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Ambient and Indoor Sampling for Public Health Evaluations of Residential Areas Near World Trade Center - Sampling Protocol

Following the WTC disaster, the New York City Department of Health working with the Agency for Toxic Substances and Disease Registry and the New York State Department of Health conducted indoor and dust sampling in 30 residential buildings in Lower Manhattan. The sampling plan for this investigation is provided below.

Foreword - February 26, 2002

This protocol was used by the New York City Department of Health in collaboration with the U.S. Agency for Toxic Substances and Disease Registry, U.S. Public Health Service Commissioned Corps, and the federal World Trade Center Environmental Assessment Working Group to conduct a limited investigation (November 4 - December 11, 2001) of residential areas near and around the World Trade Center. Prior to implementing the investigation, this protocol was reviewed by members of the federal World Trade Center Environmental Assessment Working Group. Formed on September 15, 2001, the working group is made up of representatives from the U.S. Department of Health and Human Services, the U.S. Environmental Protection Agency, and the U.S. Department of Labor. The purpose of the group is to coordinate public health and occupational sampling and data review among the three federal agencies in support of the New York City Department of Health and the New York State Department of Health. In addition, the protocol was reviewed by representatives of the New York State Department of Health, New York State Department of Environmental Conservation, the New York City Department of Environmental Protection, and the New York City Department of Health. On October 26, 2001, the New York City Department of Health, Institutional Review Board approved the protocol.

Sampling of the residential areas occurred from November 4 through December 11, 2001, and was conducted by U.S. Public Health Service Commissioned Officers detailed to the New York City Department of Health with assistance from the New York City Department of Health. It is anticipated that the final report concerning this limited pilot investigation will be available in May 2002. However, the New York City Department of Health will provide participants in this investigation and the public with relevant public health information as soon as data analysis and interpretation permit. On February 8, 2002, the New York City Department of Health did provide the participants with preliminary results regarding the amount of asbestos detected in air and settled dust. This information, along with the amount of fibrous glass detected in settled dust, was also provided to the general public.

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October 26, 2001, Protocol for Ambient and Indoor Sampling for Public Health Evaluations of Residential Areas Near World Trade Center, New York, New York

I. Introduction

Prior to November 4, 2001, this sampling protocol was developed to assess potential exposures to airborne and settled surface dust that entered residential areas following the collapse of the World Trade Center (WTC) buildings. The collapse of the WTC buildings resulted in a large number of residents being evacuated from their homes. Since the collapse, some residents have not re-occupied their apartments/homes near the WTC. Many of these residents have either visited to assess damage or to clean. Many have re-occupied their homes, and it is anticipated that more residents will soon be moving back. To date, environmental sampling efforts have focused on rescue/recovery areas (occupational); some sampling of commercial buildings to ensure office worker safety; and ambient (outdoor) air sampling for asbestos in a number of residential/commercial areas. Additional sampling is needed to assess possible WTC-related contaminants in residential areas–both indoors and outside.

Surface dust and debris containing asbestos have been found in lower Manhattan. Asbestos has been detected in personal air samples of rescue and recovery workers. In addition, low levels of asbestos have been detected in air samples collected at the WTC perimeter. Crystalline silica quartz has been detected in some of the 30 settled dust samples collected by the Centers for Disease Control and Prevention's National Institute of Occupational Safety and Health (NIOSH). Although most samples contained less than 5%, some samples contained from 15-20% crystalline silica quartz. Of the twelve personal air samples from the work site that have been analyzed for respirable crystalline silica, no detectable levels were found.

Dust, bulk, and air samples (mostly on or near the work site), as well as surface runoff water, river sediment, and river water have been analyzed for other contaminants, including metals, volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), dioxins and polychlorinated biphenyls (PCBs). The low levels of these contaminants that have been found do not indicate an immediate need to conduct widespread environmental testing for them.

Materials in airborne dust that may be of more immediate health concern–especially to residents who are returning to lower Manhattan–are those that can cause eye, nose, and throat irritation. Materials that can be inhaled or respired from airborne dust may cause respiratory irritation and exacerbation of pre-existing problems such as asthma, emphysema, and cardiopulmonary disease. Analysis of WTC-related residential surface and airborne dust, both indoors and outdoors, is to 1) respond to public concerns, 2) determine if residents are being exposed to concentrations of materials that may be of public health concern; 3) determine whether areas already cleaned (inside and outside environments) contain materials that may be of public health

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concern; and 4) provide information to the public on the potential health implications (or lack of implications) of the sample results.

During October 2001, information from residents supported the need to further assess potential indoor and outdoor environmental health issues. Burning throats have been reported to be a common problem in the recently re-occupied residential areas. Residents in south Battery Park City, whose windows were open at the time of the WTC collapse, have settled dust in their homes. Some have disposed of furniture, stereo equipment, etc., because they were covered with "ash and dust." Homes in part of the Tribeca zone (Chambers Street to Murray Street, west of Broadway) are not yet occupied, but were reported to have roofs covered with hand-sized chunks of insulation-like material that contain small pieces of mica-like material. In addition, the mica-like material has clogged roof drains and resulted in standing pools of water on residential roof tops.

II. Sampling Objective

The **overall objective** of this sampling is to provide results upon which public health agencies can further determine the potential for environmental exposures to WTC collapse-related materials and possible health implications of the exposures. Sampling will characterize ambient and indoor airborne and potentially airborne particles (surface dust) in residential areas of lower Manhattan from the collapse of WTC. Specifically, the objective is:

> Characterize the make-up and size distribution of settled dust and airborne breathing zone dust in residential areas–both indoors and outside–near the WTC. This information will be used to further determine if materials are present in air at levels of public health concern; and if materials are present in settled surface dust that can be re-entrained and result in continued exposures.

Sample locations will be selected in a concentric circle pattern, starting close to the WTC. Section V, Residence Selection/Sampling rationale, of this protocol describes this approach.

Note: The sampling objective/approach is focused on contaminants that emanated from the collapse of the WTC towers and that might cause health problems. However, this investigation will not be able to conclude if contaminants/materials are actually from the disaster. The contaminants that have been selected for testing might be present in some areas from other sources. Examples include: cooking on a stove top can increase indoor airborne particulate matter; vehicle exhaust can increase outdoor airborne particulate matter; recent home renovation can result in an increase in levels of gypsum, fiberglass, etc. in the air and surface dust.

III. Data and Quality Assurance

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Co-located samples will be collected in 10% of the air samples. While not a true duplicate, evaluation of the results will provide some information on the quality of the sampling technique. Generally, analysis of duplicate samples should be within +/- 25% of each other.

At least two field blanks (or 10% of samples submitted, whichever is greater) per air sample method per sample team will be submitted with the air samples collected each day. Blank cassettes should be opened at the same time as the sample cassettes are opened (just prior to sampling). Blank cassettes will be recapped and stored in a clean area (e.g., closed bag or box) with the covers from the sampling cassettes during the sampling period.
Each air sampling pump will be calibrated with a representative sampling device in-line before and after sample collection. Sample flow rates will be documented in the sampling log. The average of pre- and post-calibration flow rates will be used as the sample flow rate, for sample volume calculations.

Dust samples will be collected using the U.S. Environmental Protection Agency (EPA) Environmental Response Team (ERT) indoor dust sampling standard operating procedure (SOP). Duplicate samples are not feasible with indoor surface dust sample collection. Co-located samples (samples collected from adjacent areas of the floor) will be collected in 10% of the indoor surface dust sample locations. While not a true duplicate, evaluation of the results will provide some information on the variability of contaminants in the dust.

Samples should not be packaged in untreated polystyrene–electrostatic forces may cause fiber loss from some sample filters.

Chain of custody will be established and maintained throughout sample collection, transport, and analysis of the samples. Laboratory analysis shall follow all method-required quality assurance and quality control procedures.

All samples collected, unless analyzed with destructive methods, will be archived until further notice.

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IV. Sampling Parameters

Parameter	Sample Type	Indoor/Outdoor	Rationale for Selection
Asbestos	breathing ht., time-weighted air	I/O	Known use in building construction, evidence of presence in early air sampling and in settled dust, known inhalation carcinogen
Inhalable (<100 m)* thoracic (<10 m)* respirable (<4 m)* respirable (<2.5 m)	breathing ht., time-weighted, air	I/O	To determine relative amounts of each air fraction present and to have each fraction analyzed for silica, gypsum, mica, fiberglass, and calcite to qualitatively determine potential hazards
Respirable crystalline silica	breathing ht., time-weighted, air	I/O	Known component of concrete, evidence of presence in some settled dust samples, known inhalation carcinogen.
pH**	dust	I/O	Concrete has a high pH, if dust has a high pH, it may be contributing to reported symptoms of eyes, nose, and throat (ENT) irritation
Asbestos**	dust	I/O	Determine if asbestos is present in dust
gypsum, silica, mica, fiberglass, calcite**	dust	I/O	Associated with building materials (concrete, drywall) and known to be irritating to ENT

* results will be used to better understand the potential for ENT and respiratory irritation, and possibly for determining the possibility of acute/chronic health problems. Results will assist in providing information/recommendations to the public (e.g., what is contributing to irritation, how to reduce exposures)

** to assist in characterizing dust that can become airborne (re-entrainment of settled dust that may be the source of continuing air contamination), and to make recommendations for outdoor dust remediation

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V. Residence Selection/Sampling Rationale

The selection of residential sampling locations will be decided upon by New York City Department of Health (NYCDOH). The general NYCDOH approach is described as follows: A total of approximately 60 residential units will be sampled (a **unit** is an individual apartment in a multi-apartment building). A series of three concentric circles is being drawn around the WTC location. These circles will be divided by direction or zone from the WTC (north, south and west, and east). From five to seven of the multi-residential buildings will be selected for testing from within each zone.

Testing locations will mainly focus on occupied residences. However, approximately five unoccupied units nearest the WTC will be targeted for testing. In addition, approximately five units will be selected outside of the concentric circles, that were not impacted by the WTC collapse, to serve as background sample locations.

Sampling personnel will document the rationale for selecting buildings and residential units for sampling. They will also document sample locations, conditions during sampling, and possible interfering factors (e.g., traffic, construction). In addition, unit occupants and building owner/operators will be requested to provide information that will better assist in evaluating the results. *Appendix A* of this plan contains the information needed/requested.

VI. Sampling/Analysis Approach

1. Indoor

Air and surface dust sampling will focus on both a common entryway area into the building (e.g., lobbies, front entryways) and on a selected number of apartments/units in the building. Attempts will be made to select apartments/units where dust is visible as well as units where dust is not visible. Selecting entryways and common areas should be representative of worst case conditions for contaminant/material track-in from outdoors. Selecting two apartments/units in the same building–with and without visible dust--should provide information on the ranges of contaminants found in indoor living spaces.

If the building is unoccupied and no central HVAC system is present, aggressive (leaf blower, high-power fan) indoor air sampling should be conducted. If the building is occupied, air sampling should be conducted with the building/unit heating, ventilation, and air conditioning (HVAC) system's fan in continuous operation. After sampling is completed, filters for the HVAC system, if applicable, should be inspected. If dust is present, recommend filter replacement.

Indoor air sampling for asbestos will be conducted and analyzed using NIOSH methods 7400 and 7402. Respirable crystalline silica will be sampled and analyzed using NIOSH method 7500. Air sampling for inhalable and thoracic size particles will be conducted using EPA method IP-10A. The respirable silica sample will be used to analyze the respirable fraction of the dust. The relative amounts (percent weight) of each fraction present will be determined. Each fraction will be analyzed for silica, gypsum, mica, and calcite using X-ray diffraction (XRD) analysis. Fibrous glass will be analyzed using scanning electron microscopy (SEM).

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Indoor floor dust samples will be collected using the EPA ERT SOP for household dust collection. As much dust as possible will be collected; the area vacuumed will be measured and reported. Samples will be analyzed for crystalline silica, gypsum, mica, and calcite using XRD analysis. Asbestos and fibrous glass will be analyzed using New York State Method 198.1 (polarized light microscopy [PLM]); if <1% asbestos is found, New York State Method 198.4 (transmission electron microscopy [TEM]) analysis will be conducted. The pH of the dust will be tested using EPA SW846 Method 9045C.

2. Outdoor

Outdoor air and settled dust sampling will occur in areas adjacent to the residential building being tested indoors. Sampling will occur concurrently with indoor sampling.

Ambient air sampling will be conducted at breathing height. Air sampling for asbestos will be conducted and analyzed using NIOSH methods 7400 and 7402. Respirable crystalline silica will be sampled and analyzed using NIOSH method 7500. Air sampling for inhalable and thoracic size particles will be conducted using EPA method IP-10A. The respirable silica sample will be used to analyze the respirable fraction of the dust. The relative amounts (percent weight) of each fraction present will be determined. Each fraction will be analyzed for silica, gypsum, mica, and calcite using XRD analysis, and for fibrous glass using SEM.

Settled surface dust samples will be collected by scooping visible dust into a glass container. A minimum of 25-30 grams of sample is required. The area of the surface sampled (e.g., 100 cm^2) will be measured and documented. Samples will be analyzed for crystalline silica, gypsum, mica, and calcite using XRD analysis, and for asbestos and fibrous glass using New York State method 198.1 (PLM). If PLM shows less than <1% asbestos, New York State Method 198.4 (transmission electron microscopy [TEM]) analysis will be conducted. The pH of the dust will be tested using EPA SW846 Method 9045C.

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Sample/Analytical Methods

Parameter	Environmental Media	Sampling/Analytical Method	Sample Flow/time	Analytical LOD/LOQ*
Asbestos**	I/O*** air	NIOSH 7400, NIOSH 7402 Breathing zone sample height	16 L/min -4 hr (3840L) 5 hr (4800L) 6 hr (5760L)	0.010 f/cc (LOQ) 0.008 f/cc 0.007 f/cc
Inhalable (<100 m) particles	I/O air	ACGIH/ISO sampling criteria Gravimetric, XRD (crystalline silica, gypsum, mica, and calcite), and SEM (fibrous glass).	4 L/min -3.2 hr (750L)	30 ug / 40 ug/m^3
Thoracic (<10 m) particles	I/O air	EPA IP-10A/Gravimetric, XRD (crystalline silica, gypsum, mica, and calcite), and SEM	4L/min - 3.2 hr (750L) (fibrous glass)	30 ug/ 40 ug/m^3
Respirable crystalline silica and respirable (<4 m) particles	I/O air	NIOSH 7500/ Gravimetric, XRD (gypsum mica, and calcite), and SEM (fibrous glass)	2.5 L/min-5.3 hr(800L)	5 ug / 6 ug/m^3 30 ug/ 90 ug/m^3
Respirable (<2.5 m) particles	I/O air	EPA IP-10A/Gravimetric XRD (crystalline silica, gypsum, mica, and calcite), and SEM	4L/min - 3.2 hr (750L) (fibrous glass)	30 ug/ 40 ug/m^3
pH	I/O dust	EPA SW 846 Mtd 9045C (soils)	10-25 g	
asbestos	I/O dust	NY State Method 198.1 (PLM) and if <1% NY State Method 198.4 (TEM)	10-25 g	
silica, gypsum, fiberglass, mica, and calcite	I/O dust	XRD (SEM for fibrous glass)	10-25 g	

* LOD:Limit of analytical detection; LOQ: Limit of analytical quantitation

** use professional judgement re: asbestos sampling times to avoid filter overload (collection of 2 samples with different sampling times may be necessary)

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*** I: indoor; O: outdoor

VII. Interference from existing building materials

It is anticipated that some of the contaminants/materials found in this sampling effort will be un-related to the WTC event. Attempts will be made during sample collection to note other possible sources of contaminants (Section VIII, Information Needs for Samples/Sample Locations).

To better determine if contaminants/materials found are within area background levels, approximately five residential units outside of the concentric circle zones will be selected for testing (indoor air and surface dust, outdoor air and surface dust). Contaminant levels found inside and outside of the background homes, along with specific sample location information, will be considered when data interpretation is conducted.

VIII. Community Notification of Results

The analytical results along with a public health interpretation will be provided to the community in several different ways. All participants who allowed sampling in their home will be provided with their individual results. Each building owner/operator will be given results of all sampling conducting in the building. Results (without personal identifiers) will also be provided to all occupants of the building. Finally, all results (without personal identifiers) will be provided to residents in lower Manhattan.

In each instance, notification will include a summary of the results; a comparison of the results of samples collected in lower Manhattan with the results of samples collected as NYC background; a public health interpretation of the results; a discussion of the limitations of the data; and recommendations (if needed) that would reduce exposures.

These notifications will be prepared after all of the analytical data has been received. It is anticipated that notification will occur within *6-8 weeks* after sampling is begun. However, data and its QA/QC will be reviewed as it is provided by the laboratory. If, results are found that indicate a more immediate notification is necessary (e.g., levels are found that pose a public health hazard), the participants who may be impacted will be notified as soon as possible. Based on the circumstances, this notification may include just residents in an individual unit, or it may include all residents in the building along with the building owner/operator. If such a notification is necessary, all involved public health agencies will take steps to ensure that it includes specific recommendations/actions that can be quickly implemented to reduce exposures below levels that pose a health hazard.

IX. Screening Values/Data Interpretation/Recommended Actions

Screening levels and actions are outlined in *Appendix B.*

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Data will be evaluated by local, state and federal public health agencies. Evaluations will include:

1) Indoor sample results will be compared to the results found in the background homes and evaluated on a residence-by- residence basis (for the individual occupants)
2) All indoor data will be compared to the results found in the background homes and evaluated to determine any public health implications for residents near the WTC
3) All outdoor data will be compared to the results found in the background homes and evaluated to determine any public health implications for those living near the WTC
4) The relationship between materials found in indoor and outdoor samples will be evaluated.

For 1 through 3, above, sample results will first be compared to the results from background homes. If results are less than or within the levels found in background locations, then the health interpretation will stress that there is no indication that the resident(s) in the area tested are at any increased risk compared to those in communities further away from the WTC.

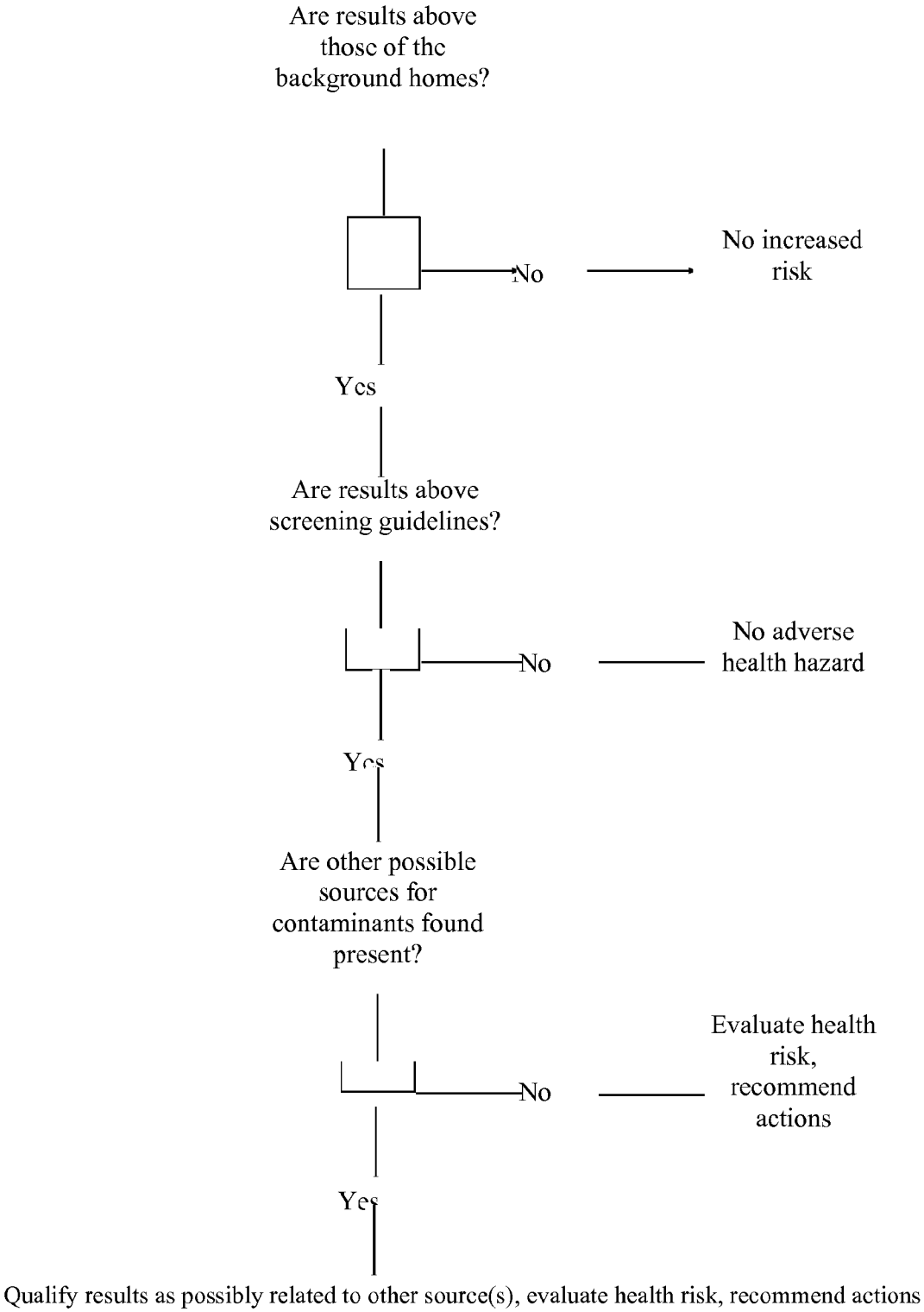
If sample results are higher than those of the background homes, the results will be compared to screening guidelines. These screening levels are outlined in the next Section. If values are below screening guidelines, the health interpretation will stress that the levels of contaminants found are below those of public health concern. If values exceed the screening guidelines, then sample collection information (Appendix A) will be reviewed in detail to determine if a possible source or contributing source (e.g., remodeling activities, road construction) of the contaminant(s) is possible. If a possible source or contributing source is found, this information will be included in the interpretation of the results. If the possible source is controllable (e.g., sweeping with a broom), recommendations will be made that will reduce levels of contaminants. If no other source of the contaminant(s) is indicated and sample collection information indicates the presence of variables associated with WTC-related dust (e.g., visible settled dust, windows open during WTC collapse), this information will be included in the interpretation of the results. Recommendations to clean (or re-clean) areas to reduce exposures will be made. A public health implications statement will be provided with each set of results.

If levels of contaminants are found outdoors that exceed those of the background homes and the screening guidelines, recommendations will be made to take steps that eliminate transporting the contaminants indoors (e.g., reduce contaminant track in by removing or changing shoes prior to entering residence, use higher efficiency filters on HVAC systems, keep windows closed). In addition, a public health implications statement will be provided for outdoor results.

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Figure 1 - Follow Chart of How Data Evaluations Will be Conducted



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APPENDIX A

Sample Survey Forms

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INFORMATION NEEDS FOR SAMPLES/SAMPLE LOCATIONS

This package of contains a series of forms designed to collect the relevant information for all of the samples taken at one particular building.

The following SECTIONS are included:

1. General information about the sampling event (page 3)
2. Information about the building the samples will be taken around and from (page 4-5)
3. Information for the sample taken outside of the building (page 6)
4. Information for the sample taken inside the building from a common area (page 7-8)
5. Information for each sample taken inside the building from residential Unit 1 (page 9-12)
6. Information for each sample taken inside the building from residential Unit 2 (page 13-16)
7. Site Sketches (outside sample on page 17, inside common area on page 18, residential unit 1 on page 19, and residential unit 2 on page 20).

Each sample must be associated with one form from SECTION 3, 4, or 5. The collection of samples from the building must be associated with the forms from both SECTIONS 1 and 2.

Page 2 of this package contains a checklist to be completed at the end of the sampling event. This checklist will be used to validate information collection.

Finally, use the supplied camera to take photos of the outside structure of the building, the outside sampled area, inside sampled residential unit 1 and inside sampled residential unit 2. Note the exposure number for each set on the final checklist.

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FINAL CHECKLIST

Sample Location Site Sketches Completed on the appropriate page? **Y** **N**

Include:

- Building location with respect to streets (include street names)
- Number building sides
- North arrow
- Location of building entrance(s)
- Location of broken windows
- Location of debris generated by WTC collapse or other conditions
- Location of outside sample
- Plan view location of inside sample(s) (include floor number)
- Location/description of other dust generating activities (e.g., construction, road work, traffic)

Photos of Building Taken?	**Y**	**N**	
If yes, were photos taken of the			**Exposure Range (e.g., 1-4)**
Outside structure	**Y**	**N**	_____
Inside sampled residential unit1	**Y**	**N**	_____
Inside sampled residential unit2	**Y**	**N**	_____
Building number noted on camera	**Y**	**N**	
Camera number			_____
Total number of exposures for this sampling event			_____

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SECTION 1. General Information About the Sampling Event

A. Sampling Event Number _____

B. Date of Sampling Event _____

C. Names of Sampling Team Members _____

_____

_____

Weather Conditions:

D. Expected Daytime High Temp. _____

E. Average Wind Velocity **calm** **light** **moderate** **strong** **gusty**

F. General Wind Direction **N** **NE** **E** **SE** **S** **SW** **W** **NW** **Variable**

G. Rain During the Last 3 Days? **Y** **N**
If yes, was the amount of rain in general **light** **moderate** **heavy**

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SECTION 2. Information About the Building

Background Information

A. Building Address _____

B. Building Point of Contact
Name _____
Phone Number _____
Relationship to Building (e.g., manager) _____

C. Name of Building Owner _____

D. Mailing Address of Building Owner
_____
_____

E. Reason this building was selected for sampling?
_____
_____
_____

Building Area/Characteristics Information

F. Have neighboring streets been cleaned since the WTC collapse? **Y** **N** **Not Sure**
If yes, date of last cleaning _____

G. Total number of floors _____

H. Is the entire building residential? **Y** **N** **Not Sure**
If no, which floors have residential occupants? _____
(ground floor=1)

I. How many walk-in entrances to the building? _____
(include entrances from parking areas)

J. How many of these entrances are on - (see reference site sketch map)
Side 1 _____
Side 2 _____
Side 3 _____
Side 4 _____
Other side (specify) _____

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SECTION **2. Information About the Building** (continued)

K. Number of broken windows
*(Please count the **total** number of broken windows for each side of the entire building and then for **each floor** of the building where a residential unit is to be sampled)*

	Building	(1)Unit Floor Sampled	(2)Unit Floor Sampled
Side 1	_____	_____	_____
Side 2	_____	_____	_____
Side 3	_____	_____	_____
Side 4	_____	_____	_____
Side 5	_____	_____	_____
Side 6	_____	_____	_____

L. Is there an HVAC system for the building? **Y** **N** **Not Sure**
If **NO** go to Section 3.

What type of filter is used? High Efficiency Filter Regular Filter **Not Sure**
Filter Name _____

Filter Size _____

Filter Type _____ Paper _____Electrostatic _____Fiberglass _____Other (describe)

Filter Efficiency Rating_____

Has the filter been changed since the WTC collapse? **Y** **N** **Not Sure**

If yes, date _____

Have the ducts been cleaned since the WTC collapse? **Y** **N** **Not Sure**

If yes, date_____

Does system recycle air? **Y** **N** **Not Sure**

If yes, what percent of the air is recycled? _____% **Not Sure**

Has the system been recycling since the WTC collapse? **Y** **N** **Not Sure**

M. Has the HVAC system been **SERVICED** since the WTC collapse? **Y** **N** **Not Sure**

If yes, date_____

N. Has the HVAC system been **CLEANED** since the WTC collapse? **Y** **N** **Not Sure**

If yes, date_____

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SECTION 3. Information for SAMPLE taken OUTSIDE of the building

A. Location number of Sampling Event _____

B. Side of building where sample was taken? *(see reference site sketch)*

Side 1 Side 2 Side 3 Side 4 Other Side (_____)

C. Is sample location (with sample number) shown on map? **Y N**

D. How far is the sample location from the building edge? _____(feet)

E. How far is the sample location from the nearest busy street? _____(feet)

F. Is there obvious evidence of WTC generated dust visible?

On building	**Y**	**N**	
On adjoining sidewalk	**Y**	**N**	
On street near the building	**Y**	**N**	
On roof	**Y**	**N**	**Not Available Applicable**
Have these areas been cleaned since WTC collapse?	**Y**	**N**	

G. Are there dust generating activities in the area?

Construction	**Y**	**N**
Road work	**Y**	**N**
Truck traffic	**Y**	**N**
Heavy car traffic	**Y**	**N**
Bus stop	**Y**	**N**

H. Is dust visible?

In this area where dust sample will be gathered	**Y**	**N**
On the surface where the air sampler will be set-up	**Y**	**N**
In the air of this area	**Y**	**N**

I. For dust samples, estimate the size of the area sampled _____ (specify units)
If this information is included in the chain of custody form please skip this question.

SECTION 4. Information for SAMPLE taken inside the building from COMMON AREA

A. Floor Number (ground floor = 1, basement = B) _____

B. Type of Common Area
____ Stairwell _____ Lobby _____ Hallway _____ Other (describe)

C. Are sample locations (with sample number) shown on map? **Y** **N**

D. Is dust visible in this area? **Y** **N**

E. Has the area where sample was obtained been cleaned since WTC event? **Y** **N** **Not Sure**

If yes:
Date of last cleaning _____
Who conducted cleaning?
____ Building owner
____ Tenant
____ Asbestos remediation contractor
____ Professional cleaning contractor
____ Private cleaning contractor
____ Name and Contact Information for Contractor:

_____
_____

F. How was this area cleaned?

____	Wet mopping			
____	Dusting			
____	Sweeping	**Broom**	**Vacuum**	**HEPA Vacuum**
____	Carpet cleaner			
____	Curtains	**Removed**	**Cleaned In Place**	**Cleaned and Rehung**
____	Furniture	**Removed**	**Cleaned In Place**	**Cleaned and Returned**

G. How much dust was present in this area prior to cleaning?

Normal Amount	**Slight Increase Over Normal**	**Moderate Increase Over Normal**	**Large Increase Over Normal**

H. Has there been routine cleaning since the WTC collapse? **Y** **N** **Not Sure**

I. If yes, how is this area routinely cleaned?

____	Wet mopping			
____	Dusting			
____	Sweeping	**Broom**	**Vacuum**	**HEPA Vacuum**
____	Carpet cleaner			

4. Information for SAMPLES taken inside the building from COMMON AREAS (continued)

J. Were windows near the common area open during WTC collapse? **Y** **N** **Not Sure**

If yes, how many were open? _____

K. Were windows near the common area broken during WTC collapse? **Y** **N** **Not Sure**

If yes, how many were broken? _____

How many windows are still broken? _____

L. Distance from sample location to closest broken/open window _____(feet)
NA

M. Which side of the building is this window?
Side 1 **Side 2** **Side 3** **Side 4** **Other Side (_____)**

N. Is there an HVAC system for the common area? **Y** **N** **Not Sure**

(If No or Not Sure, skip to SECTION 5)

Is it separate from the building's HVAC system? **Y** **N** **Not Sure**

(If No or Not Sure, skip to SECTION 5)

What type of filter is used? **High Efficiency Filter** **Regular Filter** **Not Sure**

Filter Name _____

Filter Size _____

Filter Type _____ Paper _____Electrostatic _____Fiberglass _____Other (describe)

Filter Efficiency Rating_____

Has the filter been changed since the WTC collapse? **Y** **N** **Not Sure**

If yes, date_____

Have the ducts been cleaned since the WTC collapse? **Y** **N** **Not Sure**

If yes, date_____

Does system recycle air? **Y** **N** **Not Sure**

If yes, what percent of the air is recycled? _____% **Not Sure**

Has the system been recycling since the WTC collapse? **Y** **N** **Not Sure**

O. Has the HVAC system been **SERVICED** since the WTC collapse? **Y** **N** **Not Sure**

If yes, date_____

P. Has the HVAC system been **CLEANED** since the WTC collapse? **Y** **N** **Not Sure**

If yes, date_____

Q. Was the HVAC fan ON during the entire air sampling period? **Y** **N** **Not Sure**

If NO, how long did the fan run (in hours)? _____**hours** **Not Sure**

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SECTION 5. Information for samples taken from RESIDENTIAL UNIT 1.

A. Point of Contact for Residential Unit 1
Name _____
Address _____
Phone Number _____

The following questions describe the characteristics of the area the listed samples were taken from.

B. Location of Floor Above Ground Level Number (ground floor = 1, basement = B) _____

C. Type of Residential Area Sampled

_____Living Room	_____Bedroom
_____Dining Room	_____Den/Office
_____Kitchen	_____Bathroom
_____Hallway	_____Other (please describe)

D. Are sample locations (with sample number) shown on map? **Y** **N**

E. Is dust visible in this area? **Y** **N**

F. Has area where sample was obtained been cleaned since WTC event? **Y** **N** **Not Sure**

If yes:
Date of last cleaning _____ **Not Sure**

Who conducted cleaning?
____ Building owner
____ Tenant
____ Asbestos remediation contractor
____ Professional cleaning contractor
____ Private cleaning contractor
____ Name and Contact Information for Contractor:
_____
_____

G. How was this area cleaned?

____	Wet mopping			
____	Dusting			
____	Sweeping	**Broom**	**Vacuum**	**HEPA Vacuum**
____	Carpet cleaner			
____	Curtains	**Removed**	**Cleaned In Place**	**Cleaned and Replaced**
____	Furniture	**Removed**	**Cleaned In Place**	**Cleaned and Replaced**

SECTION 5. Information for samples taken from RESIDENTIAL UNIT 1 (continued)

H. How much dust was present in this area prior to cleaning?

Normal Amount	**Slight Increase Over Normal**	**Moderate Increase Over Normal**	**Large Increase Over Normal**

CITY_21MC100_003246073

NYC-WTC_000445187

I. Has there been routine cleaning since the WTC collapse? **Y** **N** **Not Sure**

J. If yes, how is this area routinely cleaned?

____	Wet mopping			
____	Dusting			
____	Sweeping	**Broom**	**Vacuum**	**HEPA Vacuum**
____	Carpet cleaner			

*These next two questions refer to large appliances (dishwashers, refrigerator, washer/dryer, etc). If **no** appliances are present, please skip to **question M.***

K. How were appliances cleaned?

In Place **Replaced** **Removed** **Not Cleaned** **Not Necessary to Clean**

L. How were the walls and floors near the appliances cleaned:

Wall Surfaces **Underlying Floor** **Between Appliance and Walls** **Not Necessary to Clean**

M. Were windows near the area open during WTC event? **Y** **N** **Not Sure**
If yes, how many were open? _____

N. Were windows near the area broken during WTC event? **Y** **N** **Not Sure**
If yes, how many were broken? _____
How many windows are still broken? _____

O. Distance from sample location to closest broken/open window _____(feet)
NA

P. Which side of the building is this window? (see reference site sketch map)

Side 1 **Side 2** **Side 3** **Side 4** **Other Side**
(_____)

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SECTION 5. Information for samples taken from RESIDENTIAL UNIT 1 (continued)

Q. Is this unit currently occupied? **Y** **N**

Is there a **separate** HVAC system for this residential unit? **Y** **N**

Is there a **significant** amount of dust that would preclude aggressive sampling? **Y** **N**

Recommend: Aggressive sampling for unoccupied residential units that have their own HVAC and **DO NOT** *have a significant amount of dust.*

R. Did this unit meet the criteria to be aggressively sampled? **Y** **N**

If **YES**, was this unit aggressively sampled? **Y** **N**

If this unit met the criteria for aggressive sampling and was not aggressively sampled, why not?

If this unit does not have it's own HVAC system, please skip to question W.

S. What type of filter is used? **High Efficiency Filter** **Regular Filter** **Not Sure**

Filter Name _____
Filter Size _____
Filter Type _____ Paper _____Electrostatic _____Fiberglass _____Other (describe)

Filter Efficiency Rating_____

Has the filter been changed since the WTC collapse? **Y** **N** **Not Sure**
If yes, date_____

Have the ducts been cleaned since the WTC collapse? **Y** **N** **Not Sure**
If yes, date_____

Does the system recycle air? **Y** **N** **Not Sure**
If yes, what percent of the air is recycled? _____% **Not Sure**
Has the system been recycling since the WTC collapse? **Y** **N** **Not Sure**

T. Has the HVAC system been **SERVICED** since the WTC collapse? **Y** **N** **Not Sure**
If yes, date_____

U. Has the HVAC system been **CLEANED** since the WTC collapse? **Y** **N** **Not Sure**
If yes, date_____

V. Was the HVAC fan ON during the entire air sampling period **Y** **N** **Not Sure**
If NO, how long did the fan run (in hours)? _____hours

CITY_21MC100_003246075

NYC-WTC_000445189

W. Do any residents or frequent visitors smoke in this unit? **Y** **N** **Not Sure**

X. Residential Activities	During Sampling		Previous 24 hours	
Smoke?	**Y**	**N**	**Y**	**N**
Use Stove?	**Y**	**N**	**Y**	**N**
Use Oven?	**Y**	**N**	**Y**	**N**
If use either, were these	**Gas**	**Electric**	**Gas**	**Electric**
Was the exhaust fan on?	**Y**	**N**	**Y**	**N**
Use the dishwasher?	**Y**	**N**	**Y**	**N**
Have a Fire in the Fireplace/Wood Stove?	**Y**	**N**	**Y**	**N**
Clean?	**Y**	**N**	**Y**	**N**
Vacuum?	**Y**	**N**	**Y**	**N**
Burn Candles or Incense, etc.?	**Y**	**N**	**Y**	**N**
Open Windows?	**Y**	**N**	**Y**	**N**
Children playing near the equipment?	**Y**	**N**	–	–

Y. Window position change from the **start** of sampling? **Opened** **Closed** **No Change**

Z. How much activity occurred in the sampled room? **None** **Occasional** **walk by equipment** **Frequent movement**

SECTION 5. Information for samples taken from RESIDENTIAL UNIT 1.

B. Point of Contact for Residential Unit 1
Name _____
Address _____
Phone Number _____

The following questions describe the characteristics of the area the listed samples were taken from.

B. Location of Floor Above Ground Level Number (ground floor = 1, basement = B) _____

C. Type of Residential Area Sampled

_____Living Room	_____Bedroom
_____Dining Room	_____Den/Office
_____Kitchen	_____Bathroom
_____Hallway	_____Other (please describe)

D. Are sample locations (with sample number) shown on map on page 19? **Y** **N**

E. Is dust visible in this area? **Y** **N**

F. Has area where sample was obtained been cleaned since WTC event? **Y** **N** **Not Sure**

If yes:
Date of last cleaning _____ **Not Sure**

Who conducted cleaning?
____ Building owner
____ Tenant
____ Asbestos remediation contractor
____ Professional cleaning contractor
____ Private cleaning contractor
____ Name and Contact Information for Contractor:
_____
_____

G. How was this area cleaned?

____	Wet mopping			
____	Dusting			
____	Sweeping	**Broom**	**Vacuum**	**HEPA Vacuum**
____	Carpet cleaner			
____	Curtains	**Removed**	**Cleaned In Place**	**Cleaned and Replaced**
____	Furniture	**Removed**	**Cleaned In Place**	**Cleaned and Replaced**

SECTION 5. Information for samples taken from RESIDENTIAL UNIT 1 (continued)

H. How much dust was present in this area prior to cleaning?

Normal Amount	**Slight Increase Over Normal**	**Moderate Increase Over Normal**	**Large Increase Over Normal**

CITY_21MC100_003246077

NYC-WTC_000445191

I. Has there been routine cleaning since the WTC collapse? **Y** **N** **Not Sure**

J. If yes, how is this area routinely cleaned?

____	Wet mopping			
____	Dusting			
____	Sweeping	**Broom**	**Vacuum**	**HEPA Vacuum**
____	Carpet cleaner			

*These next two questions refer to large appliances (dishwashers, refrigerator, washer/dryer, etc). If **no** appliances are present, please skip to **question M.***

K. How were appliances cleaned?

In Place **Replaced** **Removed** **Not Cleaned** **Not Necessary to Clean**

L. How were the walls and floors near the appliances cleaned:

Wall Surfaces **Underlying Floor** **Between Appliance and Walls** **Not Necessary to Clean**

M. Were windows near the area open during WTC event? **Y** **N** **Not Sure**
If yes, how many were open? _____

N. Were windows near the area broken during WTC event? **Y** **N** **Not Sure**
If yes, how many were broken? _____
How many windows are still broken? _____

O. Distance from sample location to closest broken/open window _____(feet)
NA

P. Which side of the building is this window? (see reference site sketch map)

Side 1 **Side 2** **Side 3** **Side 4** **Other Side**
(_____)

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SECTION 5. Information for samples taken from RESIDENTIAL UNIT 1 (continued)

Q. Is this unit currently occupied? **Y** **N**

Is there a **separate** HVAC system for this residential unit? **Y** **N**

Is there a **significant** amount of dust that would preclude aggressive sampling? **Y** **N**

Recommend: Aggressive sampling for unoccupied residential units that have their own HVAC and **DO NOT** *have a significant amount of dust.*

R. Did this unit meet the criteria to be aggressively sampled? **Y** **N**

If **YES**, was this unit aggressively sampled? **Y** **N**

If this unit met the criteria for aggressive sampling and was not aggressively sampled, why not?

_____

_____

If this unit does not have it's own HVAC system, please skip to question W.

S. What type of filter is used? **High Efficiency Filter** **Regular Filter** **Not Sure**

Filter Name _____

Filter Size _____

Filter Type _____ Paper _____Electrostatic _____Fiberglass _____Other (describe)

Filter Efficiency Rating_____

Has the filter been changed since the WTC collapse? **Y** **N** **Not Sure**
If yes, date_____

Have the ducts been cleaned since the WTC collapse? **Y** **N** **Not Sure**
If yes, date_____

Does the system recycle air? **Y** **N** **Not Sure**
If yes, what percent of the air is recycled? _____% **Not Sure**
Has the system been recycling since the WTC collapse? **Y** **N** **Not Sure**

T. Has the HVAC system been **SERVICED** since the WTC collapse? **Y** **N** **Not Sure**
If yes, date_____

U. Has the HVAC system been **CLEANED** since the WTC collapse? **Y** **N** **Not Sure**
If yes, date_____

V. Was the HVAC fan ON during the entire air sampling period **Y** **N** **Not Sure**
If NO, how long did the fan run (in hours)? _____hours

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NYC-WTC_000445193

W. Do any residents or frequent visitors smoke in this unit? **Y** **N** **Not Sure**

X. Residential Activities	During Sampling		Previous 24 hours	
Smoke?	**Y**	**N**	**Y**	**N**
Use Stove?	**Y**	**N**	**Y**	**N**
Use Oven?	**Y**	**N**	**Y**	**N**
If use either, were these	**Gas**	**Electric**	**Gas**	**Electric**
Was the exhaust fan on?	**Y**	**N**	**Y**	**N**
Use the dishwasher?	**Y**	**N**	**Y**	**N**
Have a Fire in the Fireplace/Wood Stove?	**Y**	**N**	**Y**	**N**
Clean?	**Y**	**N**	**Y**	**N**
Vacuum?	**Y**	**N**	**Y**	**N**
Burn Candles or Incense, etc.?	**Y**	**N**	**Y**	**N**
Open Windows?	**Y**	**N**	**Y**	**N**
Children playing near the equipment?	**Y**	**N**	–	–

Y. Window position change from the **start** of sampling? **Opened** **Closed** **No Change**

Z. How much activity occurred in the sampled room? **None** **Occasional** **Frequent**

walk by equipment movement

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OUTSIDE SAMPLE LOCATION SITE SKETCH

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INSIDE SAMPLE LOCATION SITE SKETCH- Common Area

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NYC-WTC_000445196

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INSIDE SAMPLE LOCATION SITE SKETCH- RESIDENTIAL UNIT 1

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INSIDE SAMPLE LOCATION SITE SKETCH - RESIDENTIAL UNIT 2

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APPENDIX B

Screening Guidelines/Recommendations

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NYC-WTC_000445199

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Screening Guidelines/Recommendations

The screening guidelines that follow were developed for use in interpreting the results of the sampling effort. If contaminants are below screening guidelines, further health evaluation of the data is not necessary. If guidelines are exceeded, additional review of the data and the sample collection circumstances is necessary. If a guideline is exceeded, it does not automatically indicate that a health concern exists.

ASBESTOS

Interpretation of bulk and air samples: The following table provides a general guide for determining public health actions based upon sampling of both bulk material and indoor air. The table integrates the Environmental Assessment Workgroup multi-agency recommendations for reoccupation of residences in lower Manhattan (see attachment 1). It is important to note that the ultimate decision criteria for reoccupation is the ambient air level of asbestos. Bulk asbestos determinations are useful for (1) determining the potential for decontaminating ambient air and (2) for determining the type of further sampling needed.

In general the sampling and resampling strategy encompasses testing of bulk material and clean up until such a time that further clean up will not lower bulk asbestos levels. Confirmation is made by air sampling; reoccupation of residents is acceptable below 0.01 f / cc.

ATSDR, with multi-agency concurrence, has provided guidance for re-entry into New York City buildings and has concluded that the 0.1 f/cc OSHA PEL is not acceptable for schools or residences (see attachment 1 ATSDR, CDC, EPA, OSHA Environmental Assessment Workgroup Asbestos Action Levels for World Trade Center Response October 11, 2001).

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NYC-WTC_000445200

NYC-WTC_000445201

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Follow up Recommendations Based on Sampling Results from ATSDR's Residential Sampling

Asbestos level (bulk and air)	Sequential steps for follow up	Comments/Notes:
Settled dust > 1% asbestos w/w (PLM) and air any level	1. Clean-up 2. Resample air and bulk 3. Evaluate data 4 Determine next actions based on follow up recommendations	Clean-up should follow OSHA standards for training and worker protection and any state laws for licensing. Consideration should be given to removing hard to clean furnishings, like carpet and upholstery, if sampling data remains elevated after repeated cleaning
Settled dust >Detection Limit - 1% w/w (PLM) and air > 0.01 f/cc (TEM)	1. Clean-up 2. Resample air and bulk 3. Evaluate data 4. Determine next actions based on follow up recommendations	Consideration should be given to removing hard to clean furnishings, like carpet and upholstery, if sampling data remains elevated after repeated cleaning
Settled dust >Detection Limit - 1% w/w (PLM) and air <0.01 f/cc (TEM)	1. Evaluate all appropriate data related to asbestos (air, bulk, personal monitors - PLM, PCM, TEM) 2. Determine appropriate follow up based on professional judgement 3. If clean up is recommended, resample and reevaluate results	Special attention should be paid to hard to clean surfaces. (e.g., certain fabrics, furniture, carpet, and curtains).
Settled dust Non-detect (PLM) and air > 0.01 f/cc (TEM)	1. Clean-up 2. Resample air 3. Evaluate air data 4. Determine follow up actions	Remain advised of outdoor levels. If high levels are frequent retesting may be appropriate.
Settled dust Non-detect (PLM) and air <0.01 f/cc (TEM)	No further action	

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NYC-WTC_000445202

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Action Level & Analysis Method	General Public/Recommendations[1]	Supporting Information[2]	Comments
NYC Background[3] PCM/PCMe[4] f/cc (see footnotes 2 and 3)	• No restriction on access to any area.	AHERA standards (40 CFR 763); ATSDR Toxicological Profile for Asbestos; OSHA 29 CFR 1926.1101	• Remediation goal is to achieve background levels. • AHERA guidance for schools requires that when schools are remediated for asbestos, the indoor air levels of asbestos should be similar to local outdoor air levels. • Lowest attainable cancer risk
NYC Background to 0.01 f/cc PCM/PCMe[3]	• No restriction on access to streets and public/ commercial building; continue to monitor • Evaluate to determine if long-term access is acceptable; evaluate trends over months. ▪ Identify source ▪ Take action, as practical, to reduce levels to background	AHERA standards (40 CFR 763); ATSDR Toxicological Profile for Asbestos; IRIS; OSIIA 29 CFR 1926.1101	• No significant cancer risk for short-term occupancy for residential and school buildings. • AHERA guidance for schools requires that when schools are remediated for asbestos, the indoor air levels of asbestos should be similar to local outdoor air levels

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NYC-WTC_000445203

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70 structures/mm^2 TEM	• If < than 70 s/mm^2, no restrictions on access to buildings • If > 70 s/mm^2, resample to confirm and analyze field blanks; take action to identify source and reduce levels to < 70 s/mm^2	AHERA standards (40 CFR 763) NYC Clearance standard for buildings	• AHERA standards apply only to schools, and by NYC ordinance to buildings. • Method sensitivity and counting rules should follow Appendix A (Table 1) in AHERA 40 CFR 763; Method sensitivity based on # grids analyzed and air sample volume and must be maintained at 0.005 f/cc.
0.01 - 0.1 f/cc PCM/PCMe^3	• Continue to monitor; consider the need for additional sampling sites. • If air levels are consistently between 0.01 to 0.1 f/cc, evaluate the need for advisories, the need to limit access and the need for dust suppression..	Lowest limit set at 1/10 PEL/REL/TLV; AHERA standards (40 CFR 763); ATSDR Toxicological Profile for Asbestos; IRIS; OSHA 29 CFR 1926.1101;	• Long-term exposures may increase cancer risk in the general public. • Unlike workers the general population, includes children and sensitive persons, does not receive exposure monitoring and does not participate in annual health screening
> 0.1 f/cc PCM/PCMe^3	• Evaluate the need to restrict general public access. • Continue to monitor; consider the need for additional sampling sites..	Unacceptable cancer risk following long-term exposure; AHERA standards (40 CFR 763); ATSDR Toxicological Profile for Asbestos; IRIS; OSHA 29 CFR 1926.1101	General public should not be exposed to levels suspected of adverse health effects upon long-term exposure.

1. General public includes adults and children not directly involved in emergency response and recovery activities. 2. Documents and information that were considered in setting the action level. 3. Background levels for NYC are being determined. 4. PCM equivalents (PCMe) is determined using TEM analysis and counting fibers > 0.3) m in diameter and > 5) m in length. PCMe should be determined using consistent methods to provide comparable concentrations. If PCM is exceeded, may need to determine PCMe using TEM. Use professional judgement to determine if PCMe is needed by evaluating the frequency and magnitude of exceedance, size of geographic area involved, and trends in data.

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NYC-WTC_000445204

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Action Levels for Respirable Silica *General Public/Residents*		
Action Levels: Settled dust (XRD) and respirable silica < 4) m (NIOSH 7500)	**Steps for follow up**	**Comments/Notes**
Settled dust > 5% crystalline silica and Air > 50) g/m^3	1. Evaluate data, including trends over time 2. Evaluate need to warn sensitive groups (people with breathing problems) 3. Evaluate the need to restrict general public access 4. Identify source and take action to reduce levels below 6) g/m^3 5. Evaluate dust loading and silica content to determine if dust clean up is needed 6. Resample after actions have been taken, or if no action, continue to monitor to confirm elevated levels	Clean up should follow OSHA standards for training and worker protection and any state laws for licensing Consideration should be given to removing hard to clean furnishings, like carpet and upholstery, if sampling data remains elevated after repeated cleaning NIOSH REL occupational standard for 8 hour TWA exposure. Should limit exposure of general public to levels above occupational standards

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NYC-WTC_000445205

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Settled dust >5% crystalline silica and Air 6 to 49) g/m^3	1. Evaluate data, including trends over time 2. Evaluate need to warn sensitive group (people with breathing problems) 3. Identify source and take action to reduce levels below 6) g/m^3 4. Evaluate dust loading and silica content to determine if dust clean up is needed 5. Resample after actions have been take, or if no action, continue to monitor to confirm elevated levels	Lower limit for air considers detection limit and 1/10 NIOSH REL
Settled dust > 5% crystalline silica and Air < 6) g/m^3	1. No restrictions on access to any area 2. Evaluate dust loading and silica content to determine if dust cleanup is warranted 3. Air monitor under high activity conditions to determine if there is a potential for elevated silica in air due to dust content	Respirable silica defined as silica less than 4) m. Air action level set as close to 1/10 NIOSH REL as practical based on sampling methods (NIOSH 7500). Activity level, as well as dust content and loading, will influence air levels of silica. If air sampling was under aggressive conditions, this represents worse case and the area can be cleared.
Settled dust < 5% respirable silica and Air < 6) g/m^3	No further actions	Respirable silica defined as silica less than 4) m. Air action level set as close to 1/10 NIOSH REL as practical based on sampling methods (NIOSH 7500).

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NYC-WTC_000445206

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Particulate Matter (PM) Screening Guidelines for World Trade Center Response

Ambient Screening Guidelines ($\mu g/m^3$)	Outdoor Air General Public Comments/Recommendations	Indoor Air General Public Comments/Recommendations
Respirable Particulate 24 hour $PM_{2.5}$[1]		
40	● Compare results to representative background.** ● Use for evaluation of outdoor contribution to indoor concentrations ● Identify meteorological conditions and factors such as road traffic during sampling. [4] ●Compare to DEC monitors ● Consider re-sampling, exposure or trend analysis.	● Compare results to representative background.** ● Evaluate multiple source contributions (WTC, outdoor, candles, smoking,..).[3] ● Review pre-sampling questionnaire responses. ● Assess ventilation systems (heating and cooling). ● Recommend proper clean-up techniques be employed. ● Consider re-sampling and evaluate nearby residences/common areas.

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NYC-WTC_000445207

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Respirable Particulate $PM_{4.0}$[7]		
60	● Compare results to representative background.** ● Use for evaluation of outdoor contribution to indoor concentrations ● Identify meteorological conditions and factors such as road traffic during sampling. [4]	● Compare results to representative background.** ● Evaluate multiple source contributions (WTC, outdoor, indoor) ● Review pre-sampling questionnaire responses.
Thoracic Particulate 24 hour PM_{10} [1]		

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155	• Compare results to representative background.** • Identify meteorological conditions and factors such as road traffic during sampling. • Use for evaluation of outdoor contribution to indoor concentrations • Compare to DEC monitors	• Compare results to representative background.** • Review pre-sampling questionnaire responses. • Evaluate multiple source contributions (WTC, outdoor, indoor activities cooking [5],cleaning,..). • Assess ventilation systems (heating and cooling). • Recommend proper clean-up techniques be employed. • Consider re-sampling and evaluate nearby residences/common areas.
Inhalable Particulate 24 hour TSP [2]		
250	• Compare results to representative background.** • Identify meteorologic conditions, activities such as road traffic or construction activities during sampling. • Assess the need for dust suppression procedures.	• Compare results to representative background.** • Assess ventilation systems (heating and cooling). • Consider evaluating with modification to occupational standards. [6] • Recommend proper clean-up techniques be employed. • Consider re-sampling after clean-up has occurred.

** As sampled in "Ambient and Indoor Sampling for Public Health Evaluations of Residential Areas Near WTC."

[1] National Ambient Air Quality Standard (NAAQS)

[2] Total Suspended Particulates, New York State Ambient Air Quality Standard

[3] The range of ratios reported in the 1996 and 2001 draft Ambient Air Criteria Documents for Indoor and Outdoor concentrations of $PM_{2.5}$ could be used to select a multiplier to be applied to the area level of concern. While estimates (from a limited number of studies) range from slightly less than one, to two (higher if smoking

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NYC-WTC_000445209

households are included), 1.5 is proposed as the multiplier, resulting in a value of 60 $\mu g/m^3$ (It may be necessary to revisit this value if the ratio for the control homes differs from the historical data, or if EPA has additional information that would support a different multiplier.). Contribution from a smoker in the home was estimated in various studies described in the 1996 Criteria Document for PM as contributing 20 to 45 $\mu g/m^3$ to $PM_{2.5}$ time-averaged measurements (12-24 hour samples).

[4] The concentration of PM at street level monitors can vary greatly from concentrations measured at monitors sited in accordance with EPA's requirements. The influence of traffic (how much, what types of vehicles), the presence of bus stops or traffic lights and wind patterns associated with "urban canyons" are all factors that will influence particle concentrations at street level. Of the limited number of studies identified that looked at differences between area and street-level monitoring results, street level results were reported to be about 1.3 times higher than area type monitor results for the same time period. From historical data collected in Manhattan at a rooftop monitor and a street level monitor the ratio for average street/area concentrations of PM_{10} was about 1.3, and about 1.5 for $PM_{2.5}$. Limited data for an additional street-level monitor in NYC produced similar ratios for each particulate fraction.

[5]Cooking was estimated to add 10-20 $\mu g/m^3$ to 12- hour PM_{10} concentrations.

[6] The ACGIH TLV (8 hour TWA) for inhalable particulate matter, not otherwise classified is 10 mg/m^3, and is intended to be protective against worker irritation. A screening value could be developed by applying uncertainty factors such as a ten-fold uncertainty factor for sensitive sub-populations or for longer than work day exposures.

[7] Developed by assuming a straight line correlation between $PM_{2.5}$ and PM_{10} and then using the associated line slope factor to determine the screen guideline. The guideline was rounded down to the nearest whole ten number.

*Screening Guidelines = are levels for the general public that require further evaluation. Levels measured above a screening value does not indicate that adverse health effect will result.

** As sampled in "Ambient and Indoor Sampling for Public Health Evaluations of Residential Areas Near WTC."

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pH Guidelines

The pH of a substance represents the hydrogen ion concentration of the substance. The range of pH values is generally from 0 to 14 with 7 being considered a neutral pH. Substances with a pH of less than 7 are considered to be acidic and will yield hydrogen ions when they are in solution. Acids will change litmus paper red. A base is a substance with a pH greater than 7 and will yield hydroxyl ions in solution. Bases will react with acids to form salts and water. In the body, a normal balance between acids and bases is maintained that keeps the extracellular fluids in the body with a pH between 7.35 and 7.45. A pH out of this range indicates a state of acidosis or alkalosis. Regulation of the pH in the body depends on the function of the lungs and the kidneys.

Guidelines for the interpretation of the pH values of the dust samples being proposed are included in this plan to assist in defining what role if any that the pH may be in the irritant properties of the dust. An irritant effect is one where the tissue has been stimulated and responds with a reversible inflammatory response. Common symptoms from exposure to an irritant are cough, burning of eyes, nose, & throat, tearing, dyspnea, and wheezing.

There are very few standards for the regulation of the pH of a substance. The national Secondary Drinking water standards set the pH range at 6.5 - 8.5. EPA has established guidelines for the testing of the acute dermal irritation and the acute eye irritation properties of substances. Those guidelines state that it is not necessary to test substances with a pH of less than 2.0 or greater than 11.5 as they are known to be corrosive. A corrosive is a highly reactive substance that causes irreversible damage to living tissue after less than 4 hours of exposure. Using this information as a basis, the following guide is proposed:

pH	Acid/base	Properties
0 - 2.0	Strongly acidic	Corrosive
>2.0 - 6.5	Weakly acidic	Irritant
>6.5 - 8.5	Neutral	
>8.5 - 11.5	Weakly basic	Irritant
>11.5	Strongly basic	Corrosive

To put these levels into perspective, the pH of some common substances is included below.

Substance	pH
Gastric Juice	1.4

Lemon Juice	2.4
Vinegar	3.0
Tomatoes	4.2
Rain	5.5
Blood or Tears	7.0
Household Ammonia	11.5
Household Bleach	12.5