04 million s/L for Source 2 million s/L for Surface	20,000

B.4.4. Determination of Stopping Point

The analytical sensitivity and detection limit of microscopic methods (such as TEM and PCM) are a function of the volume of air drawn through the filter and the number of grid openings or fields counted. In principle, any required analytical sensitivity or detection limit can be achieved by increasing the number of grid openings or fields examined. Likewise, statistical uncertainty around the number of fibers observed can be reduced by counting more and more fibers. Stopping rules are needed to identify when microscopic examination should end, both at the low end (zero or very few fibers observed) and at the high end (many fibers observed). Table 23 identifies the stopping rules used for this study.

Table 23. STOPPING RULES FOR ASBESTOS COUNTING

Method	Stopping Rules
TEM (ISO 10312:1995) Perimeter air	Count a minimum of four grid openings. If $\geq$100 structures are identified, counting is stopped. If <100 structures are identified, count until 100 structures are identified or the required number of grid openings to achieve an analytical sensitivity of 0.0005 asbestos structures/cm^3. Always complete the structure count for the last grid opening evaluated.
TEM (ISO 10312:1995) Worker air	Count a minimum of four grid openings. If $\geq$100 structures are identified, counting is stopped. If < 100 structures are identified, count until 100 structures are identified or the required number of grid openings to achieve an analytical sensitivity of 0.005 asbestos structures/cm^3. Always complete the structure count for the last grid opening evaluated.
PCM (NIOSH 7400) Perimeter air	100 fields are viewed or 100 fibers are counted (but not less than 20 fields must be counted).
Modified ASTM D 5755-03 Settled Dust/Pavement Dust	Count a minimum of four grid openings. If $\geq$100 structures are observed, counting is stopped. If < 100 structures are identified, continue counting additional grids until the 100 structures are counted or until an analytical sensitivity of 250 s/cm^2 for settled dust or 1000 s/cm^2 for pavement samples has been achieved. Always complete the structure count for the last grid opening evaluated.
Modified EPA 100.2 Water	Count a minimum of four grid openings. If $\geq$100 structures are observed, counting is stopped. If < 100 structures are identified, continue counting additional grids until the 100 structures are counted or until an analytical sensitivity of 0.04 million s/L or two million s/L depending on water source has been achieved. If not, continue until this analytical sensitivity has been achieved. Always complete the structure count for the last grid opening evaluated.

B.4.5. Air Samples (PCM)

Perimeter Samples—The 0.45-µm pore size MCE air sampling filters will be prepared and analyzed for total fibers using NIOSH Method 7400 "*Asbestos Fibers by PCM*" ("A" Counting Rules). Fibers greater than five µm in length and with an aspect ratio greater than 3:1 will be counted.

Personal Samples—0.8-µm pore size MCE air sampling filters will be prepared and analyzed for total fibers using NIOSH Method 7400 "*Asbestos Fibers by PCM*" (A Counting Rules). Fibers greater than five µm in length and with an aspect ratio greater than or equal to 3:1 will be counted.

B.4.6. Air Samples (Lead)

The 0.8-µm pore size MCE air sampling filters will be prepared and analyzed for inorganic lead using NIOSH Method 7300 "Elements by ICP *(Nitric/Perchloric Acid Ashing).*"

B.4.7. Settled Dust Samples (TEM)

The analytical sample preparation and analysis for asbestos will follow ASTM Standard D5755-03 "Microvacuum Sampling and Indirect Analysis of Dust by Transmission Electron Microscopy for Asbestos Structure Number Surface Loading" with the following exceptions:

Section 10.4.1 through 10.4.3: The sample collection container will be rinsed with approximately 100ml of 50/50 mixture of particle-free water and reagent alcohol using a plastic wash bottle. The suspension will be poured through a 1.0 by 1.0 mm opening screen into a pre-cleaned 500 or 1000 ml specimen bottle. All visible traces of the sample contained in the collection device will be rinsed through the screen into the specimen bottle. The washing procedure will be repeated three times. The volume of the suspension in the specimen bottle will be brought to 500ml with particle free water.

Section 16.2 Recording Data Rules: ISO 10312:1995 counting rules will be followed.

B.4.8. Pavement Dust Samples

The analytical sample preparation and analysis for asbestos will follow ASTM Standard D5755-03 "Microvacuum Sampling and Indirect Analysis of Dust by Transmission Electron Microscopy for Asbestos Structure Number Surface Loading."

B.4.9. Water Samples

The asbestos content of the water samples will be determined using EPA Method 100.2 "*Analytical Method Determination of Asbestos in Water.*" The method will be modified to count all structures greater than or equal to 0.5 µm in length and with an aspect ratio of greater than or equal to 3:1 to achieve an analytical sensitivity of 0.04 million s/L for the source water and 2.0 million s/L for the surface water.

B.5. 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.

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., Table 5 through Table 13) to ensure completeness, traceability, and comparability of the data and samples collected.

$ The air flow rate of the sampling pump will be set to the target value and measured at the beginning, then hourly with adjustments as necessary, and at the end of the sampling period. If the flow rate deviates more than ten percent, the impact to the results will be evaluated.

$ Proper handling of air sampling filters and sample containers to prevent cross contamination.

$ Collection of field blanks and field duplicate samples.

$ Field cross-checking of data forms to ensure accuracy and completeness. Strict adherence to the sample chain of custody procedures outlined in this QAPP.

B.5.1.1. Air Field QC for Asbestos and Total Fibers

Field QC air samples will include field blanks and field duplicates.

B.5.1.1.1. Field Blanks

Field blank samples are used to determine if any contamination has occurred during sample handling. Field blanks will be collected each day of sampling. Field blanks are filter cassettes that have been transported to the sampling site, opened for a short-time ($\leq$ 30 seconds) near an actual sampling location without any air having passed through the filter, and then sent to the laboratory.

B.5.1.1.2. Field Duplicates

A duplicate sample is a second sample collected concurrently at the same location as the original sample.

B.5.1.2. Pavement Dust Field QC

Field QC air samples will include field blanks. Field blank samples are used to determine if any contamination has occurred during sample handling. Field blanks will be collected each day of sampling. Field blanks are filter cassettes that have been transported to the sampling site, opened for a short-time ($\leq$ 30 seconds) near an actual sampling location without any air having passed through the filter, and then sent to the laboratory.

B.5.1.3. Settled Dust Field QC

Field QC settled dust samples will include field blanks and field duplicates.

B.5.1.3.1. Field Blanks

A field blank is prepared by placing a collection device in the field, removing the lid and then immediately replacing the lid.

B.5.1.3.2. Field Duplicates

A duplicate sample is a second sample collected concurrently at the same location as the original sample.

B.5.1.4. Water Field QC

Field QC water samples will include field blanks and field duplicates.

B.5.1.4.1. Field Blanks

A field blank is a clean glass empty container. The container will be opened in the field for approximately 30 seconds. When received at the laboratory, the container will be filled with approximately 800 ml of laboratory water.

B.5.1.4.2. Field Duplicate

A duplicate sample is a second sample collected at the same location as the original sample, but is collected immediately after the original sample is collected.

B.5.2. Laboratory Quality Control Checks

A summary of the analytical methods and the quality assurance/quality control (QA/QC) checks is presented in Table 24.

B.5.2.1. Air Laboratory QC

B.5.2.1.1. Lot Blanks

Before air samples are collected, a minimum of two percent of unused filters from each filter lot of 100 filters will be analyzed to determine the mean asbestos structure count. The lot blanks will be analyzed for asbestos structures by using ISO 10312:1995. If the mean count for all types of asbestos structures is found to be more than ten structures/mm^2 the filter lot will be rejected.

B.5.2.1.2. Laboratory Blank

Laboratory blanks are unused filters (or other sampling 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.5.2.1.1) 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 laboratory clean area blanks (see Section B5.2.1.3) that meet the blank control criteria. Laboratory blank count sheets should be maintained in the project folder along with the sample results.

B.5.2.1.3. Laboratory Clean Area Blanks

Clean area blanks are prepared whenever contamination of a single laboratory prep blank exceeds the criteria specified in Section B.5.2.1.1or whenever cleaning or servicing of equipment has occurred. To check the clean area, a 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 by using ISO Method 10312:1995. If the blank control criteria (see Section B.5.2.1.1) are not met, the area is cleaned by 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-µm pore size MCE filter by using a calibrated air sampling pump. The samples should then be analyzed by 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.

B.5.2.1.4. 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 a percentage 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 an acceptable analytical variability as shown in Table 25.

B.5.2.1.5. Duplicate Analysis

A duplicate sample analysis is also performed on a percentage 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 for the duplicate analysis is that the counts from the original and duplicate analyses will fall within the acceptable analytical variability shown in Table 25

B.5.2.1.6. 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 be done by more than one analyst in the initial laboratory and also by the QC laboratory. Counting will involve re-examination of the same grid openings by the participating analysts. Such recounts provide a means of maintaining comparability between counts made by different microscopists. Repeat results should result in a level of consensus between laboratories such that both laboratories have >80% true positives, <20% false negatives, and <20% false positives in their verified counting analysis of asbestos structures.

B.5.2.1.7. Interlaboratory QA Checks

EMSL will submit a percentage of air samples to a QA laboratory for verified counting and duplicate analyses as described in the previous sections.

B.5.2.2. Settled Dust /Pavement Dust Laboratory QC

B.5.2.2.1. Laboratory Blanks

A laboratory blank is prepared by filtering water through the same type of filter used to prepare TEM grids. A sample blank should be prepared each time a new batch of filters is opened and each time the filtering unit is cleaned. Blanks will be considered contaminated if they have greater than or equal to ten asbestos structures per square millimeter. The source of the contamination must be found before any further analysis can be performed. Reject samples that are processed along with the contaminated blank samples and prepare new samples after the source of the contamination is found.

B.5.2.2.2. Laboratory Duplicates

A duplicate sample analysis is also performed on a percentage of the samples analyzed to assess the reproducibility of the sample preparation and analysis. A duplicate analysis is the analysis of a second aliquot of the original dust samples aqueous suspension.

B.5.2.2.3. Replicate Analysis

Replicate analysis will be performed on a percentage of the samples as described for the air samples in Section B5.2.1.

B.5.2.3. Water Laboratory QC

B.5.2.3.1. Laboratory Blanks

A laboratory blank is prepared by filtering 100 mL of water through the same type of filter used to prepare TEM grids. A sample blank will be prepared with each sample set.

B.5.2.3.2. Laboratory Duplicates

A duplicate sample analysis is also performed on one of the samples analyzed to assess the reproducibility of the sample preparation and analysis. A duplicate analysis is the analysis of a second aliquot of the original water sample.

B.5.2.3.3. Replicate Analysis

Replicate analysis will be performed on one of the samples as described for the air samples in Section B5.2.1.4.

Table 24. ANALYTICAL METHODS AND QUALITY ASSURANCE (QA)/QUALITY CONTROL (QC) CHECKS

Matrix	Analyte	Method and Analytical Sensitivity	QA/QC Checks	Frequency	Acceptance Criteria	Corrective Action if Acceptance Criteria Not Met
Perimeter Air	Asbestos by TEM	ISO Method 10312:1995; 0.0005 s/cm^3	Lot Blanks	2% of unused filters	<10 asbestos s/mm^2	Reject filter lot
			Laboratory Blanks	Each sample batch	<10 asbestos s/mm^2	Collect and analyze clean area blanks; re-prep filter samples
			Laboratory Clean Area Blanks	Whenever laboratory blanks do not meet criteria	<10 asbestos s/mm^2	Find and eliminate source of contamination
			Replicate Analysis (recount by same analyst)	3 samples	Acceptable Analytical Variability from Table 25	Re-examine grids to determine cause of variation
			Verification Counting	2 samples	>80% true positives, <20% false negatives, <20% false positives	Re-examine grids to determine cause of variation
			Duplicate Analysis (reprep and analysis by same analyst)	3 samples	Acceptable Analytical Variability from Table 25	Re-examine grids to determine cause of variation; re-prep filter samples
			Interlaboratory Verified Counting	2 samples	>80% true positives, <20% false negatives, <20% false positives	Re-examine grids to determine cause of variation
			Interlaboratory Duplicate Analysis	3 samples	Acceptable Analytical Variability from Table 25	Re-examine grids to determine cause of variation; re-prep filter samples

Table 24. (continued)

Matrix	Analyte	Method and Analytical Sensitivity	QA/QC Checks	Frequency	Acceptance Criteria	Corrective Action if Acceptance Criteria Not Met
Perimeter Air (cont)	Total Fibers by PCM	NIOSH Method 7400; 0.001 f/cm^3 With 2400L	Blind recounts on reference slides	Daily	Per laboratory control charts	Investigate source of imprecision; re-count reference slides
			Blind recounts on filter samples	10%	See Step 13 of Method 7400	Investigate source of imprecision; re-count filter sample
Worker Air	Total Fibers by PCM	NIOSH Method 7400; 0.006 f/cm^3 (480 L) 0.003 f/cm^3 (960 L)	Blind recounts on reference slides	Daily	Per laboratory control charts	Investigate source of imprecision; re-count reference slides
			Blind recounts on filter samples	10%	See Step 13 of Method 7400	Investigate source of imprecision; re-count filter sample
	Asbestos by TEM	ISO Method 10312:1995; 0.005 s/cm^3	Lot Blanks	2% of unused filters	<10 asbestos s/mm^2	Reject filter lot
			Laboratory Blanks	Each sample batch	<10 asbestos s/mm^2	Collect and analyze clean area blanks; re-prep filter samples
			Laboratory Clean Area Blanks	Whenever laboratory blanks do not meet criteria	<10 asbestos s/mm^2	Find and eliminate source of contamination
			Replicate Analysis	2 samples	Acceptable Analytical Variability from Table 25	Re-examine grids to determine cause of variation
			Verification Counting	1 sample	>80% true positives, <20% false negatives, <20% false positives	Re-examine grids to determine cause of variation

Table 24. (continued)

Matrix	Analyte	Method and Analytical Sensitivity	QA/QC Checks	Frequency	Acceptance Criteria	Corrective Action if Acceptance Criteria Not Met
Worker Air	Asbestos by TEM	ISO Method 10312:1995; 0.005 s/cm^3	Duplicate Analysis (reprep and analysis by same analyst)	2 samples	Acceptable Analytical Variability from Table 25	Re-examine grids to determine cause of variation; re-prep filter samples
Settled Dust/Pavement Dust	Asbestos by TEM	Modified ASTM D 5755-03; 250 s/cm^2 (Settled Dust) and 1000 s/cm^2 (pavement)	Lot Blanks	2% of unused filters	<10 asbestos s/mm2	Reject filter lot
			Laboratory Blanks	1 per 10 samples or each sample batch	<10 asbestos s/mm2	Collect and analyze clean area blanks; re-prep filter samples
			Laboratory Clean Area Blanks	Whenever laboratory blanks do not meet criteria	<10 asbestos s/mm2	Find and eliminate source of contamination
			Replicate Analysis	2 settled dust samples, 2 pavement dust samples	Acceptable Analytical Variability from Table 25	Re-examine grids to determine cause of variation

Matrix	Analyte	Method and Analytical Sensitivity	QA/QC Checks	Frequency	Acceptance Criteria	Corrective Action if Acceptance Criteria Not Met
Settled Dust/Pavement Dust	Asbestos by TEM	Modified ASTM D 5755-03; 250 s/cm^2 (Settled Dust) and 1000 s/cm^2 (pavement)	Duplicate Analysis	2 settled dust samples, 2 pavement dust samples	Acceptable Analytical Variability from Table 25	Reprepare and re-examine sample to determine cause of variation; re-prep filter samples
Water	Asbestos by TEM	EPA 100.2; 0.04 million str/liter source 2 million str/ liter runoff	Lot Blanks	2% of unused filters	<10 asbestos s/mm^2	Reject filter lot
			Laboratory Blanks	1 per 10 samples or each sample batch	<10 asbestos s/mm^2	Collect and analyze clean area blanks; re-prep filter samples
			Laboratory Clean Area Blanks	Whenever laboratory blanks do not meet criteria	<10 asbestos s/mm^2	Find and eliminate source of contamination
			Replicate Analysis	1 sample	Acceptable Analytical Variability from Table 25	Re-examine grids to determine cause of variation

Matrix	Analyte	Method and Analytical Sensitivity	QA/QC Checks	Frequency	Acceptance Criteria	Corrective Action if Acceptance Criteria Not Met
			Duplicate Analysis	1 sample	Acceptable Analytical Variability from Table 25	Reprepare and re-examine sample to determine cause of variation

Table 25. ACCEPTED ANALYTICAL VARIABILITY FOR SAMPLE RE-ANALYSIS*

Type of Sample		Accepted Variability
Air Samples	lab replicate	1.96
	lab duplicate	2.24
	Interlaboratory duplicate, co-located	2.50
Non-Air Samples	lab replicate	2.24
	lab duplicate	2.50

Note: These accepted variabilities will be used as guidelines to assess data quality: no data will be automatically excluded without thorough review.

$$\text{Analytical Variability } = \frac{AnalysisA - AnalysisB}{\sqrt{AnalysisA + AnalysisB}}$$

which is the absolute value of the difference of the two analyses, divided by the square root of the sum, which is an estimate of the standard deviation of the difference based on a Poisson counting model. For replicate air samples, for which the simple Poisson model is most directly applicable, the value 1.96 is chosen so that the criterion will flag approximately 1 replicate pair out of 20 for which the difference is due only to analytical variability, i.e., it has a “false positive” rate of 5%. For the other types of analyses, where greater natural variability is expected than indicated by a pure Poisson model, the criterion value has been increased from 1.96 in order to avoid flagging too many cases where the difference between the values is due only to normal variation, and not to any problem with either analysis. The values 2.24 and 2.50 were selected as targeting false positive rates of 2.5% (1/40) and 1.125% (1/80) for the Poisson model.

Example 1: For replicate air samples where A = 0 fibers and B = 3 fibers, the variation is considered acceptable, while A = 0 and B = 4 would be flagged for further investigation. Likewise A = 1 and B = 6 is acceptable, while A = 1 and B = 7 is flagged. At higher levels, A = 20 and B = 34 is acceptable, but A = 10 and B = 24 is flagged.

Example 2: For interlab duplicate non-air samples, A = 0 and B = 6 is acceptable, but
A = 0 and B = 7 is flagged. Likewise, A = 1 and B = 8 is acceptable, but A = 1 and B = 9 is flagged.

B.6. INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

B.6.1. 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 at least daily in the field before and after use. Spare equipment such as air sampling pumps and conductivity meter will be kept on site to minimize sampling downtime. A backup meteorological instrument will be available onsite.

B.6.2. Laboratory Equipment/Instrumentation

As part of the EMSL's QA/QC Program, a routine preventive maintenance program is performed to reduce instrument failure and other system malfunctions of transmission and scanning electron microscopes. The laboratory has an internal group and equipment manufacturers' 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 specifications and the requirements of ISO Method 10312:1995.

B.7. INSTRUMENT CALIBRATION AND FREQUENCY

B.7.1. Field Instrument/Equipment Calibration

B.7.1.1. Air Sampling Pumps

Before the sampling pumps are used in the field, their performance will be evaluated by a qualified technician. The air sampling pumps for asbestos sampling, which are the primary air sampling item, will be evaluated to determine that they are capable of maintaining a stable flow rate for a given static pressure drop; i.e., the pressure drop created by a 25-mm, 0.45 µm MCE membrane filter with a five-µm pore-sized MCE backup diffusing filter and cellulose support pad contained in a three piece cassette at a flow rate of eight liter/min @ STP.

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.

B.7.1.2. Airflow Calibration Procedure

Flow measurements will be taken by secondary standard rotameters that have been pre-calibrated in the laboratory using a primary standard. Primary standard calibration documentation will be available in the field. The flow meter will be placed downstream of the filter cassette at the beginning and ending of the sampling periods and the measurement recorded.

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

- Flow meter model and serial number
- Sampling train (pump, flow control valve, and filter)
- Relevant calculations

Pump checks will be performed at least every hour during sample collection. These periodic checks will include the following activities:

- Observe the sampling apparatus (filter cassette, vacuum pump, etc.) to determine whether it’s been disturbed.
- Check the pump to ensure that it is working properly and the flow rate is stable at the prescribed flow rate on the pump-mounted rotameter, where installed.
- Inspect the filter for overloading and particle deposition
- Record all information (location, pump number, time, flow rate, and corrective action) in a log book.

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.

B.8. INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

B.8.1. Air Sampling Filter Media

See Section B.5.2.1.1 regarding the quality control check of the filter media.

B.8.2. Sampling Containers for Water Samples

Sample containers used to collect water samples for asbestos analysis will be provided by EMSL. EMSL will be responsible for pre-cleaning these containers as required by EPA Method 100.2.

B.8.3. Hydrant Water

Hydrant water was collected prior to the demolition to verify its acceptability for use. This water was considered acceptable as the asbestos concentration was non-detect at an analytical sensitivity of 0.04 million s/L.

B.9. NON-DIRECT MEASUREMENTS

No data are needed for project implementation or decision making that will be obtained from non-measurement sources such as computer data bases, programs, literature files, or historical data bases.

B.10. DATA MANAGEMENT

Commercially available computer hardware and software will be used to manage measurement data 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 is required by using alternative means of calculations.

B.10.1. Field Data Management

Field data will be entered into a Microsoft Excel spreadsheet (or other applicable 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, sampling period and weather patterns for that day. Information will be collected and recorded via daily logs and chains –of-custodies (COC) in order to have a seamless flow of project specific data that can be QA/QC'ed accordingly. The project logs will record the contractors as well as the consultant project site specific activities. Special consideration will be given to the sample location graph as well as the contractor's progress with the demolition activities. The consultant (Berger) will be adequately staffed to provide ample attention to each activity (i.e. air sample calibration and COC, QA/QC, monitoring of demolition contractor's (LVI) activities) It is anticipated that several consultant personnel will be on-site throughout the project from setup until completion in order to actually capture all of the data, work practices, and sampling required by the QAPP.

B.10.2. Laboratory Data Management

Laboratory data will be entered into a Microsoft Excel spreadsheet (or other applicable spreadsheet) to facilitate organization, manipulation, and access to the data. 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.

EMSL utilizes an automated Laboratory Information Management System (LIMS) to record, document and assimilate pertinent field, laboratory, and administrative data.

The validation of this software, including final report templates are performed by the Corporate MIS Department and the Quality Assurance Department. Data validation is a continuing process that takes place every time samples arrive at the laboratory and is carried through during log in, analysis and final reporting. This process is performed by the Laboratory Manager each time a final report goes through the procedures of review and signature. All calculations and reporting performed by the software is implemented by the Laboratory Management, the Corporate MIS staff or the Quality Assurance (QA) Department. This coordination between the QA Department, Laboratory Management and the MIS Department allows the software to be reviewed and altered as necessary to comply with regulatory agencies and/or accrediting organizations requirements.

B.10.2.1. Data Validation

In addition to the initial verification, there is a continual validation process that occurs each time that the Laboratory Manager proofs a report prior to release to the client. If any of the errors that are found during this proofing process are not traced back to transcription or analytical error, then the computer system is suspect and will be investigated. The processes that undergo this continuous validation includes:

- Sample Receiving
- Sample Log In
- Sample Analysis
- Analytical Results Entry
- Proofing of Reports

B.10.2.2. Exported Data

Exported data is provided in a variety of formats. Export formats for data deliverables are implemented and controlled by the corporate MIS staff, which has the flexibility to implement new export formats as required. Electronically delivered data is not intended to replace hard copy results. Final, signed client reports are submitted in addition to delivery by email or diskette. In this way, exported data can be verified. Laboratory data is typically exported into a Microsoft Excel spreadsheet to facilitate organization, manipulation, and access to the data. 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.

C. ASSESSMENT/OVERSIGHT

C.1. ASSESSMENT AND RESPONSE ACTIONS

C.1.1. Performance and System Audits

C.1.1.1. Field Audit

The EPA-ORD QA Officer (or their representative) will audit the field sampling and data collection activities. The audit will include, but not be limited to, the examination of sample collection and equipment calibration procedures, sample labeling, sampling data and chain-of-custody forms, and other sample collection and handling requirements specified in the QAPP. Prior to the audit, a detailed checklist will be developed for use based on the approved QAPP. The auditor will document any deviations from the QAPP so that they can be corrected in a timely manner.

Prior to leaving the site, the auditor will debrief the EPA-ORD Task Order Manager and the Berger Project Manager 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 to the EPA-ORD Task Order Manager.

C.1.1.2. Laboratory Audits

The EPA-ORD QA Officer (or their representative) will conduct a laboratory quality assurance audit. The focus of the review will be the air analyses performed to support the primary project objective. Prior to the audit, a detailed checklist will be developed for use based on the approved QAPP. This audit will be conducted as soon after the laboratory receives the samples as practical to ensure compliance with the approved QAPP. The auditor will debrief the EPA-ORD Task Order Manager and the Berger Project Manager 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 to the EPA-ORD Task Order Manager.

If any serious problems are identified, the Berger Project Manager will ensure that immediate corrective action is performed. The laboratory will not analyze any samples until all audit recommendations have been resolved and documented in a memorandum to the Berger Project Manager. The Berger/Cadmus Project Manager will keep the EPA-ORD TOM informed of audit results and corrective actions.

C.1.2. Corrective Action

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 through a memorandum to the Berger Project Manager. The Cadmus/Berger Project Manager will then forward a copy to the EPA Task Order Manager.

C.2. 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 Cadmus Project Manager will provide verbal progress reports to the EPA Task Order Manager. 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. The Cadmus Project Manager will promptly advise the EPA-ORD Task Order Manager on any items that may need corrective action.

A written report will be prepared for each field and laboratory audit. The audit reports will be prepared by the person who conducts the audit. These reports will be submitted to the EPA Task Order Manager.

The final project report will be prepared in accordance with the guidelines specified in the EPA Handbook for Preparing ORD Reports, EPA/600K/95/002.

D. DATA VALIDATION AND USABILITY

D.1. DATA REVIEW, VERIFICATION, AND VALIDATION

The analytical laboratory, EMSL, 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 that would caution the data user of possible unreliability. The analytical results will be compared to the stated data quality indicators for each data quality objective. Field data and laboratory reports will then be reviewed and validated by Cadmus/Berger.

D.1.1. Laboratory Data Review

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 or analyst. A second data reviewer will also verify correctness of the data. Finally, the Laboratory Quality Assurance Manager at EMSL will provide one additional data review to verify completeness and compliance with the project QAPP. Any deficiencies in the data will be documented and identified in the data report.

D.1.2. Field and Laboratory Data Verification/Validation

Data verification and data validation will be conducted in accordance with EPA "*Guidance on Environmental Data Verification and Data Validation*," EPA QA/G-8 (EPA/240/R-02/004, November 2002. This will be performed by Cadmus/Berger's QA Officer, or designee.

Data verification is the process of evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method or QAPP requirements. The goal of data verification is to ensure and document that the data are what they purport to be, that is, that the reported results reflect what was actually done.

Data validation is the analyte- and sample-specific process that extends the evaluation of the data beyond data verification. Data validation continues with the review of the raw analytical data and analysis notes. 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 (e.g., field blanks). Analytical data not appearing to be valid or not meeting data quality indicators will be flagged and reported to the Cadmus/Berger Project Manager. The Cadmus/Berger Project Manager will then transfer this information to the EPA Task Order Manager.

D.2. DATA AND SAMPLE ARCHIVAL

Data and sample storage encompasses an archival of all collected samples, generated electronic files, and any laboratory notes collected during collection or analysis of samples. Upon completion of the analysis, the respective laboratory will store the remaining portions of the samples or sample preparations (e.g., TEM grids) until such materials are requested to be shipped to EPA. *Note: No samples or sample preparations will be discarded.* Following submission of the final project report, all laboratory and field records/files (paper and electronic) will be transferred to the Cadmus Project Manager. The Cadmus Project Manager will then transfer the complete project file to the EPA-ORD Task Order Manager for permanent retention.

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F. APPENDIX A. DRAFT ALTERNATIVE ASBESTOS CONTROL METHOD

Developed by EPA Region 6 and EPA Office of Research and Development
July 19, 2007 version

1.0 Background

In response to Section 112 of the Clean Air Act which requires EPA to develop emission standards for hazardous air pollutants, EPA promulgated the National Emission Standards for Hazardous Air Pollutants (NESHAP). 40 CFR Part 61 Subpart M (Asbestos NESHAP) specifically addresses asbestos, including demolition activities.

Asbestos NESHAP regulations require that all regulated asbestos-containing materials (RACM) be removed from structures prior to demolition once the RACM exceeds a specified amount. Asbestos-containing materials (ACM) are defined as those materials containing more than one percent asbestos as determined using the method specified in Appendix E, Subpart E, 40 CFR Part 763, Section 1, Polarized Light Microscopy (PLM).

RACM includes friable ACM; Category I non-friable ACM that has become friable, Category I non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading; and Category II non-friable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected during demolition operations.

Asbestos removal can account for a significant portion of the total demolition costs. In many cities, the cost of asbestos removal prohibits timely demolitions and results in substandard structures which become fire and safety hazards, attract criminal activity, and lower property values.

For structures that are structurally unsound and in imminent danger of collapse, the Asbestos NESHAP requires that the portion of the structure which contains RACM must be kept adequately wet during demolition and during handling and loading of debris for transport to a disposal site. No other engineering controls are required.

This Alternative Asbestos Control Method (AACM) was developed by EPA as an alternative work practice to the Asbestos NESHAP, where certain RACM are removed prior to demolition and other RACM are left in place.

The goal is to provide significant cost savings while achieving an equal or better standard of protection of human health and the environment. This method is much more restrictive than the Asbestos NESHAP requirements for buildings in imminent danger of collapse.

2.0 Applicability

This Alternative Asbestos Control Method applies to any structure subject to the Asbestos NESHAP regulation (i.e., structures that meet the definition of facility under the Asbestos NESHAP), except as noted below.

The size of structures which can be demolished using this method is limited to three stories or less (maximum height of 35 feet). This allows adequate wetting of both the interior and exterior of the structures and is within the working reach of both the wetting and the demolition equipment.

3.0 Building Inspection/Asbestos Assessment

A comprehensive inspection of the interior and exterior of the structure to be demolished shall be conducted in accordance with EPA's Asbestos Hazard Emergency Response Act (AHERA, 40 CFR Part 763). Specific criteria for inspection, sampling, and assessment are in Subpart E (763.85, 763.86, and 763.88, respectively). The inspection shall be performed by an accredited asbestos building inspector.

4.0 Asbestos Removal

Table 1 summarizes the ACM that may be present in buildings and whether or not the ACM must be removed prior to demolition.

All thermal system insulation (TSI) and spray-applied fireproofing shall be removed due to the inability to adequately wet these materials during demolition. Fire curtains may be removed if it is easier to do so than to adequately wet and handle this heavy material.

Vermiculite insulation, if present, shall be removed prior to demolition as an RACM, regardless of the measured asbestos concentration.

All asbestos removal operations shall be performed in accordance with state and federal law by a licensed asbestos abatement contractor.

5.0 Demolition Practices

Several demolition work practice standards shall be employed to ensure that the method is protective of human health and the environment. These standards involve the equipment used, the wetting process, the demolition process, and visible emissions.

Demolition contractors shall provide an Asbestos NESHAP-trained individual to oversee the demolition process.

5.1 Equipment Used

Track hoes and end loaders or equivalent shall be used during demolition to minimize the generation of dust. No bulldozers, explosives, or burning will be permitted.

5.2 Wetting Process

Structures to be demolished will be thoroughly and adequately wetted with amended water (water to which a surfactant has been added) prior to demolition, during demolition, and during debris handling and loading. Surfactants reduce the surface tension of the water, increasing its ability to penetrate the ACM.

For this method, the Asbestos NESHAP definition for "adequately wet" will be used. That is, "sufficiently mix or penetrate with liquid to prevent the release of particulates. If visible emissions are observed coming from the asbestos-containing material (ACM), then that material has not been adequately wetted. However, the absence of visible emission is not sufficient evidence of being adequately wet." The demolition contractor's Asbestos NESHAP-trained individual will verify that ACM is adequately wetted.

Amended water shall be applied with a minimum of two hoses. The amended water shall be delivered as a mist. Direct high-pressure water impact of RACM is prohibited. There must be visible foam forming at the impact of the spray and the structure.

The wetting process consists of three stages. In each stage, both interior and exterior wetting of the structure shall be performed. To the extent feasible, cavity areas and interstitial wall spaces shall be wetted during each of the wetting stages.

Table 1. Asbestos Removal Requirements of AACM

Asbestos-Containing Material	Removed Prior to Demolition?
Thermal System Insulation (TSI)	
▪ Tank insulation	Yes
▪ Pipe insulation	Yes
▪ Elbow/fitting/valve insulation	Yes
▪ Boiler insulation	Yes
▪ Duct insulation	Yes
▪ Cement and patching compound	Yes
Surfacing Material	
▪ Asbestos-impregnated plaster, stucco	No
▪ Spray-applied fireproofing	Yes
▪ Spray-applied surface coatings (popcorn ceiling, vermiculite treatments)	No
▪ Spray applied acoustical or decorative surfacing	No
▪ Troweled-on crows foot texture, splatter texture, and joint compound.	No
▪ Spray-applied surface coatings crows foot texture, splatter texture, etc.	No
Miscellaneous Material	
▪ Mastic for flooring	No
▪ Window Caulking	No
▪ Fire curtains in auditoriums	Optional
▪ Fire doors	Optional
▪ Vibration-dampening cloths	No
▪ Asbestos-cement tiles, sheets, roofing, shingles, and transite	No
▪ Asbestos-impregnated roofing cement and asphalt roofing	No
▪ Shingles	No
▪ Linoleum or other floor tile	No
▪ Roll flooring	No
▪ Ceiling tile	No
▪ Asbestos-impregnated pipe	No
▪ Vermiculite insulation	Yes

On the day before the demolition, access openings shall be made into the attic spaces from the exterior. The structure shall be first pre-wet (until adequately wet) from the interior and then from the constructed exterior attic access openings to enhance water retention and maximize wetting effectiveness.

This pre-wetting shall prohibit further access into the structure, because of safety concerns. The structure shall be re-wet (until adequately wet) from the exterior through the windows, doors, and attic access openings on the day of demolition prior to demolition. Finally, wetting (until adequately wet) shall be done during the demolition and during loading of debris into lined disposal containers.

5.3 Demolition Process

The demolition contractor shall minimize breakage of asbestos-containing materials. All demolition shall be completed in a timely manner that will allow the debris generated during that day to be completely removed from the demolition site for disposal.

5.4 Visible Emissions

The Asbestos NESHAP standard of "no visible emissions" shall be employed. Visible emissions mean any emissions, which are visually detectable without the aid of instruments, coming from RACM or asbestos-containing material. This does not include condensed, uncombined water vapor. The demolition contractor's NESHAP-trained individual shall verify the absence of visible emissions and has the authority to stop work if visible emissions are observed.

During a demolition, it is often not possible to distinguish visible emissions from ACM and those from construction debris; therefore, should a visible emission be observed, the demolition effort shall pause until the deficiencies in the application of the wetting controls eliminate the visible emission.

6.0 Weather Restrictions

Demolition activities shall be delayed/halted in the case of any inclement weather that will impede the demolition contractor's ability to adequately wet the structure (e.g., freezing temperatures).

In addition, if visible dusting is observed in the vicinity of the demolition site, the demolition shall be delayed/halted.

7.0 Monitoring Requirements

Demolition contractors are required to comply with all applicable OSHA (29 CFR 1926) regulations for worker protection during asbestos removal and demolition activities. This includes the use of personal protective equipment (PPE) such as Tyvek suits or equivalent, respirators (as necessary), and gloves (as necessary); and personal monitoring.

Because, like the Asbestos NESHAP, this method is designed to be a work practice standard, monitoring of air (other than that mandated by OSHA statute), soil, and other media is not required.

8.0 Waste Handling

Several wastes are generated during demolition activities, including demolition debris, disposable PPE, and potentially contaminated water and soil, and must be properly disposed. All wastes generated must be removed from the site at the end of the day and transported to an appropriate disposal facility. Transport and disposal shall be in accordance with all federal, state, and local requirements. All waste haulers shall be leak-proof. Double-lining of the haulers with 4-mil or thicker polyethylene film and then sealing the top seams of the film is a suggested mechanism, but the contractor must do what is required to prevent leaks from the transport vehicles. Vehicles shall be decontaminated within the bermed area before leaving the demolition area.

8.1 Demolition Debris

Segregation of portions of a structure that may contain RACM from portions of a structure that clearly do not contain RACM shall be done when practical in an effort to minimize RACM debris. For example, segregation may be used if a large warehouse is being demolished and only a small portion (e.g., office space) contains RACM.

When segregation is not practical, all demolition debris shall be disposed as RACM in a licensed asbestos disposal facility. Debris shall be kept adequately wet during loading into containers. Containers shall be covered during transport.

8.2 PPE

All disposable PPE shall be disposed as RACM. Reusable PPE shall be decontaminated in accordance with OSHA standard practices.

8.3 Potentially Contaminated Water and Impervious Surfaces

No potentially contaminated water runoff is permitted from the site during the demolition period. All impervious surfaces will be thoroughly washed with water (not amended) before site closure.

Construction site best management practices shall be used to prevent water runoff. Drains and sewer connections must be capped or plugged prior to wetting. Berms and/or trenches must be created as necessary to prevent runoff of water from the demolition site. If possible, the bermed/trenched area should extend 25 ft from the building and/or loading area. If not possible, adjacent areas and structures need to be covered with plastic.

The berm/trench must be sufficiently spaced from the building to permit the movement of the demolition equipment and to allow the truck loading to occur within the enclosed space. All plastic shall be disposed as RACM.

If large water volume use or impermeable conditions surrounding the building create excessive water volume and simple containment and percolation is not feasible, the water must be pumped and either disposed as ACM or filtered through a series of filters ultimately removing all fibers equal to or larger than five microns before transporting to a publicly-owned treatment works or discharging to a sanitary sewer. The filters must be disposed as RACM.

8.4 Potentially Contaminated Soil

Following the removal of demolition debris, bare soil within the bermed area shall be excavated to a minimum depth of three inches or until no debris is found. Berms created shall also be removed and disposed as potentially asbestos-contaminated. All removed soil shall be disposed as RACM.

9.0 Site Closure

Following demolition and waste disposal, all waste and debris must be gone from the site and the site must be secured so as not to create a safety hazard.