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Ambient and Indoor Sampling for Public Health Evaluations of Residential Areas Near WTC

I. Introduction:

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 reoccupied their apartments/homes near the WTC. Many of these residents have either visited to assess damage or to clean. Many have reoccupied 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 “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. 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), PAHs, dioxins and 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) determine if residents are being exposed to concentrations of materials that may be of public health concern; 2) determine whether areas already cleaned (inside and outside environments) contain materials that may be of public health concern; and 3) provide information to the public on the potential health implications (or lack of implications) of the sample results.

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Information from residents support 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 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 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 and ending in neighboring boroughs. 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:

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 +/- 20% of each other.

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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 volume calculations.

Dust samples will be collected using the 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:

<u>Parameter</u>	<u>Sample Type</u>	<u>Indoor/Outdoor</u>	<u>Rationale for Selection</u>
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
on hold? Total Suspended particulates	breathing ht., Continuous, real- time, air	O	Characterize amount of airborne dust that is inhalable ($\leq 100 \mu\text{m}$ aerodynamic diameter)
PM10 and P ₁ 12.5	breathing ht., Continuous, real- time, air	O	Characterize the amount of airborne dust that is respirable
Inhalable ($<100\mu\text{m}$)* thoracic ($<10\mu\text{m}$)* respirable ($<2.5\mu\text{m}$)*	breathing ht., time-weighted, air	I/O	To determine relative amounts of each 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 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
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 general NYCDOH approach is described as follows: A total of approximately 60 residential units will be sampled (a **unit** is an individual apartment or a common area 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 ten units will be selected outside of the concentric circles, in neighboring boroughs or communities, 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. Section VII of this plan contains the information needed/requested.

It should be noted that types of contaminant/materials and their concentrations may vary as the distance of the residence from the WTC increases.

VI. Sampling/Analysis Approach:

1. Indoor

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 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 several 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, 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'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 method 7400. If an action level is exceeded subsequent filter analysis using NIOSH 7402 to determine if the fibers present are asbestos will be conducted. Respirable crystalline silica will be sampled and analyzed using NIOSH method 7500. Air sampling for inhalable, thoracic, and respirable size

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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 X-ray diffraction (XRD) analysis.

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, fiberglass and calcite using XRD. Asbestos will be analyzed using NIOSH Method 9002 (PLM); if <1% is found, 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 method 7400. If an action level is exceeded subsequent filter analysis using NIOSH 7402 to determine the amount of asbestos fibers present will be conducted. 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 X-ray diffraction (XRD) analysis.

ON HOLD? Twelve-hour, continuous, 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 crystalline silica, gypsum, mica, fiberglass and calcite using XRD, and for asbestos using NIOSH Method 9002 (PLM). If PLM shows less than <1%, analyze for asbestos using TEM. The pH of the dust will be tested using EPA SW846 Method 9045C.

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Sample/Analytical Methods

<u>Parameter</u>	<u>Environmental Media</u>	<u>Sampling/Analytical Method</u>	<u>Sample Flow/time</u>	<u>Analytical LOD / LOQ*</u>
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 ON HOLD?	O air	EPA Method # (continuous realtime) Breathing zone sample height	12-hr	
PM10 and PM2.5 ON HOLD?	O air	EPA Method # (continuous real-time) Breathing zone sample height	12-hr	
Inhalable (<100µm) thoracic (<10µm) respirable (<2.5µm)	I/O air	IOM personal sampler. Analyze each fraction for crystalline silica, gypsum, fiberglass, and 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	NIOSH 9002 (PLM), and if <1% TEM	“	
silica, gypsum, gypsum, fiber-glass, calcite	I/O dust	XRD	“	

* 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)

*** I: indoor; O: outdoor

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VII. Interference from existing bldg materials:

It is anticipated that some of the contaminants/materials found in this sampling effort will be unrelated 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 ten residential units outside of the concentric circle zones will be selected testing (indoor air and surface dust, outdoor air and surface dust). Background levels, along with specific sample location information will be considered when data interpretation is conducted.

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VIII. Information Needs for Samples/Sample Locations:

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

A. Sample Collection Assessment Form

1. Description of 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)

☐ Occupied residence
☐ Unoccupied residence
☐ Common area

Justification for sample location (describe):

2. Physical address

3. Apartment/floor number/common area location

4. Contact Phone #

5. Side of building (N, S, E, W)

6. Is visible dust present (air, surfaces)

☐ Yes ☐ No
 If YES, describe

7. Was HVAC fan in operation during entire sampling event?

☐ Yes ☐ No
 If NO, how was the fan running (hrs.): _____

8. For surface dust sampling, measurement of area sampled (square meters or square feet) _____

9. Sketch of area showing air and surface dust sample locations

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For outdoor sampling, provide the following:

10. Location of samples relative to main entryways of residential buildings
11. Side of building (N, S, E, W)
12. Location of samples relative to roadways
13. Location of samples relative to dust-generating activities (describe activities)
 - _____ construction
 - _____ Remodeling
 - _____ Roadwork
 - _____ Other (describe)
14. Is visible dust present (air, surfaces)
 - Yes No
 - ~~If YES~~, describe
15. Weather prior to and during sampling
 - (Avoid ambient sampling during or just following rain events)
 - _____ date of last rain event
 - _____ wind velocity and direction
16. Sketch of area showing air and surface dust sample locations

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B. Information Needed from Occupant/Resident

1. Has area been cleaned since WTC event

☐ Yes ☐ No

2. If YES to Question 1,

_____ Date(s) of cleaning

3. Description of cleaning

☐ wet mopping

☐ dusting

☐ sweeping (Broom, vacuum, HEPA vacuum)

☐ carpet cleaner

☐ appliances cleaned (surface and beneath, including refrigerator coils, dryer vents)
(describe)

☐ furniture removed/cleaned (describe)

☐ window treatments (curtains, etc) removed/cleaned (describe)

☐ Other (describe)

4. Who conducted the cleaning

☐ Tenant/occupant

☐ Building owner/operator

☐ Cleaning company (provide name)

5. Was visible dust present prior to cleaning?

☐ Yes ☐ No

If YES, describe

6. Is dust still present?

☐ Yes ☐ No

If YES, describe

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7. Is your HVAC (heating/AC) system in your apartment/condominium (vs. a bldg-controlled system)?

Yes No

If YES, what type of filter do you have (describe)?

Name _____

Size _____

Type _____

What was the date of the last filter change? _____

Have you been using your HVAC system since the WTC event?

Yes No

If YES, is it _____ recirculating air or _____ drawing from the outside?

Has the HVAC system been service or cleaned since the WTC event?

Yes No

Have the ducts been cleaned since the WTC event?

Yes No

If YES, provide date(s) of cleaning _____

8. Do you or does anyone who lives here, or visits frequently, smoke tobacco products?

Yes No

9. During this air and dust sampling, did you:

Cook on the stove

Yes No

If yes, was the exhaust fan on

Yes No

Have a fire in your fireplace

Yes No

Smoke cigarettes or other tobacco

Yes No

Clean or vacuum

Yes No

If yes, describe _____

Burn candles, incense, etc.

Yes No

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Open your windows

☐ Yes ☐ No

Turn off the HVAC (heating/AC) system fan (it should be on during the entire sampling period)

☐ Yes ☐ No

If YES, what time did you turn off the system _____

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C. Information Needed from Building Owner/Operator—for general bldg condition, common areas of the building, and heating/air system descriptions

Note: Please provide the sampling team with a copy of your latest NYDEP check list/building inspection report

1. Has the building interior been cleaned since WTC event

☐ Yes ☐ No

2. If YES to Question 1,

Date(s) of cleaning

What areas were cleaned (describe)?

e.g., common areas (entryways, lobbies, hallways, etc), individual apartment units

3. Description of cleaning

☐ wet mopping

☐ dusting

☐ sweeping (Broom, vacuum, HEPA vacuum)

☐ carpet cleaner

☐ furniture removed/cleaned (describe)

☐ window treatments (curtains, etc) removed/cleaned (describe)

☐ Other (describe)

4. Who conducted the cleaning

☐ Tenant/occupant

☐ Building owner/operator

☐ Cleaning company (provide name)

5. Was visible dust present before cleaning?

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☐ Yes ☐ No

If YES, describe (include location(s))

6. Is dust still present?

☐ Yes ☐ No

If YES, describe (include location(s))

7. Is there a building-wide HVAC system (as opposed to each apartment having separate systems)?

☐ Yes ☐ No

If YES, has the HVAC system been used since the WTC event?

☐ Yes ☐ No

Has the HVAC system been service or cleaned since the WTC event?

☐ Yes ☐ No

Has the system been _____ recirculating air or _____ drawing from the outside?

If recirculating, what % of air was recirculated? _____

What type of filter(s) are in the system (describe)?

Name(s) _____

Size(s) _____

Type(s) _____

What was the date of the last filter change (or range of dates if multiple units involved)?

Have the ducts been cleaned since the WTC event?

☐ Yes ☐ No

If YES, provide date(s) of cleaning _____

8. During this air and dust sampling, was there:

Foot traffic (people leaving/entering the common spaces being tested)

☐ Yes ☐ No

Likely cigarette or other tobacco smoking

☐ Yes ☐ No

Cleaning or vacuuming

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Yes No
If yes, describe

Use of candles, incense, etc.

Yes No

Open windows

Yes No

Open doors

Yes No

Turn off the heating/AC system fan (it should be on during the entire sampling period)

Yes No

If YES, what time did you turn off the system

9. Have you seen evidence of dust being tracked into the building since the WTC collapse?

Yes No

If YES, name/describe the entryway locations

Describe the material being tracked indoors

Is the material still being tracked indoors?

Yes No Can't tell

10. Has the exterior of the building been cleaned since WTC event?

Yes No

11. If YES to Question 10,

Date(s) of cleaning

12. Description of cleaning

sweeping

vacuuming

water spray

high pressure wash

Other (describe)

13. Who conducted the cleaning

Building maintenance

Cleaning company (provide name)

Other (describe)

14. Was visible dust present?

Yes No

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If YES, describe

15. Is dust still present?

☐ Yes ☐ No

If YES, describe

16. Have the **grounds** of the building been cleaned since WTC event?

☐ Yes ☐ No

17. If YES to Question 10,

☐ Date(s) of cleaning

18. Description of cleaning

☐ sweeping
☐ vacuuming
☐ water spray
☐ high pressure wash
☐ Other (describe)

19. Who conducted the cleaning

☐ Building maintenance
☐ Cleaning company (provide name)
☐ Other (describe)

20. Was visible dust present?

☐ Yes ☐ No

If YES, describe

21. Is dust still present?

☐ Yes ☐ No

If YES, describe

22. Have there been any recent or ongoing construction or remodeling activities inside or outside the building?

☐ Yes ☐ No

If YES,

☐ Date(s) of activities
☐ Describe activities, including location(s):

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IX. Community Notification of Results:

The analytical results along with a public health interpretation will be provided to the community in several different ways. Each participant who allowed sampling in their home will be provided with their individual results. Each building owner/operator will be given results of all sampling conducted 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; 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 *4-6 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.

X. Screening Values/Data Interpretation/Recommended Actions:

Screening levels and actions are outlined in Section XI of this proposal.

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

- 1) Indoor sample results will be compared to background and evaluated on a residence-by-residence basis (for the individual occupants)
- 2) All indoor data will be compared to background and evaluated to determine any public health implications for residents near the WTC
- 3) All outdoor data will be compared to background and evaluated to determine any 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.

For 1 through 3, above,

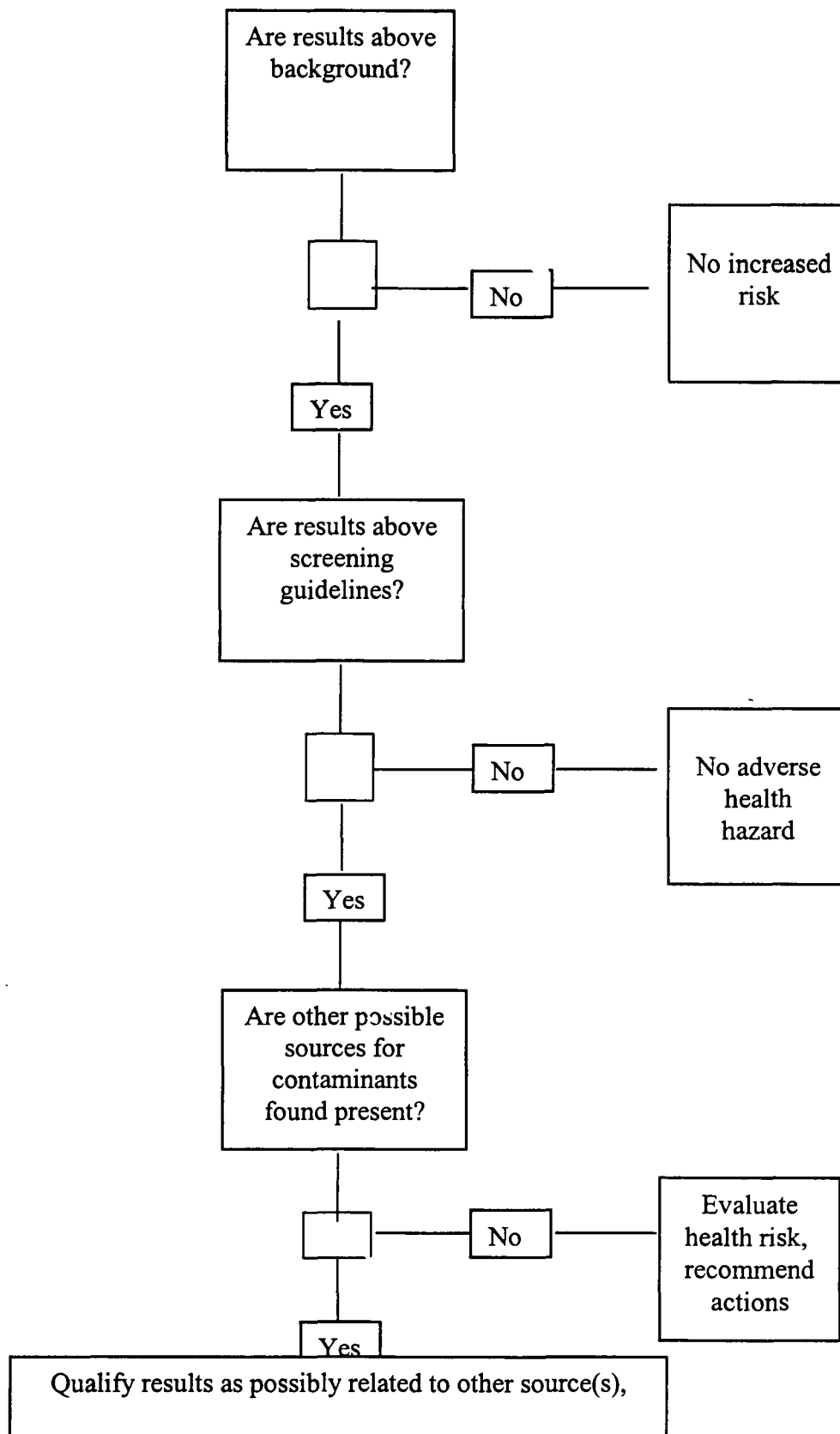
Sample results will first be compared to the results from background locations. If results are less than or within those found in background locations, then the health interpretation will stress that there is no indication that the resident(s) in the area tested are at any increased risk compared to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

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If sample results are higher than background, the results will be compared to health 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 (Section VIII) 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. *Note: we are working on an example PHI statement.*

If levels of contaminants are found outdoors that exceed background and 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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XI. Screening Guidelines/Recommendations:

The remaining pages of this document are draft, public health-based screening guidelines that are being 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.

Note: these guidelines are undergoing review and comment—they have not been updated from the previous version of this document