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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
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Seattle, Washington 98101

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Reply To
Attn Of: OOO

July 31, 2003

MEMORANDUM

TO: Dulcy Berry, Project Manager, PBS Environmental

FROM: Dan Heister, Office of Environmental Cleanup, Oregon Operations Office

CC: Dr. D. Wayne Berman, Aeolus Inc.
Dr. Aparna Koppikar, National Center for Environmental Assessment

SUBJECT: North Ridge Estates Site, Klamath Falls, Oregon
Final Sampling and Analysis Plan For a Fast-Track Sampling Program (July 25, 2003)

Overview

Consistent with the AOC (paragraph 29) EPA has disapproved the sampling and analysis plan (SAP) referenced above (dated 7/25/2003). Also per the AOC (paragraph 29) EPA has exercised its authority to modify the SAP. Those modifications are reflected in the attached SAP (in bold). Because of the numerous edits it will be necessary for you to ensure that the change are consistently reflected throughout the entire document. Much of this has been done already, however some additional tightening will be required. Please returned the final SAP to me no later then 8:00 AM (PST) on Tuesday August 5, 2003. As a reminder, failure to complete activities and products within the scheduled time frames listed in the AOC are subject to the assessment of stipulated penalties outlined in the AOC.

Below please find a summary of EPA edits to the above-referenced document. In general, the approach described is expanded from the earlier June version of this plan; however, a few items remain which require additional evaluation. Although this work is being performed in support of the initial sampling effort at the site, the extent to which these data support future risk assessment activities should be maximized. While the approach described continues to focus on statistical power of the results, the bottom line for EPA is that residents currently live on site and have potential exposures to asbestos from ACM or from soil, dust, or air. Data that is collected from individual residences should be used to assess risk to those individuals living within the respective residences. This work can be in addition to the pooling of data needed to draw statistically meaningful conclusions about the nature of the material and potential risk on the site as a whole. For the purposes of the removal action the residence by residence information will take priority.

The elutriator method has not been formally approved by EPA; therefore, twenty percent of the samples

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will be randomly analyzed by an alternate method (likely the Region 10 glove box method).

Also, EPA would like to receive splits of each sample collected using the elutriator method so that a subset of these could be analyzed for QA/QC purposes and so that alternate analytical methods can be used for comparison with identification of "protocol" structures.

Specific comments on the document and suggestions for improving the document are provided below. Please contact me if you need additional clarification on these comments.

Specific Comments

Page 1, Item 4: Residents expressed interest in knowing concentrations of asbestos fibers in household dust as these represent a potential "sink" that may be indicative of longer term exposure than 24 hours of air sampling. EPA is requiring the collection of dust samples inside all residences - this approach is consistent with sampling techniques used at other asbestos sites - regardless of the outcome of Tasks 1 and 2.

Page 3, Section 1.1.2: The questions (1, 2, and 3) was reworded to indicate current versus future risk. Although some of the ACM that is not weathered may be shown to not pose a risk under current conditions, this material could undergo a weathering process that has been observed at some locations on site. Prevention of future releases should occur to the extent possible. As written, the only factor these questions consider is the presence of ACM in soil. The paragraph following these questions acknowledge that weathered material presents a worst-case scenario; EPA incorporated this concept into the questions themselves.

Page 4, first bullet: Although a dust model was verified for a study of fiber emissions from roads, a model has not been developed or verified for a site similar to this site. This emphasizes the importance of collecting additional data to verify the models and assumptions proposed for this project. EPA is therefore requiring the collection of this additional verification data.

Page 5, Section 1.1.3.1: References to access occurred in the past. References to dates that have occurred were updated.

Page 10, Section 1.1.3.1.4: Based on comments received from EPA headquarters, splits of soil samples should be provided to EPA so that an independent determination of the presence of asbestos in soil can be made using an alternate technique. As stated in the introduction of this memo, the elutriator method has not yet been approved by EPA so we will be requiring twenty percent of randomly selected splits be run by an alternate method.

Page 13, Section 1.1.3.1.5: Splits of all samples collected from the elutriator should be provided to EPA. These samples could be run as QA samples or will be archived for later analysis if the target size for fibers for the new slope factor varies from the "protocol" structure measurements reported by Dr. Berman. EPA is requiring that all structures be counted. If counts are conducted carefully and according to procedures similar will not cost more than counting "protocol" structures.

Page 16, Section 1.2.2: Similar to the concern stated in the introduction, EPA is interested in evaluating air concentrations of asbestos fibers at each residence individually. EPA is therefore requiring the data be generated for the individual residences first and "pooling" of data occur second. The individual residence information may be needed to support removal actions at the site or to focus future investigative efforts. Also, the individual residents living at the site are very interested in knowing what their exposures may be ("Is my air safe?"), not what the average exposure to the average person is at the site.

Page 19, 1.2.3: Indoor air sampling will not be done under direct observation, but rather through a resident maintained activity log and a PBS equipment check conducted at two hour intervals during the sampling events.

Page 19 Section 1.2.3.1: As a follow up to the previous comment, pooling data may provide statistical power to draw conclusions about contaminant distributions at the site, but pooling data does not address the individual resident's concerns about asbestos levels within their homes. Data will be reported on a residence by residence basis first before any pooling analysis can occur.

Page 20, Section 1.2.3.2: The samplers will be placed within 30 meters in a direction crosswind from each house... All outdoor sampler locations will be approved by the EPA OSC prior to sampling.

Page 22, Section 1.2.3.5: Please expand the dimensional criteria to fibers to include all structures. Page 13 states that PCME will be counted for samples collected from the elutriator. A consistent approach should be used for air samples. EPA will collect splits from a minimum of 20% of all houses for QA/QC purposes.

Page 23, 1.3.1: Soil samples will be taken at all suspected "Burial Pit" locations.

Page 26, Section 1.3.2.5: Please expand the dimensional criteria to fibers to include all structures. Page 13 states that PCME will be counted for samples collected from the elutriator. A consistent approach should be used for air samples. EPA will collect splits from a minimum of 20% of all houses for QA/QC purposes.

Page 26-27, Section 1.4: EPA is requiring that a protocol for indoor dust be developed as soon as possible and that all residences be sampled and analyzed.

Page 28, Section 2.2.1: EPA is requiring splits of every sample collected from the elutriator. Dr. Berman explained that an additional air sample could be collected from each soil sample tumbled in the elutriator. These samples would serve QA/QC purposes and provide EPA with an archive for the site.

Page 29, Section 2.2.2: EPA will collect field duplicates at a minimum of 20% of homes to verify results reported by the RP's laboratory. Because of the importance of this site and the presence of actual residents on the site, EPA might consider collecting field duplicates of air samples at every home.

Additonal Requirements

Dr. Berman will develop a sampling protocol for collecting composite samples near the immediate residence. EPA and its contractor will collect and analyze the samples for each of the residences.

Soil samples will be collected from all residences, suspected burial piles/pits and at locations with high concentrations of ACM on the surface. Lateral and vertical delineation of these areas of interest will be conducted by collecting subsurface soil samples at regular intervals to fully delineate.

At the OSC's discretion indoor and outdoor air samples may be collected at several residences during simulation of typical outdoor activities such as, lawn mowing, weed whacking, and roto-tilling. Indoor activities will include vacuuming, dusting, and sweeping floors.

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SAMPLING AND ANALYSIS PLAN
FOR A FAST-TRACK SAMPLING PROGRAM
AT THE NORTH RIDGE ESTATES SITE,
KLAMATH FALLS, OREGON

D. Wayne Berman, Ph.D.
August 1, 2003

This Sampling and Analysis Plan (SAP) was developed in fulfillment of the requirements for Task 6A of the Statement of Work (SOW) under the Administrative Order on Consent (AOC) between the U.S. Environmental Protection Agency (EPA) and the MBK partnership (MBK) in response to the presence of asbestos containing materials (ACM) in soils at the North Ridge Estates Site. It describes work to be performed for a fast-track investigation to rapidly address questions concerning the range of hazards potentially posed by the asbestos observed at the Site

Under this SAP, site soils in the vicinity of occupied residences will first be sampled to evaluate the degree to which ACM may have weathered and released asbestos into the surrounding soil matrix and to provide an indication of the degree of risk potentially posed by the presence of ACM (and any asbestos that may have been liberated from the ACM). Subject to the analytical results from these initial samples, additional sampling may potentially be conducted to provide an indication of the depth and/or spatial distribution of ACM and free asbestos in soils and the degree with which asbestos in soils may become airborne. Separately, the degree with which asbestos may be affecting environments in the homes of residents on site will also be evaluated. ? ? ☆

To accomplish the above-stated objectives, work proposed under this SAP is divided into two initial tasks and two followup tasks:

Initial Tasks

(1) collect and analyze surficial soils and soils from selected ACM debris piles under existing conditions (i.e. prior to planned debris removal at locations to be sampled);

(2) collect and analyze indoor/outdoor air samples;

(3) survey soils spatially and at depth; and/or ? why the or? ⇒ a survey should also be done regardless of 1 or 2

(4) collect and analyze household dust.

EPA is requiring the collection of dust samples inside all residences - this approach is consistent with sampling techniques used at other asbestos sites - regardless of the outcome of Tasks 1 and 2.

This SAP includes both a field investigation plan (FIP) and a quality assurance project plan (QAPP) for the proposed work. These are described separately below. References, figures, and tables are also provided in later sections

1 FIELD INVESTIGATION PLAN

As indicated above, the field investigation plan is divided into two initial tasks (Tasks 1 and 2) and two, potential, followup tasks (Tasks 3 and 4), which are separately described below

1.1 Initial Task 1: Collect and Analyze Surficial Soils and Soils from Selected

ACM Debris Piles Under Existing Conditions

1.1.1 Purpose

Under this task, samples will be collected and analyzed to evaluate the degree to which asbestos containing material (ACM) may have weathered and released asbestos into the surrounding soil matrix and to provide a preliminary indication of the degree of risk potentially posed by the presence of ACM (and any asbestos that may have been liberated from the ACM) in local soils.

The question of whether the soil matrix within which ACM is embedded poses a health hazard that is separate from (and in addition to) any potential threat that may be posed by the ACM itself is a critical question that needs to be answered early in this project. This information will be used to design required later stages of the investigation and/or strategies for any remediation that may be required.

If potentially hazardous concentrations of asbestos are observed in soils, the data developed in this task will also be used to evaluate the relationship between asbestos concentrations in soil, asbestos concentrations in any embedded ACM, and the mass of ACM that is present.

The purpose for sampling under this task is focused to address the above-described objectives. Questions concerning the detailed distribution of asbestos concentrations over the site may be addressed by later work, as appropriate. The need to gather such information either to support risk assessment or to support defined risk-management decisions for the site will be evaluated based on the data derived under this task and Task 2 (Described below).

1.1.2 Questions and their associated decision rules

(1) Have asbestos structures been released from ACM into surrounding soils in sufficient concentrations to pose an unacceptable risk **at present AND in the future** (independent of the risk potentially posed by the presence of the ACM itself)?

(2) Does the presence of ACM itself pose a potentially unacceptable risk **at present AND in the future**?

(3) If substantial concentrations of asbestos structures have been released into surrounding soils, what is the nature of the relationship that links asbestos concentrations in soils with asbestos concentrations in the embedded ACM and the mass of the ACM?

These questions (1, 2, and 3) were reworded to indicate current versus future risk. Although some of the ACM that is not weathered may be shown to not pose a risk under current conditions, this material could undergo a weathering process that has been observed at some locations on site. Prevention of future releases should occur to the extent possible. As written, the only factor these questions consider is the presence of ACM in soil.

Regarding the first of the above, if "worst case" soil samples (i.e. soil samples collected in the immediate vicinity of highly concentrated, heavily weathered ACM) are shown not to contain sufficient concentrations of asbestos to pose unacceptable hazards themselves, then future site activities can be focused exclusively on the ACM at the site. If potentially hazardous concentrations are identified in worst case samples, then future work at the site should be focused on establishing the conditions (and locations) under which unacceptable concentrations may exist. Thus, Question No. 3 (above) may need to be addressed and/or some modified form of Task 3 may need to be conducted.

If average case soil samples (i.e. soil samples collected from surficial composites averaged over large areas of the site) show that soil concentrations pose an unacceptable risk, independent of contributions from any embedded ACM, than future site activities need not distinguish between ACM and the soils within which it is embedded. Moreover, some modified form of Task 3 may need to be conducted. It is not clear, under such circumstances whether addressing Question No. 3 (above) will be helpful.

Regarding the second question, if the product of asbestos concentrations estimated from "worst case" ACM samples and the highest mass concentrations of such ACM observed on site are shown not to represent sufficient concentrations of asbestos to pose an unacceptable risk, than further evaluation of ACM in site soils may not be required, at least as a current risk (rather than a potential, future risk). Moreover, if potentially unacceptable asbestos concentrations are not found in either soils or ACM, other than completing Task 2 (and any additional work that might potentially be suggested based on the results of Task 2), it may not be necessary to further evaluate either ACM or asbestos in soils at the site.

If potentially unacceptable concentrations of asbestos are found in "worst case" ACM soils, than future site work should be focused on establishing and/or addressing the locations and conditions under which potentially unacceptable accumulations of ACM may exist at the site. Whether such an investigation or work should focus specifically or exclusively on ACM or whether it should be focused on the soils within which the ACM is found depends on the answers obtained for Question No. 1.

Regarding Question No. 3, if potentially hazardous concentrations of asbestos in soils are found in "worst case" samples, the results from these samples will be combined with results from the best case samples evaluate the relationship between asbestos concentrations in soils, asbestos concentrations in the embedded ACM, and the mass concentration of the ACM that is present. Such a relationship can then be used to help identify locations and conditions under which potentially unacceptable concentrations of asbestos may exist in soils. For example, if such concentrations can be shown to be a function of the mass concentration of ACM in the soil and field personal can be trained to provide reasonable, visual estimates of such concentrations, this would lead to a quick method for field screening to be used in future work at the site.

To determine whether observed asbestos concentrations in soils or ACM pose a potential risk, the associated risks will be estimated for the concentrations of interest by

---Julie—Please list the type of verification data you'd like added.-----
Although a dust model was verified for a study of fiber emissions from roads, a model has not been developed or verified for a site similar to this site. This emphasizes the importance of collecting additional data to verify the models and assumptions proposed for this project. EPA is therefore requiring the collection of this additional verification data.

- modeling emissions and dispersion from soils and/or ACM using published emission models appropriate for each exposure pathway of interest and coupling them with demonstratably conservative , simple dispersion models (either simple box models for personal exposures, or the simple Gaussian dispersion model of Turner (1970) for more distant exposure. Note that exposure pathways of interest that lack associated, published models will be evaluated by adapting models for similar pathways in a demonstratably conservative manner Note that this is the same general approach used in an earlier study in which measured and modeled exposure concentrations exhibited reasonable agreement (Berman 2000);and

- converting the resulting airborne exposure concentration estimates to risk estimates using the procedures described in Berman and Crump (2001). Risks will also be estimated

using the unit risk factor and procedures defined in IRIS (1988). Risk estimates will be adjusted from lifetime, continuous exposure to the duration and frequency of exposure that is appropriate for each exposure pathway to be addressed.

It is anticipated that each of the outdoor pathways listed in the HHRA work plan for this site will be evaluated to determine the greatest contributor to risk that is relevant to each kind of location from which samples are collected and decisions concerning the acceptability of risks associated with the concentrations observed will be based on the greatest contributing pathway. Note that pathways involving indoor exposures are being separately addressed (Task 2).

1.1.1 Sampling Plan Design

Sampling under this task is divided into separate sampling efforts: surficial sampling and selected ACM debris pile sampling.

1.1.1.1 Surficial sampling

The area designated for collecting surficial samples under this task is an area of the North Ridge Estates Site that has been historically identified as containing ACM in soils. The shaded area indicated in Figure 1 is the area designated for sampling.

1.1.1.1.1 **Estimating the number of samples.** As indicated in Section 1.1.2.2, existing conditions are to be characterized by collecting and analyzing a series of composite samples. The minimum number of samples that will need to be collected to adequately characterize the area is estimated based on the data quality objectives (DQO) process, as summarized briefly below.

As described in Section 1.1.1 above, among the stated purposes for sampling is to provide a preliminary indication of the degree of risk posed by the presence of asbestos in the soils to be sampled. This is typically accomplished by comparing an estimate of the mean concentration measured in the matrix of interest (typically the 95% upper confidence limit to the mean – the UCL95) to a target criterion representing the maximum acceptable concentration. In turn, the target criterion will typically be derived by modeling that links measured concentrations in soils to airborne exposure concentrations, which can then be related to risk. Details of the manner in which such modeling is to be conducted will be provided at a later date and is not needed for the process described below for estimating the number of samples to be collected.

Given that a decision concerning the degree of risk will be rendered by comparing an estimate of the mean concentration to a target criterion, the appropriate data quality objectives for this decision rule are defined in terms of acceptable error rates for the decision. The data quality objectives thus proposed are:

(4) that there will be less than a 5% chance that the mean concentration of composite samples will be falsely determined to be less than a target criterion (to be defined by modeling exposure and risk)[1]; and

(5) that there will be no more than a 10% chance of falsely determining that the mean concentration is greater than the target criterion whenever the true mean concentration is less than or equal to one tenth of the target criterion[2].

(1)

The number of samples required to satisfy the above objectives can now be defined by specifying several assumptions concerning the nature of variation expected to be observed among the samples collected and construction of power curves that correspond to the above-stated decision rule and stated assumptions.

It is assumed that the variation in measured concentrations across composite samples will be lognormally distributed[3]. Because the site is to be characterized by constructing a series of composites from a large number (8 to 12) of component samples (see Section1.1 2.2), it is anticipated that the composite samples to be generated during this sampling event will be relatively homogeneous. Therefore, it is further assumed that the coefficient of variation observed across the composites to be generated will be less than one.

A set of power curves appropriate for the above stated decision rule and corresponding assumptions is presented in Figure 2. Visual inspection of Figure 2 indicates that (as long as the observed variation in samples is no worse than assumed), collection of approximately seven samples should be adequate for achieving the stated data quality objectives. Note that seven samples reflects the minimum number that need to be collected to satisfy stated objectives. Collecting a larger number of samples will further improve the power of anticipated decisions.

1.1.1.1.1 Selection of sampling locations. To assure that the designated area is sampled in an unbiased manner while assuring that the entire area is adequately represented, locations for collecting samples will be defined based on a stratified-random sampling scheme. One procedure for designing such a scheme is illustrated in Figure 3 and this scheme may be adopted. However, field conditions may suggest alternate schemes for defining a sampling array and, as long as a similar algorithm to that described below is applied, the requirements for stratified-random sampling will be satisfied.

For the scheme illustrated in Figure 3, the irregular shape of the designated sampling area is divided into 120 equal-area squares. These squares are then grouped into 10 sets of 12. Each of the groupings is outlined in heavy line in Figure 3 and is assigned a number (from one to 10). Note that the groupings are arbitrary, although an attempt was made to keep each grouping as compact (i.e. as close to square in shape) as possible. However, because each grouping is composed of 12 grid squares, each grouping extends over the same area.

To satisfy the requirements for stratified-random sampling, it is assumed that one composite will be generated from each of the 10 groupings identified in Figure 3. Further, each composite will be constructed from 12 component samples with one such component to be collected from each of the 12 grid squares comprising that grouping. The location from which each component sample should be collected should be chosen randomly from within its designated grid square, with the following, additional constraints:

(6) samples are to be collected only from within the shaded area of Figure 3. If random selection of a location from within a grid square that lies at the boundary of the shading falls outside of the shading, the location is to be re-selected so that it falls within the shaded area. Importantly if locations need to be re-selected for this reason, such re-selection shall be noted in the log book; and

(7) if sampled locations fall within roadways, over large rocks, or other solid objects that cannot easily be sampled using the procedure described in Section 1.1.2.3, the sampling location within that particular grid square will be re-selected to move its location to an area covered by material that can be conveniently sampled. If locations need to be re-selected for this reason, such re-selection shall be noted in the log book.

(1)

1.1.1.1.1 Sample collection procedures. One sample is to be collected from each of a set of locations selected using a stratified-random sampling scheme in a manner similar to that described in Section 1.1.2.2. Procedures to be used for establishing sampling locations in the field and for collecting samples from each such location are defined below.

Establishing field locations for sampling. The grid to be used to identify sampling locations will first be established by selecting one or more reference points that will be positioned using GPS equipment. The rest of the vertices of the grid will then be established by direct measurement from the reference points established.

The location to be sampled within a particular grid square will be determined expeditiously in the field by the sampling technician, attempting to randomize the locations from grid to grid and avoiding bias based on the presence of pavement, large rocks, and other impervious surfaces.

Each grid square will be assigned a unique number, which will be recorded in the logbook along with the GPS location of each sampling point within that grid square. Sampling locations will also be identified on the digital site map to be created under Task 7A of the SOW to the AOC.

Note that the locations of houses, driveways, roadways, other land improvements, known landfills, and natural features of note will also be located using GPS equipment and will also be identified on the digital site map to be created under task 7A of the SOW to the AOC.

Each sample to be collected will be labeled with a unique number that will include the number of the grid square from which it is collected (xxx) and the date the sample is collected (mm-dd-yy) coded as follows: xxx--mmddyy. Note that, under this task, these samples represent components of composites that will be generated by combining multiple components and composites will also be labeled and coded uniquely (see Section 1.1.2.4).

Procedures for sample collection. Samples are to be collected per the procedures described in Chapter 8 of the *Superfund Method for the Determination of Releasable Asbestos in Soils and Bulk Materials* (Berman and Kolk 1997) with the following modifications.

Sample collection. A template with an 8-inch square opening will be placed on the ground with the center at a selected sampling location. The soil will be misted with water as necessary during the sample collection process to control dust. A trowel will be used to dig-out and collect material within the template to a depth of 1 inch. Sampled material will be placed in a clean, sealable plastic bag, and the bag labeled with the sample location identifying number. Component samples for each specific composite will be placed together in a labeled, plastic bucket and will be stored in a secured location onsite (tentatively in the warehouse building), for later preparation and analysis (see Sections 1.1.2.4 and 1.1.2.5 below).

Note that, given the above procedure, it is estimated that the mass of material collected for component samples from each location will be approximately 2.2 Kg. Thus (given the stratified scheme proposed above) the mass of each composite sample to be generated for each selected grid grouping will total approximately 26 Kg (12 x 2.2).
Importantly: the amount of water to be added during misting will be strictly controlled so as to avoid creating a need to dry the samples prior to preparation (as described in Section 1.1.2.4).

Decontamination of field equipment. Prior to use in the field, all sampling equipment (e.g. trowels and templates) will be decontaminated by washing with biodegradable soap, rinsing with asbestos-free water, and drying either with asbestos-free cloth rag or forced air. If forced air is

used, it must be HEPA filtered to assure that it remains asbestos-free. Sampling equipment will be similarly decontaminated prior to removing it from the site.

Between collection of individual soil samples, sampling equipment may be wiped clean with a clean, asbestos-free cloth rag.

Wash and rinse water will be collected and containerized, and handled with the contractor's decontamination unit wastewater. Any disposable materials used for decontamination (e.g. rags) will be disposed with ACM waste.

Chain-of-Custody. The Project Coordinator's representative will manage sample handling, transport and storage with appropriate Chain-of-Custody documentation.

Documentation. The following information will be recorded for each soil sample collected under this task:

- the sample identifier (including the grid square number and the date that the sample was collected);
- the time that the sample was collected;
- the GPS location of the sample;
- any required modifications to the location initially selected for sample collection along with the reasons (i.e. the nature of any field obstructions or an indication that the location initially selected falls outside of the shaded area designated for sample collection in Figure 1) for needing such modification;
- any changes or modifications required to the above-indicated procedures for sample collection;
- relevant observations concerning the condition (presence of vegetation, color and condition of soil, relative apparent moisture content, etc.) of the location from which the sample is collected (to be supplemented with photographs);
- documentation of any ACM (size, nature, color, type, etc.) observed at the sample location; and
- any other, potentially relevant information concerning the conditions under which the sample is collected.
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1.1.1.1.1 **Sample Preparation Procedures**. Samples are to be field prepared, labeled, and shipped to the laboratory per the procedures described in Chapter 8 of the Superfund Method (Berman and Kolk 1997) incorporating the modifications described below. Sample preparation will be conducted outside, on the west side of the warehouse on the concrete pad.

The set of component samples collected and stored as described in Section 1.1.3.1.3 will first be grouped per the map of composites presented in Figure 4 to create groups that will be combined to create 10 composite samples. Component samples in each group will be prepared together. Samples are to be combined and prepared per the procedures described below.

Splits of soil samples will be provided to EPA so that an independent determination of the presence of asbestos in soil can be made using an alternate technique. The elutriator method has not yet been approved by EPA so we will require twenty percent of randomly selected splits be run by an alternate method.

Field preparation. Component samples in a particular group will each be weighed (per Section 8.2.1 of Berman and Kolk 1997) and they will then be combined in a common, clean, pre-weighed bucket. The material will then be homogenized and split per Section 8.2.3 of Berman and Kolk (1997) or some other procedure that is suitable for homogenizing and splitting approximately 20 kg of material. For example, samples may be mixed by adequately tumbling in a sealed, heavy plastic bag and may then be split by coning and halving (as opposed to quartering). Importantly, whatever procedure is selected for splitting, it must *not* be size selective.

Two equal splits will be created from the above-described procedures and each will contain half of the mass of each composite. Identifiers will be assigned to each such split (as described below) and the weights of each split will be recorded. One such split will then be labeled (as described below), sealed, and stored in a secure location for later use, if needed. The second split of each composite will be processed as follows.

The ACM in the material from the second split (down to the smallest visible piece) will be separated from the soil by some combination of sieving and physical removal during inspection of small quantities of the soil that are spread out on a clean, flat surface. Ultimately, the separated ACM and soil will each be placed in their own clean, pre-weighed buckets, will be separately weighed, and their weights recorded in the log book for the particular grouping/composite/split identifier.

The ACM-free soil obtained from the above procedure will then be sieved into a separate coarse fraction (of material greater than 3/8ths inch or approximately 1 cm in diameter) and fine fraction (of material less than 3/8th in) per Section 8.2.2 of Berman and Kolk (1997). After recording its weight, the coarse fraction will then be stored for later disposal (in the manner described below). The fine fraction will be homogenized and split per Section 8.2.3 of Berman and Kolk (1997) to produce four equivalent splits of 50 to 70 g each. After recording the identifying numbers (assigned as indicated below) and weights for each split, two of the splits will be labeled and packaged for shipment to a laboratory for asbestos analysis per Berman and Kolk (2000). A third split will be labeled and packaged for shipment to a laboratory for the determination of silt content. The fourth split will be labeled and stored for later use, if necessary. Excess soil will be stored for later disposal in the manner described below.

The ACM separated from each sample in the manner described above will be visually characterized and documented in the log book and will then be processed as follows. The ACM (separated into convenient sized fractions) will be sealed in clean, clear plastic bags (double bagged) with as much of the air removed from each bag as reasonably possible. The material will then be crushed with a rubber mallet and/or rolling pin until the majority of the pieces are sufficiently small to pass through a 3/8ths in (1 cm) sieve. Excessive crushing will be avoided. Note that any fibrous bundles of material may need to be manually manipulated to produce sufficiently small bundles to pas through the sieve.

Once crushed, the ACM will be sieved per Section 8.2.2 of Berman and Kolk (1997) and homogenized and split (per Section 8.2.3) to produce four equivalent splits of 50 to 70 g each. After recording the identifying numbers (assigned as indicated below) and weights for each split, two of the splits will be labeled and packaged for shipment to a laboratory for asbestos analysis per Berman and Kolk (2000). The remaining two splits will be labeled and stored for later use, if necessary. Excess material will be stored and disposed as indicated below.

Assigning sample identifiers and labeling. For initial splits of samples prepared using the above-described procedures, each split will be identified using the following code: xx-mm-dd-yy-q with xx representing the grouping/composite number from which the material derives, mm-dd-yy indicating the date that the sample was prepared, and q being equal to either a or b to distinguish among the two splits that are created.

Splits to be sent to the laboratory that contain either soil or ACM (prepared specially) or a mix of soil and ACM (prepared routinely) will be identified in the logbook using the following code: xx-mm-dd-yy-q-p-r with xx representing the grouping/composite number from which the material derives, mm-dd-yy indicating the date that the sample was prepared, q being equal to either a or b to distinguish among the two splits that are initially created, p indicating whether the sample was prepared specially or routinely and r indicating an identifier for each, unique split.

When samples are labeled for shipment to the laboratory, they should be labeled with a "dummy" identifier (recorded in the log book) that does not provide any information that would allow determination as to the nature of the preparation, the nature of the matrix included, or whether two samples are split from the same composite.

Importantly: the coding scheme to be used for samples prepared as described above will NOT be shared with the laboratory.

Handling and Disposal. Sample material to be delivered to the laboratory will be sealed and maintained with appropriate chain-of-custody for delivery to the laboratory. Soil samples with appropriate chain of custody documentation will be packed into plastic coolers, immobilized with filler, and shipped overnight to the laboratory,

Excess sample material (i.e. ACM, soil, or mixtures of ACM and soil) that is not shipped to the laboratory or stored for possible future analysis, will be stored for appropriate disposal as hazardous ACM.

Decontamination of field equipment. Field equipment used for sample preparation will be handled and decontaminated in precisely the same manner as that described in Section 1.1.2.3 for field sampling equipment.

Documentation. The following information will be recorded for each soil sample collected under this task:

- the sample (group/composite) identifier and weight of each initial split prepared per the special preparation procedure;
- a physical description of any ACM handled during sample preparation;
- a description of the procedures required to crush any ACM prepared for analysis;
- the sample (group/composite) identifier and weight of all coarse and fine fractions separated from any sample;
- the sample (group/composite) identifier and weight of each sample split generated from every sample;
- the "dummy" identifier used for labeling each sample split that is sent to a laboratory;
- documentation of any substantive deviations from the stated procedures in this section

that were required to complete preparation of any of the samples handled;

- the date that each sample was prepared; and
- a description of any potentially relevant observations concerning unusual conditions that develop during sample preparation.
-

1.1.1.1.1 Sample analysis procedures.

Laboratory analysis. Sample splits prepared as described in Section 1.1.3.1.4 and selected for the determination of asbestos will be analyzed per the procedures of the Modified Elutriator Method (Berman and Kolk 2000). With the counting and stopping rules modified to achieve an analytical sensitivity to be determined based on the results of modeling, as described below.

To estimate an appropriate analytical sensitivity for these samples, the models described for assessing risk in Section 1.1.2 will be run backward to establish a conservative estimate of potentially acceptable bulk concentrations (based on a selected, acceptable level of risk). Likely, target concentrations will end up in a range close to 2.0×10^6 structures/g_{PM10}.

The counting rules of the ISO Method 10312 will be used for characterizing and identifying structures. **Splits of all samples collected from the elutriator will be provided to EPA. These samples may be run as QA samples or will be archived for later analysis if the target size for fibers for the new slope factor varies from the "protocol" structure measurements reported by Dr. Berman. EPA is requiring that all structures be counted. If counts are conducted carefull protocol structures, EPA will have PCME as per present EPA requirements, and both will have a complet ------This comment applies to all references to the counting rules for the ISO 10312 Method.-----**

Soil components of these samples will be analyzed first. Soil component samples will be analyzed sequentially by the laboratory and analysis will continue until at least one of the following criteria are satisfied:

- The number of samples analyzed exceeds the number required to satisfy the stated DQO's for these samples, given the observed variability among the samples;
- Sample exhibit concentrations clearly indicating that "averaged" soils contain asbestos at concentrations that potentially represent an unacceptable hazard; or
- The number of samples analyzed is sufficient to support evaluation of the relationship between asbestos concentrations in soils, asbestos concentrations in ACM, and the mass fraction of ACM in soils.
-

Note that, if the variability exhibited by these samples is substantially greater than initially anticipated, there may not be a sufficient number of samples to satisfy the stated DQOs. Under such circumstances, due to the nature of the chosen decision rule, the chance of underestimating risk will not change but the chance of overestimating risk will increase. Thus, health considerations will not be compromised.

As long as the second of the above criteria is not satisfied, the laboratory will then proceed to analyze the ACM components of each sample. The ACM components will be analyzed sequentially until at least one of the following criteria are satisfied

- The number of samples analyzed exceeds the number required to satisfy the stated DQO's for these samples, given the observed variability among the samples and/or
- The number of samples analyzed is sufficient to support evaluation of the relationship between asbestos concentrations in soils, asbestos concentrations in ACM, and the mass fraction of ACM in soils.
-

One duplicate split from each of the differing group/composite materials will also be analyzed for silt content.

Data Management. Results obtained from laboratory reports will be entered into the project database along with relevant information from field logs (such as sample identification numbers, sample locations, etc.).

1.1.1.1 Sampling of Selected ACM Debris Pile Sites

A maximum of 12 samples will be collected from areas of the site where ACM appears to be concentrated and/or due to local conditions may have weathered more extensively than at other locations on the site. Sample locations will be identified by the EPA, OSC and are intended to represent "worst case" locations in terms of both the mass concentration of ACM in contact with soils and the condition and type of ACM that is present.

1.1.1.1.1 Sample Collection Procedure. Samples will be collected from the selected locations in a manner suitable for evaluating the mass of ACM contained within the material sampled while focusing on collection of soils believed to be in reasonably close contact with such ACM. Due to the anticipated variability in conditions among the set of locations likely to be chosen, two candidate procedures for sample collection are described below.

Sample collection procedure for locations in which substantial quantities of soil are mixed within the ACM. At such sites, a square area that is approximately one ft on a side will be identified and marked. All material within this area (soil and ACM) will then be excavated to a depth of between three inches and one half ft. Excavation will continue until a minimum of 1 kg of soil will have been collected in the sample.

Sample collection procedure for locations in which large, solid pieces of ACM debris are buried within or lying over soils with little soil found mixed within the ACM. At such sites, a square that is 18 in on a side will be marked off and the ACM in this area will be removed down to the underlying soil using a sharp object such as a shovel, if necessary, to cut larger ACM pieces. The soil immediately underlying the ACM will then be excavated to a uniform depth of 1 inch and this will serve as the soil component of the sample.

In addition to collecting the soil component of this sample, the entire thin layer of ACM that was originally lying immediately above to the underlying soil will also be collected to represent the ACM component of this sample.

Note that the disadvantage of the second method proposed for sample collection .is that it limits the ability to reasonably estimate the mass concentration of ACM associated with the soil that is

sampled. For such samples, this will be assumed to be between 50 and 90%. So that large error bars will be assigned to these samples when results are used to address Question No. 3 (Section 1.1.2).

1.1.1.1.2 Sample Preparation Procedure. Samples collected from selected ACM debris piles will be prepared for laboratory analysis in the same manner as described for composite samples (Section 1.1.3.1.4), with one modification. Regarding documentation, a detailed description of the nature of the ACM, the condition of the ACM, and the nature of the location being sampled (including such things as the likelihood that such an area may capture and hold moisture) will be entered in the field log book accompanied by adequate photographic documentation.

1.1.1.1.3 Sample Analysis Procedure. Samples collected from selected ACM debris piles will be analyzed in the same manner as described for composite samples (Section 1.1.3.1.5)

1.2 .Initial Task 2: Collect and Analyze Indoor/Outdoor Air Samples

Air sampling will be conducted to evaluate the potential for asbestos from ACM in site soils to be released and either diffuse or be tracked into site homes where it might be re-suspended and inhaled by residents.

1.2.1 Purpose

Due to the complexity of the relationship between asbestos in outside soils and indoor air and the factors that contribute to substantial variability in indoor air concentrations, the work proposed under this task is intended to provide a preliminary indication of any risk potentially posed to site residents who might inhale asbestos in their homes and, if elevated levels of airborne asbestos are detected, a preliminary indication of whether such asbestos may be associated with the presence of ACM in local soils.

Questions concerning the detailed distribution of asbestos concentrations over this area or within specific houses will addressed immediately and resultant data will determine the future course of the removal action.

1.2.2 Questions and their Associated Decision Rules

Given the purpose described above, sampling will be conducted under this task to answer the following questions.

(1) Is asbestos detectable in the air in site homes and are measurements distinct?

(2) Are any airborne asbestos concentrations that are observed in site homes significantly higher than asbestos concentrations that simultaneously exist in air immediately outside the house (which might imply that household dust is a substantial source of asbestos in the home)?

(3) To the extent that airborne asbestos concentrations are observed in site homes, do they suggest that long-term average concentrations within such homes pose an unacceptable hazard to residents?

(1)

Regarding the first of the above, to the extent that asbestos structures are detected in the air, results of air measurements collected inside of site homes will be statistically evaluated to determine whether they can be considered representative of comparable environments or whether one or more is distinct from the others. This will be accomplished by conducting a chi-square analysis to see if the concentrations observed among indoor samples can be considered to come from a single Poisson distribution.

EPA is interested in evaluating air concentrations of asbestos fibers at each residence individually. EPA is therefore requiring the data be generated for the individual residences first and "pooling" of data occur second. The individual residence information may be needed to support removal actions at the site or to focus future investigative efforts.

To address Question No. 2 above, indoor concentrations measured at each residence will be compared to the concentration simultaneously measured outdoors at that residence. If pairwise comparisons between indoor and outdoor concentrations measured at each residence do not show any differences, then it will be concluded that indoor air concentrations are determined primarily by airborne transport into homes and further work will focus on whether such concentrations pose an unacceptable hazard to residents.

If pairwise comparisons suggest differences between indoor and outdoor exposures at one or more residences, further work will focus on the affects of indoor dust re-entrainment and a detailed procedure for Task 4 may need to be developed and implemented.

Indoor concentrations will also be evaluated to assess implications concerning risk. If concentrations measured indoors are shown both to be mutually consistent and shown not to be distinguishable from concentrations outdoors, the measurements will be pooled and risks will be assessed per the procedures defined in Berman and Crump (2001), with values appropriately adjusted for anticipated duration and frequency of exposure. Risks will also be assessed per the procedures defined in IRIS (1988) also with appropriate adjustments for duration and frequency.

If either indoor measurements are not entirely mutually consistent or if they are shown to be distinguishable (higher) than outdoor concentrations, risks will be assessed in a manner that accounts for activity-related exposure so that long-term average exposure concentrations can be estimated.

To determine whether indoor concentrations measured during sampling reflect long-term mean concentrations to which residents might be exposed, the log of activities collected during sampling will be evaluated and will be compared against published distributions of activities common to typical households. Measured concentrations will then be adjusted in the manner described below to account for differences between the activities actually occurring during sampling and the distribution of activities common to typical households.

Published models of indoor dust transport indicate relative dust concentrations commonly associated with the majority of indoor activities that potentially contribute substantially to long-term, mean exposure in a house. Measured concentrations will be adjusted by:

- summing the products of the published dust concentration associated with each activity observed during sampling and the duration of that activity.
- Summing the products of the published dust concentration associated with the activities that commonly contribute to long-term exposure multiplied by the respective fraction of time that each activity is routinely conducted;

- Taking the quotient of the sum derived in No. 2 above and the sum derived in No. 1; and
- Multiplying the measured asbestos concentration in a home by the quotient derived for that measurement.

Risks will then be assessed based on the adjusted concentrations using both the procedures defined by Berman and Crump and the procedures defined in IRIS.

If concentrations that are observed or estimated should be associated with potentially unacceptable levels of risk while, at the same time, indoor and outdoor concentrations are not distinguishable, a limited additional study may be conducted to evaluate whether the airborne asbestos concentrations observed at the site is distinguishable from local background. During such a study, local background will be determined by measuring airborne concentrations of asbestos at remote locations that are in the same wind stream (either upwind or crosswind) but that are removed from areas where ACM is known to be present.

1.1.1 Sampling Plan Design

As currently envisioned, air samples will be collected from a specified set of indoor locations and analyzed to support a preliminary evaluation of the degree of risk potentially posed by asbestos found in indoor air. Outdoor air will also be simultaneously sampled to provide a preliminary indication of the degree to which airborne concentrations indoors may be uniquely attributable to secondary sources (such as tracked in soils).

As previously indicated, airborne concentrations of asbestos within a home are subject to substantial variability from a variety of sources including (but not limited to):

- meteorological conditions contributing to variation both in relative humidity, which affects indoor emissions, and in airborne concentrations outdoors;
- the construction of a house, which contributes to variation in the degree of connection between indoor and outdoor air;
- the extent to which outdoor soils have been tracked into a house and the vigilance with which the house is kept clean;
- the nature of floor coverings and furnishing in a house (which potentially serve as reservoirs for dust);
- the kinds of activities conducted within a house over the long term, which contribute to the redistribution of dust; and
- the kinds of activities conducted specifically during sample collection, which contribute to the degree that house dust is re-suspended in the air while samples are being collected.
-

The first two of the above-listed sources of variation can be reasonably addressed by comparing concurrent indoor and outdoor concentrations. Thus, indoor and outdoor measurements will be conducted concurrently at each house to be sampled.

The third, fourth, and fifth of the above-listed sources contributes to variation between houses

and characterization of such variation is among the focuses of proposed sampling under this task.

The last of the above-listed sources of variation (activities conducted during sampling) will be addressed **through a resident maintained activity log and a PBS equipment check conducted at two hour intervals during the sampling events.**

1.1.1.1 Estimating the Number of Samples

As indicated in Section 1.3.1, to the extent that indoor air samples are shown to be statistically consistent (i.e. that they are likely to come from the same statistical distribution), results will be pooled. **Pooling data may provide statistical power to draw conclusions about contaminant distributions at the site, but pooling data does not address the EPA's concerns about asbestos levels within residents' homes. Data will be reported to EPA on a residence by residence basis first before any pooling analysis can occur.**

Moreover, as also indicated in Section 1.3.1, among the stated purposes for collecting these samples will be to provide a preliminary indication of the degree of risk posed by inhaling indoor air and this is typically accomplished by comparing an estimate of the mean of measured concentrations to a target criterion, the number of samples required for this effort can be estimated in a manner entirely analogous to that described in Section 1.1.2.1. In fact, the same decision rule can be applied. What differs is that the anticipated variability across air samples is substantially higher than that anticipated for soil composites. Thus, a new set of power curves that are appropriate for an estimated coefficient of variation equal to 5 (which is likely a conservative estimate for indoor air samples) are provided in Figure 5.

Due to the substantially higher variability anticipated for these samples, the second of the two data quality objectives stated in Section 1.1.2.1 is also relaxed a bit for sample collection under this task, so that a 20% probability of falsely rejecting the null hypothesis will be accepted when the true mean is less than one tenth of the target value. Given the power curves presented in Figure 5, 20 samples will be required to achieve the stated data quality objectives.

Because we will attempt to control for several of the sources of variability (including, for example, variation in resident activities), observed variation may ultimately prove to be substantially less than predicted here. If that is the case, the error rate actually achieved will be substantially smaller than that anticipated by the data quality objective defined in the last paragraph.

Because outdoor air will also be sampled in the immediate vicinity of each house that is sampled, and outdoor and indoor concentrations will be compared, the same number of outdoor samples will be collected as indoor samples.

1.1.1.2 Selection of Sampling Locations

The area designated for sampling under this task is the shaded area indicated in Figure 1. Assuming that access is granted, at least one indoor air sample will be collected from each of the approximately 22 occupied houses within the designated area. Given that the number of houses exceeds the recommended minimum number of samples estimated in Section 1.3.2.1, each house will be sampled once.

The location of air samplers collected inside of homes will be selected to be in the same room of the house where family activities tend to occur during the day but will be placed in an out of the way location so as not to be intrusive. So as to control for the types of activities in each house, an observer from the sampling team will remain with each indoor sampler to log residential activities. Alternatively, as previously described, a video camera may be installed to log activities automatically.

Outdoor samplers will be placed in an out-of-the-way location that does not interfere with homeowner activities or access. **The samplers will be placed within 30 meters in a direction crosswind from each house** and locations will be clearly marked with flagging and cones to prevent accidental damage. **All outdoor sampler locations will be approved by the EPA OSC prior to sampling.** Outdoor air samples on particular lots will be collected at times coinciding with the times over which the corresponding indoor samples are collected. Sampling stations will also be located using GPS equipment so that they can be placed on the integrated site map.

1.1.1.3 Sample Collection Procedures

Air samples will be collected using the equipment described in Chapter 7 of Berman and Chatfield (1990) using the procedures described in Chapter 9 (including pump calibration procedures and procedures for handling cassettes at the start and end of sampling) and with the following modifications:

- samples will be collected from the approximate height of the human breathing zone (i.e. 1.5 m); and

- to control analytical costs, it is desirable to collect as close to 3,000 L of air as possible. Therefore, because the maximum flow rate of the low-volume sampling pumps to be used for sampling is only approximately 2 L/min, each indoor sample (and corresponding outdoor sample) will be collected during three 8-hour intervals over three consecutive days. It is therefore anticipated that a total of approximately 2880 L (24 x 60 x 2) of air will be collected. As with indoor/outdoor samples, remote samples will each be collected over three consecutive days over a period of 8-hours per day. These samples will also be collected over the same period of days during which the various houses are sampled.

- As previously mentioned, as an alternative to having a sampler continuously logging activities within a home, a camera may be installed to log activities automatically;

- If the approach indicated above is unpalatable to a particular resident (with our without a camera), an alternative would be to collect a sample over a single, 8-hour period using a high-volume pump capable of achieving a flow rate of approximately 6 L/min. At such a flow rate, 2,880 L can be collected in a single, 8-hr period. Importantly, higher volume pumps tend to be substantially noisier than the low volume pumps proposed for use in the procedure described above. Moreover, observing over only a single, 8-hours will restrict the opportunity to collect samples over as broad a range of household activities as would likely occur over three 8-hour periods.

- Note, it is further recommended that adjacent samplers be setup in each of the houses sampled on the first day and that the second sampler be run at a flow rate that is two-thirds of the rate for the primary sampler. This is to assure that an adequately loaded filter can be collected without overloading. These first samples should be sent to the laboratory and prepared for immediate evaluation to determine the adequacy of loading. Thus, should any problems be identified, sampling rates can be adjusted for all later sampling.

Importantly, prior to use of any filter cassettes in the field, filter lot blanks must be analyzed to demonstrate the lot's suitability for use (see Section 2.2.2)

Indoor samples will be identified using the homeowner name and tax lot ID number and descriptive information such as the name of the room and level in the house and approximate

quadrant (e.g. ground floor living room northeast corner). Additional details regarding interior placement may be recorded along with the dates and times over which the sample was collected. Outdoor and remote samples will be similarly identified.

Chain-of-Custody. The Project Coordinator's representative will manage sample handling, transport and storage with appropriate Chain-of-Custody. When shipped to the laboratory, samples will be labeled in a manner making it impossible for the laboratory to determine their origin or nature.

Documentation. The following information will be recorded for each soil sample collected under this task:

- the sample identifier;
- for outdoor and remote samples, the GPS location of the sampler;
- for indoor samples, descriptive information indicating the location and conditions at the location that the sample is to be collected (supplemented with photographs);
- the dates and times over which each sample was collected;
- a complete log of the nature of activities (and the start and end times for each activity) that is conducted by residents in the vicinity of each indoor sampler over the time that samples are collected;
- any changes or modifications required to the above-indicated procedures for sample collection; and
- any other, potentially relevant information concerning the conditions under which the sample is collected.

1.1.1.1 Sample Preparation Procedures

Air samples are to be prepared using a direct transfer procedure as described in ISO Method 10312.

1.1.1.2 Sample Analysis Procedures

Laboratory Analysis. Air samples sent to the laboratory will be analyzed using the counting rules of the ISO Method 10312. **The dimensional criteria of fibers will include all structures. A consistent approach should be used for air samples. EPA will collect splits from a minimum of 20% of all houses for QA/QC purposes.**
The need for separately counting phase contrast microscopy equivalent structures (PCME) will be conducted.

The stopping rules of the ISO Method will also be modified for this project. For each air sample analyzed, a sufficient number of grid openings are to be scanned to achieve a minimum analytical sensitivity of 1×10^{-4} s/cm^3.

Data Management. Results obtained from laboratory reports will be entered into the project database along with relevant information from field logs (such as sample identification numbers,

sample locations, etc.).

1.2 Task 3: Survey Surface Soils and/or Soils at Depth

Depending on the results of sampling and analysis to be conducted as described in Task 1 above, it may appropriate to characterize the spatial distribution and/or depth profile of visible ACM and/or asbestos in soils using procedures such as those outlined below (or other measures). Once defined, the specific risk management decisions that will be required for this site will be used to determine the need for completing the work proposed under this task.

1.2.1 Purpose

Soil samples will be taken at all suspected "Burial Pit" locations during the exploratory trenching. For depth profiling, two potentially related procedures may be performed under this task. First, a series of test pits may be excavated at selected locations to log the extent of visible ACM in soils as a function of depth. Second, a series of soil samples **will** be collected during the excavation of test pits to be prepared and analyzed for the determination of asbestos **based on visual observations of the presence of ACM material.** Such samples may be useful for providing a preliminary indication extending our understanding of the degree of correlation between observation of visible ACM and the concentration of invisible asbestos fibers in the surrounding soil to look at such correlation as a function of depth.

Surveying surficial soils to delineate spatial distributions may be performed in a similar manner, except that it will not be necessary to dig test pits.

1.2.2 Sampling Plan Design for Task 3

The area designated for sampling under this task will be defined based on the specific risk-management decisions that conducting this task may ultimately be intended to address. Note that until such decisions are specified, however, it will not be possible to define the decision logic that will be used to relate results from this task to the specific questions to be answered.

1.2.2.1 Estimating the Number of Samples

Because the need for this task and, if needed, the specific objectives for this task will be defined pending the outcome of Task 1, the number of observations/samples required will also be defined at that time.

1.2.2.2 Selection of Sampling Locations

To assure that the designated area is sampled in an unbiased manner while assuring that the entire area is adequately represented, locations for collecting samples will be defined based on a stratified-random sampling scheme. A scheme similar to that defined in Task 1 will be employed, once the number of observations/samples that will be required to satisfy the data quality objectives for this task are defined.

1.2.2.3 Sample Collection Procedures

Test pits will be excavated using a sufficiently large backhoe to be capable of reaching the maximum depth desired for characterization under this task. Pits will be excavated in such a manner facilitating correlation between the material brought to the surface in the backhoe bucket and the specific depth (to the nearest one-half foot) represented by the material excavated. Each bucket brought to the surface will be examined for visual evidence of the presence of ACM and results will be recorded in the logbook.

If warranted (per Section 1.2.1), samples will be collected from excavated material to be analyzed for the determination of asbestos using the following procedures. One sample will be collected from each location to be specified based on the stratified-random sampling scheme (to be defined) for each depth interval (to be defined).

If sampling is ultimately required to support a survey of surficial soils, the procedure to be used for sampling surficial soils will be identical to that employed in Task 1 (Section 1.1.3.1.3).

Establishing field locations for sampling. The grid to be used to identify sampling locations under this task will be established in a manner similar to that defined for Task 1 (Section 1.1.2.3). However, the number of samples remains to be determined so that grid cannot be finalized at this time. As with surface sampling, a compositing scheme will be adopted in which component samples (to be collected at defined locations and depths) will be grouped in a systematic manner to create large-volume composite samples.

Procedures for sample collection. Samples are to be collected per the procedures described in Chapter 8 of the *Superfund Method for the Determination of Releasable Asbestos in Soils and Bulk Materials* (Berman and Kolk 1997) with the following modifications.

Sample collection. The material in the backhoe bucket representing the depth interval of interest will be sampled by collecting small, fixed volumes of material from random locations within the bucket using a clean trowel or other digging tool. The material will be placed in a clean, 1 L container and the process will continue until the container is full. This should represent collection of approximately 2 kg of material.

Importantly, sampling of the material in the backhoe bucket will be performed in a manner minimizing the chance that the sampling scheme is size selective. Other than rocks or other solid objects larger than 1 or 2 in. (2 to 5 cm) in diameter (which should be removed by hand) all particles within the backhoe bucket (regardless of their size) should have an equal chance of being sampled.

Sampled material will be placed in a clean, sealable plastic bag, and the bag labeled with the sample location identifying number. Component samples for each specific composite will be placed together in a labeled, plastic bucket and will be stored in a secured location onsite (tentatively in the warehouse building), for later preparation and analysis (see Sections 1.2.2.4 and 1.2.2.5 below).

Decontamination of field equipment. Procedures defined in Section 1.1.2.3 for decontamination of field equipment will also be applied in this task.

Chain-of-Custody. The Project Coordinator's representative will manage sample handling, transport and storage with appropriate Chain-of-Custody documentation.

Control of access. A safe working zone will be established around the perimeter of each test pit location using flagging and/or orange cones and the area will be supervised to allow for safe working movement of the backhoe while preventing unauthorized persons from entering the area.

Documentation. The following information will be recorded for each soil sample collected under this task:

- the sample identifier;
- the time that the sample was collected;

- the GPS location of the test pit and the depth from which each observation/sample is collected;
- any required modifications to the location or depth initially selected for sample collection along with the reasons (i.e. the nature of any field obstructions or an indication that the location initially selected falls outside of the shaded area designated for sample collection in Figure 1) for needing such modification;
- any changes or modifications required to the above-indicated procedures for sample collection;
- relevant observations concerning the condition (presence of vegetation, color and condition of soil, relative apparent moisture content, etc.) of the location from which the sample is collected (to be supplemented with photographs);
- documentation of any ACM (size, nature, color, type, etc.) observed at the sample location and depth; and
- any other, potentially relevant information concerning the conditions under which the sample is collected.
-

1.1.1.1 Sample Preparation Procedures

Samples collected under this task will be prepared, labeled, and shipped per the procedures described in Section 1.1.2.4.

1.1.1.2 Sample Analysis Procedures

Laboratory analysis. Sample splits prepared as described in Section 1.2.2.4 and selected for the determination of asbestos will be analyzed per the procedures of the Modified Elutriator Method (Berman and Kolk 2000).

Expand the dimensional criteria to fibers to include all structures. Page 13 states that PCME will be counted for samples collected from the elutriator. A consistent approach should be used for air samples. EPA will collect splits from a minimum of 20% of all houses for QA/QC purposes. The counting rules of the ISO Method 10312 will be used for characterizing and identifying structures

The set of samples collected will be analyzed sequentially until it can be demonstrated that the data quality objectives have been satisfied or the set of samples collected is exhausted, whichever comes first. It may also prove advantageous to analyze a subset of the duplicate splits from these samples.

One duplicate split from each of the differing group/composite materials will also be analyzed for silt content.

Data Management. Results obtained from laboratory reports will be entered into the project database along with relevant information from field logs (such as sample identification numbers, sample locations, etc.).

1.2 Followup Task 4: Collect and Analyze Household Dust

EPA is requiring that a protocol for indoor dust be developed as soon as possible and that

all residences be sampled and analyzed. Although there is currently no established procedure for characterizing asbestos in settled dust that can be related in any quantitative way to risk, it may be possible to establish such a procedure based on use of a combination of the Modified Elutriator Method (Berman and Kolk 2000) and methods used traditionally to characterize the mass loading of settled dust (see, for example, Que Hee et al. 1985). It may then be possible to correlate such measurements using a dynamic model of dust re-suspension (such as the model reported by Thatcher and Layton 1995) to establish a quantitative relationship between asbestos concentrations in settled dust and potential airborne exposure concentrations in a house. Should a need to pursue development of a plan for sampling settled dust in the occupied residences of this site be indicated based on the outcome of work defined in the three prior tasks, a detailed plan for work under this task will be developed and submitted for review.

Additional Requirements

As discussed with Dr. Berman, he will develop a sampling protocol for collecting composite samples near the immediate residences. EPA and its consultant will collect and analyze the samples.

Soil samples will be collected from all residences, suspected burial piles/pits and at locations with high concentrations of ACM on the surface. Lateral and vertical delineation of these areas of interest will be conducted by collecting subsurface soil samples at regular intervals to fully delineate.

At the OSC's discretion indoor and outdoor air samples may be collected at several residences during simulation of typical outdoor activities such as, lawn mowing, weed whacking, and roto-tilling. Indoor activities will include vacuuming, dusting, and sweeping floors.

Does this focus access w/ visible repair subsurface

2 QUALITY ASSURANCE PROJECT PLAN

Requirements for quality assurance (QA) and quality control (QC) to assure adequate performance of work SAP are summarized briefly below.

2.1 Quality Assurance Requirements

Field work. To assure that work is performed as described above and that it is performed in a professional manner using the standard of care that is normal for this type of work, only appropriately certified/licensed professionals will be retained to perform those aspects of the work requiring such credentials. For portions of the work not requiring specific credentialed expertise, work will be performed by trained individuals supervised by senior project staff experienced in performing these types of investigations.

In addition, the methods and procedures to be used to conduct all field work will be documented in a Work Plan, which will accompany field personnel and serve as the instructions for completing the work. The Project Coordinator's representative will be responsible for proper implementation of all elements of the Work Plan and will be responsible for documenting the specific field activities to be conducted in a logbook that will be used to retain all pertinent field observations and can be used to confirm later compliance with planned activities during daily review.

Chain of custody. All sample collection, handling, shipment, receiving, and analysis will be conducted within the control of strict chain of custody requirements.

Laboratory support. Laboratory work will be performed by appropriately accredited laboratories and an independent audit will be conducted of all asbestos laboratories retained to provide

analysis for the determination of asbestos.

QA for data management. To assure fidelity, all data entered into the project database will be reviewed for accuracy. The Project Coordinator's representative (who is not the individual who originally performs data entry) will compare all entries against the original laboratory or field reports.

2.2 Quality Control Requirements

The performance of sampling and analysis proposed under the tasks described above will be tracked based on results of the analysis of a combination of blanks, duplicates, and replicates. Separate quality control schemes are proposed for soil sampling and air sampling.

2.2.1 QC requirements for soil sampling under Tasks 1 and 3

EPA is requiring splits of every sample collected from the elutriator. An additional air sample can be collected, according to Dr. Berman, from each soil sample tumbled in the elutriator. These samples would serve QA/QC purposes and provide EPA with an archive for the site.

Quality control samples that are supplemental to the samples to be collected and analyzed as described in Tasks 1 and 2 will also be collected and submitted to the laboratory to support QC evaluations. These include:

- analysis of a minimum of three duplicate splits or 10% of the samples (whichever is greater) selected at random from among the duplicate splits of composite samples sent to the laboratory for analysis. A duplicate split represents a separate (additional) 50 to 70 g sample that is split from the homogenized matrix representing a particular composite. Each such sample will be labeled and shipped in such a manner so that the laboratory is blind to the relationship between this sample and its duplicate pair;

- if asbestos-free soils of similar origin and character can be found near the site (i.e. background soils), at least two background blank composites or a number equal to 5% of the total number of soils samples to be analyzed (whichever is greater) will be prepared in a manner identical to that described in Tasks 1 and 2 for sample composites (except that it will not be necessary to collect 8 to 12 component samples to construct each blank composite). 50 to 70 g splits of each blank will be labeled and shipped to the laboratory in such a manner that the laboratory is blind to the nature of the sample being shipped. Such blanks are to be labeled in a manner making it impossible for the laboratory to distinguish these blanks from real samples; and

- the laboratory will also generate filters from sand blanks between each field composite that is run. Initially 5% of these blanks will be analyzed to demonstrate lack of cross-contamination. The remaining blanks will be held for potential use to focus corrective actions.

Note also that the above requirements are in addition to the QA/QC requirements specified for assuring laboratory performance in the Modified Elutriator Method (Berman and Kolk 2000) itself, which (among other things) requires completion of a certain fraction of replicate counts.

Note that, although a greater number of duplicate splits will have been sent to the laboratory (see,

Section 1.1.2.4) than are listed for analysis above, the remaining samples may be used primarily for focusing corrective actions should a problem arise.

Note also that the QC filters (including filter lot blanks and replicate filter counts) that are specified in the Modified Elutriator Method (Berman and Kolk 200) will also be collected and analyzed per the requirements of the method. This is in addition to the QC samples listed above.

1.1.1 QC requirements for air sampling under Task 2

EPA will collect field duplicates at a minimum of 20% of homes to verify results reported by the RP's laboratory. Due to the presence of residents on the site, EPA may consider collecting field duplicates of air samples in every home.

Quality control samples that are supplemental to the samples to be collected and analyzed as described in Task 3 will be collected and submitted to the laboratory to support QC evaluations. These include:

- lot blanks. Two blank (sealed and unused) filter cassettes will be selected at random from each lot purchased for use in this study and will be submitted to the laboratory for analysis ***prior to use of any filter cassettes from that lot***. Should blank requirements not be satisfied (see Chatfield and Berman 1990) for a particular lot, cassettes from that lot will not be used on this project;

- field blanks. Approximately 5% of samples submitted for analysis will be field blanks. These are filter cassettes that are sent to the field, their connection ports are briefly opened and closed, and they are shipped to the laboratory along with field samples. Such blanks are to be labeled in a manner making it impossible for the laboratory to distinguish these blanks from real samples;

- field duplicates. For 5% of the indoor, outdoor, and remote samples collected, a second sampling apparatus will be set up adjacent to the original apparatus and will be operated under the same conditions over the same time interval as the original setup. Such samples, which will serve as field duplicates, will then be labeled in such a manner making it impossible to distinguish them from other samples (i.e. there will be no indication that such samples are duplicates) and will be shipped to the laboratory for analysis along with the regular samples.
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Note that analysis and evaluation of the QC samples listed above are in to be considered independent of and addition to the QC requirements identified in the ISO Method 10312 for assessment of laboratory performance.

1 SCHEDULE

The proposed schedule for the work to be conducted under this SAP is depicted in Figure 6. Note that, although the estimated time required for the effort to collect samples can be reasonably controlled, the time required for analysis will depend to some extent on how much advanced notice can be given the laboratory and precisely when the samples are delivered.

Summer is typically the busiest time of year for asbestos analytical laboratories (due to large amounts of AHERA-related work) so that there is much less spare capacity to handle jobs that have not been scheduled with substantial, advanced notice.

Given the above, we will make a best effort to obtain analytical support that will allow us to achieve the schedule milestones indicated in Figure 6. However, unforeseen difficulties with scheduling analyses may require that the schedule be stretched marginally. Should any changes be required, we will notify EPA as soon as we learn of the difficulties from our contracting laboratories.

2 REFERENCES

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3 FIGURES