Ambient and Indoor Sampling for Public Health Evaluations for areas near WTC
DRAFT ATSDR/DHAC Version 8, October 15, 2001

I. Introduction:

This sampling protocol was developed to address materials in airborne and settled surface dust that entered residential/commercial areas following the collapse of the World Trade Center (WTC) buildings. The collapse of the WTC buildings resulted in a large number of residents and office workers being evacuated from their homes. Since the collapse, some residents have not reoccupied their apartments/homes near the WTC. Others have either visited to assess damage or to clean. Many have reoccupied their homes, and it is anticipated that more and 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 air sampling for asbestos in a number residential/commercial areas. Additional environmental sampling is necessary to ensure that residential areas are not adversely impacted by WTC collapse-related materials.

Surface dust and debris containing <1-4% asbestos have been found in lower Manhattan. Asbestos has been detected in personal air samples of "hot-zone" workers. In addition, low levels of asbestos have been detected in air samples collected on the "hot-zone" perimeter. Crystalline silica quartz has been detected in some of the 30 settled dust samples collected by NIOSH. Although most samples contained less than 5%, some samples contained from 15-20% crystalline silica quartz. Detectable levels of crystalline silica have not been found in the few personal air samples from the work site that have been analyzed for it to date.

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), PAHs, dioxins and PCBs. The low levels of these contaminants 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 may cause eye, nose, and throat irritation. Materials that can be inhaled or respired from airborne dust may cause respiratory irritation and may cause 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 necessary to determine 1) if residents are being exposed to concentrations of materials that may be of public health concern; 2) whether areas already cleaned (inside and outside environments) contain materials that may be of public health concern; and 3) to provide and explain this information to the public.

Information from a south Battery Park resident supports the need to assess indoor and outdoor environmental health issues. Burning throats have been reported to be a common problem in the

materials in Dust.

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recently re-occupied residential areas. Residents in south Battery Park, who left windows open prior to 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 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. Finally, streets, sidewalks and other open spaces are periodically cleaned (HEPA vacuum trucks) and wetted (water trucks). However, the resident and others have reported swirling dust throughout the area.

II. Sampling Objective:

The **overall objective** of this sampling is to provide results upon which public health agencies can 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) that remain in residential areas and commercial areas of lower Manhattan from the collapse of the World Trade Center. 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 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 and ending in neighboring boroughs. Section V, Residence Selection/Sampling rationale, of this protocol describes this approach.

III. Data and Quality Assurance:

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 variability of contaminants in air.

At least two field blanks (or 10% of samples submitted, whichever is greater) per sample location will be submitted with the air samples. Blank cassettes should be opened at the same time as the sample cassettes are opened (just prior to sampling). Blank cassettes and their covers should be 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

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volume calculations.

Dust samples will be collected using the EPA ERT indoor dust sampling 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.

Chain of custody will be established and maintained throughout sample collection, transport, and analysis of the samples.

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

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

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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
	Total Suspended particulates	breathing ht., Continuous, real-time, air	O	Characterize amount of airborne dust that is inhalable (≤100 µm aerodynamic diameter)
	PM10 and PM2.5	breathing ht., Continuous, real-time, air	O	Characterize the amount of airborne dust that is respirable
	Inhalable (<100µm)* thoracic (<10µm)* respirable (<4µm)*	breathing ht., time-weighted, air	I/O	To determine relative amounts of each fraction present and to have each fraction analyzed for silica, gypsum, asbestos, 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 ENT irritation
	Asbestos**	dust	I/O	Determine if asbestos is present in dust
Delete?	**gypsum, mica, fiberglass, calcite****	**dust**	**I/O**	**Associated with building materials (concrete, drywall) and known to be irritating to ENT**
	magnesium	**dust**	**I/O**	**May act as a tracer for WTC-related dust, levels found in metals analysis of settled dust from 16,000-29,000 ppm**

* 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 NYC DOH. The NYCDOH approach is described as follows: Approximately 60 residential units will be sampled. A series of **three** concentric circles is being drawn around the WTC location. These circles will be divided into North, South, and East transects. Approximately three residential buildings will be selected for testing from within each area.

Testing locations will mainly focused on occupied residences. However, approximately five unoccupied units nearest the WTC will be targeted for testing. In addition, approximately ten units will be selected outside of the concentric circles, in neighboring boroughs, to serve as background sample locations.

It should be noted that contaminant/materials of concern may vary as the distance of the residence increases from the WTC.

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

VI. Sampling/Analysis Approach:

1. Interior

Air and dust sampling will focus on both common/high traffic areas of 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 visible dust is and is not reported. Selecting entryways and common areas should be representative of worst case conditions for contaminant/material track-in from outdoors. Selecting apartments/units in the same building should provide information the ranges found in indoor living spaces.

If the building is unoccupied, 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 HVAC system 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 method 7400. If an action level is exceeded subsequent filter analysis using NIOSH 7402 to determine if the fibers present are asbestos. Respirable crystalline silica will be sampled and analyzed using NIOSH method 7500. Air sampling for inhalable, thoracic, and respirable size particles will be conducted using the IOM sampler. The relative amounts (percent weight) of each fraction present will be determined. Each fraction will be analyzed for silica, gypsum, mica, fiberglass, and calcite using XRD.

Indoor floor dust samples will be collected using EPA's Environmental Response Team (ERT) SOP for household dust collection (attached). As much dust as possible will be collected; the area vacuumed will be measured and reported. Samples will be analyzed for asbestos, crystalline silica, gypsum, mica, fiberglass and calcite using XRD. The pH of the dust will be tested using

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EPA SW846 Method 9045C.

2. Exterior

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 method 7400. If an action level is exceeded subsequent filter analysis using NIOSH 7402 to determine the amount of asbestos fibers present. Respirable crystalline silica will be sampled and analyzed using NIOSH method 7500. Twenty four-hour real-time TSP, PM10 and PM 2.5 sampling will be conducted–again at breathing zone height.

Settled surface dust samples will be collected by scraping visible dust into a glass container. A minimum of 25-30 grams of sample is required. Samples will be analyzed for asbestos, crystalline silica, gypsum, mica, fiberglass and calcite using XRD. The pH of the dust will be tested using EPA SW846 Method 9045C.

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Sample/Analytical Methods [NOTE: screening levels dictate detection/quantitation limit needs]

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
Total Suspended Particulates	O air	EPA Method # (continuous realtime) Breathing zone sample height	24-hr	
PM10 and PM2.5	O air	EPA Method # (continuous real-time) Breathing zone sample height	24-hr	
Inhalable (<100µm) thoracic (<10µm) respirable (<4µm)	I/O air	IOM personal sampler. Analyze each fraction for asbestos,(TEM), and for crystalline silica, gypsum, fiberglass calcite (XRD)	2 L/min -5 hr (600L)	30 ug / 50 ug/m^3
Respirable crystalline silica	I/O air	NIOSH 7500	2.5 L/min-5.3 hr(800L)	5 ug / 6 ug/m^3
pH	I/O dust	EPA SW 846 Mtd 9045C (soils)	10-25 g	
asbestos	I/O dust	PLM, and if <1% TEM	"	
asbestos, gypsum, mica, fiberglass calcite	I/O dust	XRD	"	

* LOD:Limit of analytical detection; LOQ: Limit of analytical quantitation
** I: indoor; O: outdoor

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VII. Screening Levels/Data Interpretation:
Screening levels will be developed for respirable crystalline silica and PM in air; and for asbestos in vacuum dust and outdoor surface dust samples.

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

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

If results of testing show contamination/materials present at levels of concern, efforts should be made to reduce these levels and to take steps that eliminate transporting them indoors (e.g,. reduce contaminant track in by removing or changing shoes prior to entering residence, use HEPA filters on HVAC systems, keep windows closed).

VIII. Interference from existing bldg 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 IX, Sample Description Needs).

To better determine if contaminants/materials found are within area background levels, approximately ten residential units outside of the concentric circle zones will be selected testing (indoor air and surface dust, outdoor air and surface dust).

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IX. Sample Description Needs:

In order to interpret results, the following information should accompany each area sampled:

1. Reason for selection of site for sampling (e.g., apartment had windows open or broken during the WTC event; visible dust present in ambient air adjacent to apartment building)

2. Description of sample location
   - Physical address
   - Apartment/floor number
   - Side of building (N, S, E, W)
   - Main entryway

   Sketch of area showing sample location

3. NYDEP check list/building inspection report

4. For indoor sample locations, provide the following:
   - Has area been cleaned since WTC event?
   - Date(s) of cleaning
   - If so, description of cleaning
     - wet mopping
     - dusting
     - sweeping (Broom, vacuum, HEPA vacuum)
     - carpets washed
   - Who conducted the cleaning
   - Is visible dust present?
     - If so, describe

   During sampling, if resident(s) are present, describe activities during sampling (e.g., cooking with/without exhaust fan, using fireplace, smoking, cleaning/vacuuming)

   Residents should be advised not to burn candles, incense, etc., during air sampling

5. For entryway sampling locations (e.g., lobbies)
   - Is there evidence of dust track-in from outdoors
   - Same questions as #4

6. For outdoor sampling, provide the following:
   - Location of samples relative to main entryways of residential buildings
   - Side of building (N, S, E, W)
   - Location of samples relative to roadways
   - Location of samples relative to dust-generating activities (e.g,. construction)
   - Is visible dust present (air, surfaces)
     - If so, describe

7. Description of HVAC system

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Single or multi-unit system (if multi-unit, how many?)
Location of HVAC air handling unit (e.g., in each unit, in each window, on roof-top)
Description of conditions around HVAC air handling unit (e.g., heavy dust, no apparent dust)
Location(s) of intake(s)
Location(s) of discharge(s)
Date of last filter cleaning or filter replacement
Filter type (e.g., electrostatic)
Filter condition (visible dust present?)
Has it been in use since the WTC event?
If so, is it recirculating air or drawing from the outside?

8. Description of localized contributions to materials of interest (provide description and materials used)
Nearby construction
Remodeling activities
Road work

9. Weather prior to and during sampling
ambient sampling should be avoided during or just following rain events
date of last rain event
wind velocity and direction

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