130 Liberty Street

New York, New York

Initial Building Characterization Study Report

VOLUME I: Study Report Text, Tables, and Figures

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EXECUTIVE SUMMARY

In its role as an Environmental Consultant, the Louis Berger Group, Inc. (Berger) was retained and authorized by the Lower Manhattan Development Corporation (LMDC) to conduct an *Initial Building Characterization Study* (the Study) at the building located at 130 Liberty Street (the Building), which is scheduled for cleaning and deconstruction. The Building is a 40-story, approximately 1.4 million square foot (SF) office building, with two basement levels, located in Lower Manhattan, one block south of the World Trade Center (WTC) site. Until 1999, the Building, which was built between 1973 and 1974, was owned by the Banker's Trust Corporation. In 1999, Deutsche Bank acquired the Building and owned it until August 31, 2004, when it was sold to LMDC.

The events of September 11, 2001, which caused the destruction of the WTC Towers, physically destroyed portions of the interior and exterior of the Building and exposed it to a combination of soot, dust, dirt, debris, and contaminants. Deutsche Bank, the owner of the Building on September 11, 2001, disputed with its property insurance carriers about the extent of the damage to the Building, and whether or not it could be reoccupied. Deutsche Bank took the position that the damage to the Building was so severe and the contamination so extensive that the Building could not be reoccupied and thus must be demolished and replaced. The insurance carriers took a contrary stance that the Building's damage and contamination were similar to other buildings in the area and as such could safely and effectively be cleaned and reoccupied. The differences in opinion between Deutsche Bank and its insurers led to litigation. In preparation for litigation, both Deutsche Bank and its insurers performed environmental investigations of the Building to determine the nature and extent of the contamination.

In late 2003, Governor George Pataki appointed Senator George Mitchell to mediate the dispute between Deutsche Bank and its insurance carriers in order to progress with the planned WTC Memorial and Redevelopment Plan. With the support and assistance of LMDC, Senator Mitchell resolved the dispute, which allowed LMDC to acquire the Building in anticipation of its cleaning and deconstruction, with a commitment by Deutsche Bank's insurers to cover any required costs in excess of an agreed upon amount. The Building, as part of the WTC Memorial and Redevelopment Plan, is scheduled for cleaning and methodical deconstruction.

To ensure a safe and timely cleaning and deconstruction effort, LMDC retained Berger to perform an independent environmental investigation of the Building. The investigation included the inspection, sampling, and analysis of suspect asbestos-containing materials (ACM) and potentially contaminated dust, as well as visual observations of the presence of mold on exposed surfaces. Because LMDC was not the owner of the Building prior to August 31, 2004, the initial investigation was limited to the accessible portions of the Building.

The results of the sampling and testing performed for this Initial Building Characterization Study revealed levels of contaminants that must be addressed in the deconstruction of the Building.

Approximately 2,000 bulk samples of suspect building materials were collected and analyzed for asbestos using the Polarized Light Microscopy (PLM) and/or Transmission Electron Microscopy (TEM). The majority of samples tested negative for asbestos, including spray-on fire-proofing, wall-board, roofing materials, and most thermal insulation for piping and ducts. Other building materials tested contained greater than one percent asbestos and are considered ACM. Altogether, an approximate total of 155,000 SF of flooring and wall materials and 95,000 linear feet (LF) of caulk, insulation, and sealant materials were identified as ACM.

The dust was sampled throughout the Building and analyzed for five Contaminants of Potential Concern (COPCs) designated by the United States Environmental Protection Agency (EPA) as being associated with WTC dust (i.e., asbestos, dioxins, lead, polycyclic aromatic hydrocarbons (PAHs), and crystalline silica), as well as other contaminants suspected of being present in the Building, including polychlorinated biphenyls (PCBs) and heavy metals (barium, beryllium, cadmium, chromium, copper, manganese, mercury, nickel, and zinc).

A total of 815 bulk samples of the settled dust were collected and analyzed at a laboratory via PLM analysis. The PLM analysis is specified by the EPA, the New York City Department of Environmental Protection (NYCDEP), and the New York State Department of Labor (NYSDOL) for quantifying asbestos in bulk dust samples. Although trace amounts of asbestos were identified in some of the samples, there were no samples that contained greater than one percent asbestos via PLM analysis.

In addition to PLM testing, the Study also included TEM analysis of the dust for asbestos. The EPA (AHERA) and New York State Department of Health (NYSDOH) recognize TEM to be a more precise methodology; PLM is not the best analytical technique available to determine concentrations of asbestos fibers in WTC dust. Friable WTC dust in concentrations less than or equal to 1% asbestos still have a significant potential to generate elevated airborne concentrations when disturbed. Forty supplemental screening samples of the settled dust were collected from porous and non-porous surfaces and analyzed for asbestos using TEM. The results revealed detectable levels of asbestos that must be addressed in the deconstruction of the Building. The highest concentrations of asbestos were identified in the first and second floors, fifth floor mechanical room, and $40^{th}/41^{st}$ floor mechanical room.

In addition to the asbestos samples, 844 bulk samples of the settled dust were also analyzed for four other COPCs designated by the EPA as being associated with WTC dust (i.e., dioxins, lead, PAHs, and crystalline silica), as well as other contaminants suspected of being present in the Building, including PCBs and heavy metals (barium, beryllium, cadmium, chromium, copper, manganese, nickel, zinc, and mercury). The results revealed detectable levels of these contaminants that must be addressed in the deconstruction of the Building.

Detectable levels of silica, PAHs, dioxins, PCBs, and heavy metals, including mercury were identified in dust above and below the suspended ceilings (with the area above the suspended ceilings also being referred to as the "plenum"). The levels of the contaminants in the dust samples vary throughout the Building. These findings are consistent with studies conducted previously by others revealing the highly variable nature of contaminant levels in WTC dust. The variations in contaminant levels found are consistent with the level of disturbance that has occurred within the Building since September 11, 2001, including the cleaning of the "Gash Area."

The EPA has published residential background levels (estimated pre-existing levels) and residential benchmark levels (potential health-based cleanup target levels) for many of these contaminants in WTC-related reports. While these levels are not directly applicable to a commercial deconstruction project, these studies can be used to put the results of this Study into relative context. The specific analytes consistently found at levels above the available criteria were asbestos (levels in dust exceed in 24 of the 31 floors tested [77%]), dioxin (exceeds in 123 of 125 samples [99%]), lead (exceeds in 121 of 125 samples [97%]), quartz (exceeds in 111 of 118 samples [94%]), PAHs (exceeds in 100 of 125 samples [80%]), chromium (exceeds in 38 of 125 samples [30%]), and manganese (exceeds in 26 of 125 samples [21%]). Nickel, beryllium, and PCBs did not exceed available criteria in any of the samples tested. PCB levels were compared to the EPA spill cleanup criteria. All other analytes (cristobalite, barium, cadmium, copper, zinc, and mercury) exceeded available criteria in less than 5% of the samples tested.

In addition to the sampling of dust, a preliminary screening for mercury vapor was performed subsequent to LMDC's acquisition of the Building. The screening was performed to evaluate potential worker health and safety issues associated with mercury vapor because of its unique characteristic as a heavy metal that vaporizes at room temperature. Based on the measurements obtained from a direct-read screening device, there were no detectable mercury vapor levels in the open spaces within the Building.

Further testing is necessary to completely develop the cleaning and deconstruction plan. To this end, LMDC and Berger are currently working to develop and implement a supplemental investigation program that, at a minimum, will involve obtaining access to previously inaccessible surfaces and interstitial spaces—including the curtain wall, interior walls, the exterior of the Building, and cell systems and raceways within the concrete slabs–for testing of all of the constituents addressed in the Initial Building Characterization Study (asbestos and other analytes as well as visual inspection for mold). Berger also recommends additional testing to characterize waste materials to be removed from the Building for handling, transportation, storage, and disposal or recycling. The additional information provided from this supplemental testing and inspection program will be shared with the deconstruction contractor, regulatory authorities, and the public, as part of the finalization and implementation of the cleaning and deconstruction plan.

Based on the results of this Study, Berger offers the following recommendations:

- LMDC should continue to maintain a health and safety plan and external air monitoring program. LMDC should review and modify its health and safety plan and external air monitoring program as appropriate to address all of the conditions identified in this Study;
- LMDC should continue to review and address the potential for release of contaminants from the Building;
- LMDC should further develop and implement an emergency action plan for the Building;
- LMDC should conduct further testing as recommended in this Study;
- LMDC should further develop its plan for cleaning and deconstruction and address the contaminants identified in this Study and in the further testing;
- LMDC should continue to consult with all appropriate regulatory agencies (e.g., NYCDEP, NYSDOL, EPA, New York State Department of Environmental Conservation (NYSDEC), and Occupational Safety and Health Association (OSHA)) in order to prepare specific cleaning, deconstruction, and environmental monitoring protocols;
- In connection with the deconstruction plan, LMDC should further develop appropriate site-specific health and safety plan documents (including establishing the organizational and procedural safeguards to be implemented to ensure the protection of site workers and the surrounding community);

- In connection with the deconstruction plan, LMDC should further develop appropriate work and site operations plan documents to cover such items as work area controls/limitations, decontamination facilities, engineered containment and control systems, monitoring programs, emergency/contingency plans, waste management, and assurances that the work will comply with all applicable federal, state, and local regulations;

- LMDC should file appropriate notifications and obtain necessary permits, including the Asbestos Control Program 7 (ACP-7), from the appropriate regulatory agencies;

- As currently contemplated, LMDC should engage a contractor with a NYSDOL asbestos handling license, as necessary, to perform the work; and

- LMDC should conduct appropriate monitoring and quality assurance/quality control inspections throughout the cleaning and deconstruction process.

1.0 INTRODUCTION

In its role as an Environmental Consultant, the Louis Berger Group, Inc. (Berger) was contracted and authorized by the Lower Manhattan Development Corporation (LMDC) to conduct an *Initial Building Characterization Study* (the Study) at the building located at 130 Liberty Street (the Building), which is scheduled for cleaning and deconstruction. The Building is a 40-story, approximately 1.4 million square foot (SF) office building, with two basement levels. The Building is located in Lower Manhattan, one block south of the World Trade Center (WTC) site. Until 1999, the Building, which was built between 1973 and 1974, was owned by the Banker's Trust Corporation. In 1999, Deutsche Bank acquired the Building and owned it until August 31, 2004, when it was sold to LMDC.

As a part of the proposed reconstruction of the WTC site, the Building is scheduled to be cleaned and methodically deconstructed, including, but not limited to, removal and disposal of all interior walls, stairs, ceilings, floor coverings, Mechanical, Electrical, and Plumbing (MEP) items, exterior skin, superstructure concrete, and structural steel. The Building will be deconstructed. As a safety precaution, the deconstruction will not utilize explosion/implosion devices as is often the case with conventional building demolition. Conducting this initial Study was the initial step in the development of the cleaning and deconstruction plan.

The overall intent and objective of the Study was to provide an initial characterization of any hazardous substances of concern that are present in the Building that should be taken into account during the cleaning and deconstruction process. The characterization determined the presence of asbestos-containing materials (ACM) in the building materials, various analytes of concern in dust, and mold on exposed surfaces. The analytes to which this Study refer include: (1) five Contaminants of Potential Concern (COPCs) designated by the United States Environmental Protection Agency (EPA) as associated with WTC dust (i.e., asbestos, dioxins, lead, polycyclic aromatic hydrocarbons (PAHs), and crystalline silica); and (2) other contaminants suspected of being present in the Building and of potential concern (i.e., polychlorinated biphenyls (PCBs) and heavy metals (barium, beryllium, cadmium, chromium, copper, manganese, mercury, nickel, and zinc)). Fibrous glass, otherwise known as Man-Made Vitreous Fibers (MMVF), is also included in the list of six COPCs designated by the EPA. MMVF is known to be prevalent throughout the Building in the fiberglass insulation materials and its presence in the dust is assumed. Moreover, any procedures designed to address asbestos will also adequately address MMVF in the Building. Therefore, Berger did not analyze dust samples for MMVF.

The Study was used to facilitate and refine any further contaminant delineation studies that might be appropriate. Moreover, the Study will serve as a reference document in support of the overall building cleaning and deconstruction project.

Based on this Study, and in anticipation of further testing that is currently contemplated, decisions will be made regarding preparing an appropriate cleaning, deconstruction, and project monitoring program; a health and safety plan; the development and implementation of engineering controls to contain the work zone (i.e., to ensure no exposure to the surrounding community during the cleaning and deconstruction); handling methods for the disposal or recycling of materials generated by the cleaning and deconstruction activities; and a waste characterization, handling, and management plan. Testing will be an ongoing process, which will occur throughout the cleaning and deconstruction process, as necessary.

1.1 Background

The events of September 11, 2001, which caused the destruction of the WTC Towers, physically destroyed portions of the interior and exterior of the Building. The massive debris generated from the collapse of the WTC South Tower broke approximately 1,500 windows and opened a gash ("Gash Area") in the Building's exterior, thereby exposing portions of the interior of the north side of the Building. The debris demolished the plaza in front of the Building, thus exposing the basement and sub-basement (Basement A and Basement B) areas and rupturing a diesel fuel tank located in the basement, the contents of which burned. The ruptured fuel tank caused the concrete in the basement levels to become saturated with Diesel Range Organics (DROs), as was discovered during studies conducted by Deutsche Bank. In addition, a combination of soot, dust, dirt, debris, and contaminants settled in and on the Building. The Gash Area and broken windows exposed the interior of the Building to the elements, which may have caused some further impacts after the initial exposures and events of September 11, 2001.

Subsequent to September 11, 2001, operations were undertaken to clear debris from the plaza, lobby, and interior spaces in the Gash Area. A porous geosynthetic mesh or "netting" was hung on the outside of the Building for further protection and safety. The immediate Gash Area was cleaned in accordance with New York City Department of Environmental Protection (NYCDEP) and New York City Department of Health (NYCDOH) protocols to permit the construction of columns, beams, and floor decks to stabilize the Gash Area. Once the initial cleaning and stabilization measures were in place, office furniture, equipment, and other non-attached items in the Building were removed and disposed of by Deutsche Bank. Since September 11, 2001, several study activities were also undertaken to assist Deutsche Bank and its property insurance carriers to understand the extent and impacts of the WTC-related contamination.

Deutsche Bank, the owner of the Building on September 11, 2001, disputed with its property insurance carriers about the extent of the damage to the Building, and whether or not it could be reoccupied. According to Deutsche Bank, the Building could not be reoccupied and had to be demolished and replaced. Deutsche Bank's property insurance carriers took a contrary position. They asserted that, like other buildings in the area, this Building could be safely and effectively cleaned and reoccupied. As a result of these conflicting positions, Deutsche Bank became engaged in a dispute with two of its insurers concerning the cost to repair or, if necessary, replace the Building. This dispute became protracted and eventually resulted in litigation, indefinitely threatening to prevent the repair or replacement of the Building.

LMDC first became involved with the Building as a result of the Deutsche Bank dispute with its insurers in order to expedite its timely and safe deconstruction. The delay caused by Deutsche Bank's litigation with its insurers was neither in New York City's interest nor the interest of the residents and workers of Lower Manhattan. The delay also prevented the cleanup of the dust in the Building. Accordingly, in late 2003, Governor Pataki appointed Senator George Mitchell to mediate the dispute between the insurers and Deutsche Bank. With the active support and involvement of LMDC, Senator Mitchell resolved the dispute, permitting LMDC to acquire the Building in its present condition.

As a result of divergent opinions from Deutsche Bank and its insurers concerning the source, nature, and extent of the contamination in the Building, LMDC retained Berger to conduct its own independent environmental investigation of the Building. An impartial environmental investigation was particularly important because the competing studies prepared by Deutsche Bank and its insurers were conducted to support their respective legal positions. Accordingly, LMDC retained Berger to collect its own samples for analysis by an independent laboratory.

1.2 Previous Environmental Studies

Several studies concerning WTC-related contaminants have been performed by, or with the review of, the federal, state, and local regulatory authorities in the aftermath of the events of September 11, 2001. In particular, the EPA has been responsible for many studies, and most importantly those associated with the development of the EPA's list of COPCs, as discussed above. These studies were used in large part by Berger, albeit not exclusively, to develop the list of constituents to be included in the initial sampling and analysis program.

Berger also reviewed the studies performed by others with regard to the Building during the execution of this Study. Because the data gathered by Deutsche Bank and its insurers was obtained in the litigation context, LMDC retained Berger to conduct independent third party testing, rather than adopt the results of either Deutsche Bank or its insurers. Berger believes that such independent testing is likely to be the most unbiased presentation of the results.

The data that Deutsche Bank and its insurers collected was germane to reoccupying the Building, as opposed to deconstructing it. LMDC will deconstruct the Building; it will not be reoccupied. The purpose of the study performed by Berger was to create a safe building deconstruction program, unlike the assessments by Deutsche Bank and its insurers that were for other purposes. Berger did refer to both Deutsche Bank and its insurers' data to aid in developing the list of analytes used for this Study and to determine suitable locations for testing. Berger also performed a qualitative comparison of the results from this Study with those of Deutsche Bank and its insurers. Additional testing was performed as a result of this comparison.

1.3 Purpose and Objectives

The purpose and objectives of the Study was to provide information to LMDC and its contractors and consultants for the development of its cleaning and deconstruction plan by providing quantitative information about hazards in the Building. The Study included tests necessary to make determinations regarding: (1) appropriate safety precautions for worker and public health and safety; (2) appropriate cleaning and disposal procedures; and (3) compliance with applicable federal, state, and local regulations.

The Study was conducted as the first step in the cleaning and deconstruction process. While important, the initial characterization study is not the only step in the testing process, and additional environmental testing will be undertaken in the future, as recommended in this report.

Following the Building characterization, the cleaning and deconstruction plan will be created in compliance with applicable statutes, rules, and regulations. The cleaning and deconstruction plan will be submitted to applicable regulators for review, comment, and approval.

This initial characterization of ACM, WTC Dust (including asbestos, silica, PAHs, dioxin, PCBs, and heavy metals, including mercury), and mold is intended to assist in determining what measures and protocols may be required in support of the 130 Liberty Street cleaning and deconstruction plan. In particular, the results of the Study are intended to provide reference information allowing for informed decisions to be made regarding appropriate cleaning and deconstruction methods. These decisions include the development and implementation of engineering controls to contain the work zone (i.e., to ensure no exposure to the surrounding community during the cleaning and deconstruction) and appropriate methods for the disposal or recycling of materials generated by the cleaning and deconstruction activities. Using the available characterization results, LMDC, its consultants, and the selected deconstruction contractor can develop and implement appropriate deconstruction protocols and safety precautions for the cleaning and deconstruction process to ensure the health and safety of workers and the residents of the surrounding community. Section 5.0 sets forth conclusions and recommendations, outlining the series of tasks that are expected to follow this Study. Such tasks include preparing an appropriate project cleaning and deconstruction plan; monitoring program; a health and safety plan; and a waste characterization, handling, and management plan.

1.4 Scope of Work

To facilitate the development of the 130 Liberty Street Cleaning and Deconstruction Plan, LMDC authorized Berger to undertake this Study .

To meet these objectives, the following specific tasks were performed to complete the Study:

Task 1: Preparation of a Sampling and Analysis Plan (SAP), Quality Assurance Project Plan (QAPP), and Site-Specific Health and Safety Plan (HASP);

Task 2: Asbestos Building Inspection and Material Survey;

Task 3: Dust Characterization for Asbestos;

Task 4: Dust Characterization for Other Analytes, Including Silica, PAHs, Dioxins, PCBs, and Heavy Metals, including Mercury; and

Task 5: Visual Inspection for the Presence of Mold on Exposed Surfaces.

Task 1 consisted of the preparation of plans outlining the inspection, sampling, testing, and health and safety procedures that were used to implement the Study. These planning documents included a SAP, QAPP, and HASP. Additionally, an initial site survey was performed to verify the physical condition of the Building, to evaluate available access, and to assess whether assumptions made in the plans were appropriate.

For Task 2, the asbestos inspection and bulk sampling were conducted using the guidelines established by the EPA in the *Guidance for Controlling Asbestos-Containing Materials in Buildings,* Office of Pesticides and Toxic Substances, DOC #560/5-85-024 and 40 C.F.R. Part 763, Asbestos Hazard Emergency Response Act (AHERA). Bulk samples of suspected ACMs were analyzed by Polarized Light Microscopy (PLM) and/or Transmission Electron Microscopy (TEM), as prescribed in the New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) Methods 198.1 and 198.4. The results were compared to the criteria set by the EPA's National Emissions Standard for Hazardous Air Pollutants (NESHAP) 40 C.F.R. Part 61, Subpart M.

For Task 3, samples were analyzed by PLM with dispersion staining according to the method specified in the EPA *Interim Method of the Determination of Asbestos in Bulk Insulation Samples*, Appendix A, Subpart F, 40 C.F.R. Part 763; and NYSDOH ELAP Method 198.1. Supplemental screening samples of the settled dust were collected from porous and non-porous surfaces and analyzed for asbestos using TEM in accordance with ASTM Standard D 5755-95, "*Microvacuum Sampling and Indirect Analysis of Dust by Transmission Electron Microscopy for Asbestos Fiber Concentration.*" Porous surfaces include suspended ceiling tiles and carpet. Non-Porous surfaces included concrete, floor tiles, and wall boards. This method describes the procedures for collecting non-airborne dust samples.

For Task 4, an initial site survey was conducted and six general sampling zones were identified. The zones were based on the amount of visible dust present and the means by which dust was forced into the Building and settled on many of its surfaces on September 11, 2001. Dust may have entered the Building through the Heating, Ventilation, and Air Conditioning (HVAC) systems or through penetrations in the Building's exterior (e.g., the Gash Area and any other broken windows). Once inside the Building, dust may have been circulated by the HVAC system, vertical shafts, or broken windows. This dust was sampled from representative locations and tested using EPA-approved testing methods.

To determine a sample location plan that would be representative of the Building as a whole, six (6) zones were identified as follows:

- Zone 1 - Mechanical Rooms on the 5th, 6th, 40th, and 41st Floors to include the air intakes, fan rooms, and air handling units of the HVAC system (Figure 1).
- Zone 2 - Office Space located at or below the 24th Floor that may have been subjected to dust entering the Building through the Gash, HVAC system (and possibly circulated through the HVAC system), vertical shafts, or broken windows (Figure 2).
- Zone 3 - Office Space located above the 24th Floor that may have been impacted by dust distributed through the HVAC system, vertical shafts, or broken windows (Figure 3).
- Zone 4 - Gash Area that was cleaned by Deutsche Bank subsequent to September 11, 2001 to permit structural work to be performed (Figure 4).

- Zone 5 - Roof Area that may have been impacted by the settling or adhesion of dust to the exterior surfaces (Figure 5).

- Zone 6 - Exterior façade building materials[1] (Figure 6).

With regard to dust in particular, the sampling strategy was based on the premise that WTC dust infiltrated parts of the Building in varying degrees resulting in distinct zones of contamination, as described above. As a result, the number of samples that would be representative of each zone was determined and based in part upon some of the information identified in previous studies of the Building. Once these preliminary determinations were made, the specific floor locations were selected. This sampling-by-zone approach resulted in selecting a specific number of samples for a specific number of floors as described in Section 2.0, Methodology. This sampling approach was deemed to be representative of the dust concentrations in the Building, and therefore, samples were not collected from every floor. Furthermore, more detailed floor-by-floor sampling was also unnecessary assuming the likely deconstruction approach will include engineering controls and monitoring that will be applied to each floor regardless of the exact level of contamination on that floor.

Task 5 was a limited task consisting of the visual inspection of only the interior exposed surfaces of the Building for the presence of mold impacted-surfaces. Because mold growth can only occur in the presence of moisture, any water-damaged materials were also to be identified as part of this task.

The remainder of this document is divided into four sections. Section 2.0 describes the general methodology, which is followed by a presentation of results and findings in Sections 3.0 and 4.0, respectively. The conclusions and recommendations from this Study are presented in Section 5.0. Attached as appendices (in separate volumes) are the Task 1 Planning Documents (including the SAP, QAPP, and HASP) in Appendix A; Data Summary Tables (including asbestos and other analytes) in Appendices B and C; Asbestos Bulk Sample Location Plans (for Tasks 2 and 3) in Appendices D and E; and Final Laboratory Analytical Reports (for Tasks 2 through 4) in Appendices F through H.

1 The sampling for Zone 6 was limited to readily accessible exterior areas on the ground floor of the Building, with limited samples taken adjacent to locations of suspected ACM building material samples. Further sampling of upper levels of the Building's exterior is planned, but was not part of this initial Study.

2.0 METHODOLOGY

The following subsections present the methodologies for implementation of the Asbestos Building Inspection and Material Survey, the Dust Characterization for Asbestos, the Dust Characterization for Other Analytes, and the Visual Mold Inspection. These tasks were implemented in accordance with the SAP, QAPP, and HASP prepared for the Study (included in Appendix A, a separate volume) and the initial site survey that was performed to verify the assumptions made in these plans. Berger holds a valid NYSDOL Asbestos Handling License (License # 03-0940).

2.1 Asbestos Building Inspection and Material Survey

For this task, guidelines used were established by the EPA in the publication *Guidance for Controlling Asbestos-Containing Materials in Buildings*, Office of Pesticides and Toxic Substances, DOC #560/5-85-024 and 40 C.F.R. Part 763, AHERA. The AHERA guidelines represent the most up-to-date inspection and sampling protocol available, and as such were utilized during the inspection and bulk sampling. For the purposes of this inspection, suspect ACM were placed in three material categories: thermal systems insulation, surfacing materials, and miscellaneous materials. The locations within the Building were inspected physically, functional space-by-functional space and Homogeneous Area-by-Homogeneous Area, to determine the presence of ACM. AHERA defines a Homogeneous Area as suspect material of similar age, appearance, function, and texture.

The inspection included the following tasks:

1. Visual determination of the extent of visible and accessible suspect materials and conditions of the material;

2. Collection of samples of suspect building materials and analysis for asbestos content;

3. Determination of friability and condition of suspect materials through a physical "Hand Pressure" test;

4. Assessments of suspect friable and non-friable materials and locations;

5. Quantification of the amount of suspect friable and non-friable materials in their respective locations;

6. Identification of all suspect materials sampled on the appropriate building floor plan diagram with the sample number; and

7. Preparation of an Asbestos Field Survey Data Sheet/Chain of Custody record, which accompanied the samples to the laboratory.

Protocols associated with the Asbestos Building Inspection and Material Survey are discussed in further detail in the following subsections. These include inspection procedures, bulk sampling procedures, physical condition assessment, bulk sample submission and retention, and laboratory analytical procedures and methodologies.

2.1.1 *Physical Inspection Procedures*

All accessible locations within the Building, including the Roof, were inspected physically, functional space-by-functional space (room-by-room) and Homogeneous Area-by-Homogeneous Area, to determine the presence of ACM. A limited inspection was also conducted on the exterior façade of the Building. All suspect material in each functional space, including above the suspended ceiling (the plenum), was categorized by Homogeneous Area prior to bulk sampling. This task included, but was not necessarily limited to, the following:

1. Conducting a thorough on-site visual inspection of the Building, including areas above the suspended ceiling (the "plenum"). Inspections were scheduled and coordinated with the Building Representative and conform to the approved work schedule. During the inspection, Berger identified and documented the condition of the suspected material based on functional area usage, and other factors deemed appropriate;

2. Indicating all areas of homogeneous material, without regard to the results of subsequent laboratory bulk analysis, either on a set of building floor plans, on schematic drawings, or in tabular form;

3. Identifying the functional spaces on the drawings; and

4. Completing the Asbestos Field Survey Data Sheet/Chain of Custody Form for each homogeneous material, and listing all functional spaces where ACM is suspected to be present.

Based on the results of the physical inspection, final sample locations were identified and suspect ACM samples were collected according to the procedures described in the next section.

2.1.2 *Bulk Sampling Procedures*

Berger conducted bulk sampling of all friable and non-friable suspected ACMs in compliance with the requirements of AHERA for bulk sampling (40 C.F.R. 763.86) and consistent with the SAP and the QAPP. Over 2,000 samples of suspect ACM were collected for analysis as part of the Study. All sample locations were clearly identified on Building floor plans (Appendix D) and marked with an identification number corresponding to the respective sample number written on the Asbestos Field Survey Data Sheet/Chain of Custody Form (Appendix F), which accompanied the samples to the laboratory. A minimum of one side-by-side quality control sample was collected for each grouping of 20 samples or part thereof.

Bulk sampling was conducted in the following manner:

1. Berger collected representative bulk samples of all materials suspected to contain asbestos. Sample locations were determined using the EPA's simplified random sampling method (EPA 560/5-85-030a). All sample locations were indicated on drawings or floor plans. Each sample location was identified by a unique number that permits the cross-referencing of sample information.

2. Bulk samples were collected from materials in each Homogeneous Area to determine the asbestos content and to identify the complete content matrix of the material. Homogeneity was based on, but not necessarily limited to, the following criteria:

   - Visual appearance;
   - Texture; and
   - Use (including but not limited to: ceilings, floors, walls, mechanical equipment, ceiling tiles, floor tiles, pipe wrapping, elbow materials, valve material on structural members, decks, beams, and duct work).

3. With two exceptions, at least three samples of each suspect material were collected and analyzed before concluding that there was no asbestos in the material. The exception was a single sample of thermal system insulation, including patching, or miscellaneous material that meets the following size restrictions: the thermal system insulation is of less than six LF or six SF and the miscellaneous material is less than 160 SF or 260 LF in total quantity. Otherwise, the numbers of samples to be collected for each Homogeneous Area were as follows:

   - Surfacing material on ceilings, walls, and structural members:

a. Less than 1,000 SF = at least three samples;
b. Between 1,000 SF and 5,000 SF = at least five samples;
c. Greater than 5,000 SF = at least seven samples;
d. At least one additional sample for each additional 10,000 SF up to a total of nine samples; and,
e. At least one sample for each patched area.

- Thermal system insulation such as pipe work, valves, elbows, and ductwork:
  a. At least one bulk sample from each Homogeneous Area of patched thermal system insulation if the patched section is less than six LF or six SF;
  b. At least three bulk samples from each Homogeneous Area of thermal system insulation equal to or greater than six LF or six SF; and
  c. At least one sample of valve material, hanger, and elbow mud for each insulated line of varying diameter and visible appearance.
- Miscellaneous materials:
  a. Miscellaneous materials include ceiling and floor tiles, linoleum or vinyl floor coverings, baseboards and similar material, and their adhesives and were collected as follows: at least one sample for an area containing up to 160 SF or 260 LF of suspect material; at least three samples for an area of 260 - 5,000 SF or between 160 – 1,000 LF of suspect material; and at least one additional sample for each 5,000 SF or 1,000 LF or part thereof of material, to a total of nine samples.
  b. Roofing, built-up roof (BUR) systems as well as other types of suspected roof ACM were also sampled as follows: three samples of each layer for a homogeneous roof area up to 10,000 SF and one additional sample for each additional 10,000 SF, or part thereof, to a total of nine samples.

4. Quality Assurance/Quality Control (QA/QC) samples: one random split sample for every 20 samples, or part thereof, was collected and submitted for analysis.

2.1.3 *Physical Condition Assessment*

The EPA AHERA specifies that a physical assessment of all friable suspect material must be performed during the inspection. The suspect materials were assessed to determine the potential hazards and the hazards ranked according to severity. The physical condition assessment consisted of determining:

- The condition of the suspect ACM; and
- The cause of damage and potential for future disturbance.

AHERA lists seven categories by which to assess the current condition and potential for damage as follows:

1. Damaged or Significantly Damaged Friable Thermal System Insulation;
2. Damaged Friable Surfacing Material;
3. Significantly Damaged Friable Surfacing Material;
4. Damaged or Significantly Damaged Friable Miscellaneous Material;
5. ACM with potential for damage;
6. ACM with the potential for significant damage; and
7. Any remaining Friable ACM or Friable Suspected (assumed) ACM.

A rank of "1," means the material is in "poor" condition and requires top priority for abatement response action. A result of "5" would indicate material in "fair" condition with "moderate" potential for future damage. It would have a high priority for abatement response action. A rank of "7" indicates material in "good" condition with "low" potential for future damage. These areas would have a low abatement response priority.

The second step in the assessment process was to determine the potential for future damage or deterioration for material classified as good or fair. The potential for future damage was classified as High, Moderate, or Low. Factors considered included the potential for physical contact and the influence of environmental factors such as vibration, air erosion, the likelihood of water damage, etc.

The third step was to determine the friability rating and to classify the material as Friable ACM or Non-Friable ACM. "Friable ACM," as defined by NYSDOL and EPA, is any material that contains more than one percent asbestos and can be crumbled, pulverized, or reduced to powder by hand pressure. In New York City, the definition of "Friable ACM" is any material that contains more than one percent asbestos and can be crumbled, pulverized, or reduced to powder by hand pressure and/or mechanical means (NYCDEP Title 15 Regulations). For this study, the EPA/NYSDOL definition of friability was used. It refers to a material's likeliness to release airborne fibers. There is a greater possibility that a friable material will release fibers into the air when disturbed than will a non-friable material (e.g., floor tiles, roofing materials, etc.) thereby causing a potential hazard.

The assessment process defines the extent of the damaged condition as follows:

- If the extent of the damage is roughly ten percent of the material and is evenly distributed throughout the material, then the material is considered significantly damaged; and/or
- If the extent of the damage is roughly 25 percent of the material and is localized, then the material is considered significantly damaged.

2.1.4 *Bulk Sample Submission and Retention*

Berger was responsible for transmittal of the samples to the laboratory and for assuring that the laboratory analyzed each sample identifying the type and amount of asbestos and other components present in accordance with the QAPP.

Field personnel completed Asbestos Field Survey Data Sheet/Chain of Custody Form for all samples submitted to the laboratory. Following completion, the sampling personnel signed and dated the form and submitted the samples to the laboratory. Each person, in succession, that took possession of the samples then signed and dated the form, providing documentation that the samples were under the control of a designated person at all times. The Asbestos Field Survey Data Sheet/Chain of Custody Forms with all signatures are provided with the final reports from the laboratory (Appendix F). The bulk sample submission protocols are summarized as follows:

1. Berger submitted the bulk samples to a Laboratory that is accredited by National Voluntary Laboratory Accreditation Program (NVLAP) under the National Institute of Standards & Technology and the NYSDOH ELAP.

2. The samples were submitted to the laboratory for analysis promptly upon completion of the survey. Berger prepared and retained documentation that accurately reflected all changes in the chain of custody and location of each sample. Documentation indicated all persons who took custody of samples and the period of time in each person's custody, as well as to whom the samples were relinquished. There were no unaccounted periods of time with regard to each sample.

3. Berger had the laboratory analyze each sample and identify the type and amount of asbestos present as well as other components, in accordance with the QAPP.

4. Bulk samples were retained by the laboratory with the chain of custody documentation.

5. QA/QC was used to monitor the performance of the analytical laboratory. A duplicate sample was collected immediately adjacent to the related bulk sample for every 20th bulk sample collected. It was labeled and numbered independently in a manner such that the laboratory personnel, if the same laboratory was used for the analysis, could not have discerned the QC sample(s).

6. Samples were hand delivered to the analytical laboratory in an appropriate and suitable manner. All packaging and labels complied with Federal Department of Transportation (DOT) regulations as provided in 49 C.F.R. 171-178.

2.1.5 *Laboratory Analytical Procedures and Methodologies*

Laboratory analytical services using Polarized Light Microscopy (PLM) and Transmission Electron Microscopy (TEM) methods were performed by Amerisci Laboratories, Inc. located at 117 East 30th Street, New York, New York. Amerisci Laboratories is accredited by NVLAP (Accreditation Number 200546-0) under the National Institute of Standards & Technology (NIST); the NYSDOH ELAP (Accreditation Number 11480), and the American Industrial Hygienist Association (AIHA) (Accreditation Number 1028).

Bulk samples of suspect ACM were analyzed by PLM Method 198.1 and/or TEM Method 198.4 as described in NYSDOH ELAP for the criteria set by the NESHAP, 40 C.F.R. Part 61. They were also analyzed on a "Positive-Stop" basis using both the PLM and TEM methods. A summary description of the analyses conducted is as follows:

<u>Polarized Light Microscopy (PLM) Methods</u>

Samples were analyzed by PLM with dispersion staining according to the method specified in the EPA *Interim Method of the Determination of Asbestos in Bulk Insulation Samples*, Appendix A, Subpart F, 40 C.F.R. Part 763; and NYSDOH ELAP Method 198.1. This is a standard of analysis in optical mineralogy and the currently accepted method for the determination of asbestos in friable bulk samples. Friable ACM is any material that contains more than one percent asbestos and can be crumbled, pulverized, or reduced to powder by hand pressure. A suspect material is immersed in a solution of known refractive index and subjected to illumination by polarized light. The resulting characteristic color display enables mineral identification.

The NYSDOH has revised the PLM Stratified Point Counting Method. The new method, *Polarized Light Microscopy Methods for Identifying and Quantitating Asbestos in Bulk Samples* can be found as Item 198.1 in the ELAP Certification manual. The State of New York ELAP has determined that analysis of non-friable, organically bound material (NOB) is not reliably performed by PLM. Therefore, if PLM analysis of an NOB yields a negative result, TEM must be performed to further confirm the result. All samples were initially analyzed by PLM. Samples that produced a negative PLM result and were classified as an NOB were then re-analyzed utilizing the TEM methodology.

<u>Transmission Electron Microscopy (TEM) Methods</u>

Detection of asbestos fibers in NOBs such as floor tile, mastics, roofing materials, and window caulking/glazing, is often extremely difficult because of the small fibers used during manufacture, their subsequent mixing and coating with an organic matrix (vinyl, asphalt, etc.) and potential combination during sample preparation. To address this problem, specialized sample preparation (gravimetric reduction per Chatfield, 1991) and analysis by TEM is required.

The use of TEM addresses the principle that the limit of an optical microscope's ability to detect objects is affected by the wavelength of light, which is the source for PLM analysis. The electron microscope used in TEM analysis is inherently superior to the optical microscope for detecting very small fibers. TEM's extremely short wavelength, coupled with simple image presentation, yields resolvable images of even the smallest asbestos fibers. Furthermore, identification of chrysotile or amphibole crystalline structure can be consistently produced via the electron-diffraction capabilities of modern TEMs. Accordingly, the TEM's resolution of up to 20,000x magnification provides the most reliable method for detecting and quantifying asbestos fibers in NOBs and is considered the only method that can be used to report true negative results from PLM analysis of NOB samples as per the New York State Department of Health Environmental Laboratory Approval Program Guidelines (NYSDOH-ELAP).

Positive Stop Procedures for PLM and TEM Analysis

In accordance with EPA guidelines, samples are categorized into "homogeneous groups" by material type. The number of samples to be taken for each group is dictated by the type and quantity of the material. All samples within the homogeneous group must be less than one percent asbestos in order to classify the material as "non-asbestos." Conversely, the positive result of any one sample dictates that the homogeneous group be classified as ACM. Thus, when the individual samples of each homogeneous group are analyzed, the laboratory discontinues analysis when asbestos has been identified in one of the samples. These subsequent samples, which have not yet been analyzed, are reported as Not Analyzed/Positive Stop (NA/PS) and the homogeneous material is classified as an ACM. NA/PS procedures are economically beneficial by reducing analytical cost for repetitive analysis.

2.2 Dust Characterization for Asbestos

The guidelines used for the dust characterization for asbestos were established by the EPA in the *Guidance for Controlling Asbestos-Containing Materials in Buildings*, Office of Pesticides and Toxic Substances, DOC #560/5-85-024 and 40 C.F.R. Part 763, AHERA. Berger collected representative bulk samples of the settled dust. To determine the asbestos content from the following locations, each floor was divided into separate functional areas as follows:

- Random locations under the suspended ceiling (plenum);
- Random locations above the suspended ceiling (plenum); and
- The exterior netting on the Building.

Sample locations were determined using the EPA's simplified random sampling method (EPA 560/5-85-030a). All sample locations were documented on floor plans (Appendix E) and well as Asbestos Air Sample Logs/Chain of Custody Forms. Each sample location was identified by a unique number, which permitted the cross-referencing of sample information throughout the report. The documentation (consisting of Floor Plans and Air Sample Logs/Chain of Custody Forms) was deemed to be sufficient to locate and ascertain the extent of settled dust throughout the Building. Each floor was divided into two separate functional spaces: above the suspended ceiling (or plenum) and under the suspended ceiling. Each floor was divided into a grid with nine sections, the sections were numbered starting from Section 1 in the south west corner, Section 2 in the next section east, Section 3 in the south east corner, and Section 4 in the west central area, counting east from the west wall in each section. The 9th Section was in the northeast corner. The areas were numbered using the floor number followed by the section number. Area 1 was the southeast section of the floor. For example, the area in the southeast corner of the 1st Floor was called Area 01-01. The Areas 01-01 through 42-09 included every section of the Building; samples collected above and under the suspended ceiling were be labeled separately to identify where the samples were collected.

The dust samples were analyzed by PLM with dispersion staining according to the method specified in the EPA *Interim Method of the Determination of Asbestos in Bulk Insulation Samples*, Appendix A, Subpart F, 40 C.F.R. Part 763; and NYSDOH ELAP Method 198.1. This is a standard of analysis in optical mineralogy and the currently accepted method for the determination of asbestos in friable bulk samples. Supplemental screening samples of the settled dust were collected from porous and non-porous surfaces and analyzed for asbestos using TEM in accordance with ASTM Standard D 5755-95, "*Microvacuum Sampling and Indirect Analysis of Dust by Transmission Electron Microscopy for Asbestos Fiber Concentration.*" Porous surfaces include suspended ceiling tiles and carpet. Non-Porous surfaces included concrete, floor tiles, and wall boards. This method describes the procedures for collecting non-airborne dust samples.

2.2.1 *Physical Inspection Procedures*

All accessible locations within the Building were inspected physically, functional space-by-functional space (room-by-room) and Homogeneous Area-by-Homogeneous Area to determine the presence of settled dust above and below the suspended ceiling (the plenum). The settled dust in each functional area listed above was categorized as a separate Homogeneous Area prior to sampling. Random sampling was conducted according to the protocol described in the SAP. All sampling information was documented on the Asbestos Air Sample Logs/Chain of Custody Form. This task included, but was not necessarily limited to, the following:

1. Conducting a thorough on-site visual inspection of the Building, including areas above the suspended ceiling.

2. Each floor was subdivided into two Homogeneous Areas, one above the plenum and one below the plenum. Each Homogeneous Area was then subdivided into nine sections and one sample was collected from each of the nine sections on each floor, resulting in approximately 18 samples per floor. Samples were taken from over 800 locations,

including porous and non-porous surfaces, and on mechanical equipment, based on the amount of dust found on each for each sample area. In areas where there was no discernable difference in accumulation, samples were collected from the lowest level where dust could be sampled.

3. Berger conducted sampling of all dust suspected to be asbestos-containing in compliance with the requirements of EPA's AHERA for bulk sampling (40 C.F.R. 763.86). A minimum of one side-by-side quality control sample was collected for each grouping of 20 samples. All sample locations were clearly identified on copies of the Building schematic diagrams (drawings or floor plans) and marked with an identification number corresponding to the respective sample number.

2.2.2 *Bulk Sampling Procedure*

Berger conducted bulk sampling of the settled dust in compliance with the requirements of AHERA for bulk sampling (40 C.F.R. 763.86) and consistent with the SAP and the QAPP. A minimum of one side-by-side quality control sample was collected for each grouping of 20 samples or part thereof. All sample locations were clearly identified on building floor plans and marked with an identification number corresponding to the respective sample number written on the Asbestos Air Sample Logs/Chain of Custody Form, which accompanied the samples to the laboratory.

For areas with significant dust accumulation, the dust was wetted, scraped and placed into a sample container. For areas with minimal dust accumulation the same procedure was followed except that the sample area was larger. Sample locations in each section of the Building were determined by the inspector in the field. Samples were collected from horizontal surfaces in the section from areas that contained visible dust.

The following procedures were used in collection of forty (40) additional samples of the settled dust using the ASTM Standard D 5755-95 Microvacuum technique:

1. A sampling template of 100 square centimeters (cm^2) was used at sample locations;

2. The flow rate of the pump with the cassette attached was set above 2 liters per minute;

3. Vacuuming began inside the template and passes were made for the entire sampling time and intersected at right angles, sampling continued until there was no visible dust or for a

minimum of 2 minutes, and debris or particles greater than 1 mm in diameter were avoided; and

4. Upon completion of sampling at a location, the cassette was sealed by turning the cassette upright, turning off the pump, and sealing the top of the cassette.

The TEM samples were collected at random locations throughout the building to include porous and non-porous surfaces from above the plenum and below the plenum (for a total of 40 samples).

2.2.3 *Laboratory Analytical Procedures and Methodologies*

Laboratory analytical services using PLM and TEM methods were performed by Amerisci Laboratories, Inc. located at 117 East 30th Street, New York, New York. Amerisci Laboratories is accredited by NVLAP (Accreditation Number 200546-0) under the National Institute of Standards & Technology (NIST); the NYSDOH ELAP (Accreditation Number 11480), and the American Industrial Hygienist Association (AIHA) (Accreditation Number 1028). Descriptions of the analyses conducted are as follows:

Polarized Light Microscopy (PLM) Method

Samples were analyzed by PLM with dispersion staining according to the method specified in the EPA *Interim Method of the Determination of Asbestos in Bulk Insulation Samples*, Appendix A, Subpart F, 40 C.F.R. Part 763; and NYSDOH ELAP Method 198.1. This is a standard of analysis in optical mineralogy and the currently accepted method for the determination of asbestos in friable bulk samples. Friable ACM is that material which may be crumbled, pulverized, powdered, crushed or exposed asbestos which is capable of being released into the air by hand pressure. A suspect material is immersed in a solution of known refractive index and subjected to illumination by polarized light. The resulting characteristic color display enables mineral identification.

Transmission Electron Microscopy (TEM) Method

The dust samples were analyzed using the NYSDOH ELAP Method 198.4. The use of TEM addresses the principle that the limit of an optical microscope's ability to detect objects is affected by the wavelength of light, which is the source for PLM analysis. The electron microscope used in TEM analysis is inherently superior to the optical microscope for detecting very small fibers. TEM's extremely short wavelength, coupled with simple image presentation, yields resolvable images of even the smallest asbestos fibers. Furthermore, identification of chrysotile or amphibole crystalline structure can be consistently produced via the electron-diffraction capabilities of modern TEMs. Accordingly, the TEM's resolution of up to 20,000x magnification provides the most reliable method for detecting and quantifying asbestos fibers as per the NYSDOH ELAP.

2.3 Dust Characterization for Other Analytes

This task involved the characterization of contaminants other than asbestos in dust samples. Specific analytes included: (1) COPCs designated by the EPA as associated with WTC dust (i.e., asbestos, dioxins, lead, PAHs, and crystalline silica); and (2) other contaminants suspected of being present in the Building and of potential concern (i.e., PCBs, heavy metals, and mercury). In addition, this section discusses the methods used for an evaluation of the presence of mercury vapor, which was later added to the scope of work. It should be noted that for carpets, settled dust was evaluated by sampling and analyzing the carpet itself; as such, any chemicals present in the manufacturing or installation of the carpet will be represented in the results.

Sampling efforts were accomplished in accordance with applicable standards and a systematic, targeted sampling design to collect representative surficial samples from building components and other areas with the highest likelihood of being contaminated. The methods utilized are presented in the SAP and QAPP and are summarized in this section. The following subsections describe in further detail the initial site survey, sample location identification, and methods of sample collection and analysis.

2.3.1 *Initial Site Survey*

An initial site visit was made to the Building prior to performing the sampling. The Project Team, consisting of the Task Manager and each of the Task Coordinators, performed the initial site survey. The Project Team visited representative floors in each of the zones to gain familiarity with the entry/security procedures and Building lay-out, as well as to determine representative areas to sample. A general knowledge of the key features of the Building and the varying degree of dust accumulation were noted during the survey. During the site survey, it was noted that the Gash Area (Zone 4) was previously cleaned. It was also noted that Mechanical areas on the 5th, 40th, and 41st Floors (Zone 1) had appreciably greater dust accumulation on various surfaces compared to surfaces on office floors. This information was utilized during the development of the final sampling strategy to aid in selection of the floors that would be most appropriate for sample collection.

2.3.2 *Sample Location Identification*

A sampling strategy representative of the Building was developed following the initial site walkthrough, which identified six general sampling zones based on the amount of visible dust present and methods by which dust was thrust into the Building on September 11, 2001. Dust may have entered the Building in the following ways: (1) through the HVAC System and broken windows, which allowed falling debris, dust, and fumes to infiltrate the Building; and (2) contaminants produced as a result of combustion of building materials, building contents, fuel oil, and jet fuel that may have blown into the Building by prevailing winds. For this study, the six zones identified are illustrated on Figures 1 through 6 and consist of the following:

- Zone 1: Mechanical Rooms on the 5th and 40th floors that include the air intakes, fan rooms, and air handling units of the HVAC system (Figure 1).
- Zone 2: Office Space located at or below the 24th Floor that may have been subjected to dust entering the Building through the Gash Area, HVAC system (and possibly circulated through the HVAC system), vertical shafts, or broken windows (Figure 2).
- Zone 3: Office Space located above the 24th Floor that may have been impacted by dust distributed through the HVAC system, vertical shafts, or broken windows (Figure 3).
- Zone 4: Gash Area that was cleaned subsequent to September 11, 2001 to permit structural work to be performed (Figure 4).
- Zone 5: Roof Area that may have been impacted by the settling or adhesion of dust to the exterior surfaces (Figure 5).
- Zone 6: Exterior Façade that may have been impacted by the settling or adhesion of dust to the exterior surfaces of the Building (Figure 6).

The sampling strategy was based on the areas susceptible to WTC dust that infiltrated parts of the Building in varying degrees resulting in distinct zones of contamination, as described above. Specific floor locations were selected following a determination of the number of samples that would be representative of each zone, which was based on information identified in previous studies of the Building. This approach resulted in selecting a specific number of samples for a specific number of floors as outlined in Table 1. As a result of this approach, samples were not collected from each floor.

In Zones 1, 2, and 3, a total of thirty-two, thirty-nine, and thirty-eight sample locations were identified, respectively. In Zone 4, nine (9) sample locations were identified including two samples that were collected from the exterior netting used to contain the damage and debris caused by the collapse of the WTC. In Zone 5, four (4) sample locations were identified and each location chosen was based upon the extent of visible dust and/or the representativeness of the sample location. In Zone 6, three (3) sample locations were identified on the Exterior Façade. Within each zone, sample locations were selected so that approximately one quarter of the samples were collected from floor surfaces (both carpeted and uncarpeted), one quarter of the samples were collected from horizontal surfaces (ledges), one quarter of the samples were collected from HVAC interior ductwork, and one quarter of the samples were collected from above the suspended ceiling (plenum). Table 1 presents a summary of the number of samples collected by zone.

TABLE 1
TASK 4 – NUMBER OF SAMPLE LOCATIONS BY ZONE

Zone 1	Number of Sample Locations
5th Floor	**18**
40th Floor	**14**
Zone 1 Total	32
Zone 2	Number of Sample Locations
2nd Floor	**6**
4th Floor	**8**
10th Floor	**4**
12th Floor	**4**
14th Floor	**6**
18th Floor	**8**
Basement (Level A/B)	**2**
Basement (Vault)	**1**
Zone 2 Total	39
Zone 3	Number of Sample Locations
25th Floor	**4**
27th Floor	**2**
31st Floor	**4**
35th Floor	**2**
39th Floor	**7**
40th Floor	**12**
41st Floor	**7**
Zone 3 Total	38
Zone 4	Number of Sample Locations
7th Floor	**1**
10th Floor	**1**
12th Floor	**1**
15th Floor	**1**

TABLE 1 (continued)
TASK 4 – NUMBER OF SAMPLE LOCATIONS BY ZONE

17th Floor	**1**
22nd Floor	**1**
24th Floor	**1**
Netting (Floors 17 & 24)	**2**
Zone 4 Total	9
Zone 5	Number of Sample Locations
Roof	**4**
Zone 5 Total	4
Zone 6	Number of Sample Locations
Exterior Façade	**3**
Zone 6 Total	3

2.3.3 *Sample Collection and Analysis*

Samples were collected using wipe, vacuum, and/or bulk sampling techniques and analyzed for silica, PAHs, dioxins, PCBs, heavy metals (barium, beryllium, cadmium, chromium, copper, lead, manganese, nickel, and zinc), and mercury. Silica analysis was performed by Analytics Corporation, located in Richmond, Virginia, under NYSDOH ELAP (Accreditation Number 11386), and AIHA (Accreditation Number 100531). Severn Trent Laboratories, Inc. located in Shelton, Connecticut, performed dioxin analysis, under NYSDOH ELAP (Accreditation Number 15681). Laboratory analysis of the remaining analytes was performed by Severn Trent Laboratories, located in Sacramento, California, under NYSDOH ELAP (Accreditation Number 10602). Table 2 presents a summary of the sample collection methods by analyte and the number of samples collected.

TABLE 2
SAMPLE COLLECTION AND ANALYSIS PARAMETERS

Analytical Parameter	Analytical Method	Sampling Media	Number of Samples	Number of QC Samples	Total Number of Samples
Silica in Dust	XRD	Wipe/Vacuum	117	17	134
PAHs	8270C	Wipe/Bulk	125	17	142
Dioxin	8290	Wipe/Bulk	126	17	143
PCBs	8082	Wipe/Bulk	125	17	142
Heavy Metals	6010B	Wipe/Bulk	125	17	142
Mercury	7471A	Wipe/Bulk	125	17	142

Notes: XRD per Modified NIOSH Method 7500

Additional sample collection information is provided in Table 3, which shows the sample matrix, analytical method, sample preservation, holding time and sample container requirements by analyte.

TABLE 3
SAMPLE COLLECTION REQUIREMENTS

Analytical Parameter	Sample Matrix	Analytical Method	Sample Preservation	Holding Time (days)(1)	Sample Container
Silica in Dust	Wipe or vacuum (PW PVC)	NIOSH 7500 Modified	None	N/A	Glass Jar
PAHs	Gauze w/hexane; bulk	8270	Refrigerate / keep dark	14/40	Glass Jar
Dioxin	Gauze w/ hexane;	8290	Refrigerate / keep dark	14/40	Glass Jar
PCBs	Gauze w/hexane; bulk	8082	Refrigerate	14/40	Glass Jar
Heavy Metals	Gauze w/deionized water; bulk	6010B	None	180*	Glass Jar
Mercury	Gauze w/deionized water; bulk	7471A	Refrigerate	28*	Glass Jar

Notes:
N/A = Not applicable
(1) 14/40 = 14 days to sample extraction/40 days to extract analysis
* Metals and Mercury samples must be digested and analyzed within the stated holding times

All wipe, vacuum, and bulk samples were immediately placed in dedicated glass sample jars prior to being placed in chilled coolers and recorded on a Chain of Custody Form. Samples were preserved according to the specific method requirements and delivered to the laboratory within 24 hours of collection.

Micro-Vacuum Sampling Methods

A micro-vacuuming method was employed to collect silica and the other COPCs from within the zones described above for certain sampling substrates (e.g., carpeting). A pre-weighed polyvinyl chloride (PVC) cassette (for silica) was connected to a three-foot length run of Tygon tubing (with a 45º angle cut into the sample intake portion) on the sampling side and a pump set at a flow rate of 10.0 liters per minute on the intake side. Using a template, samples were collected within a ten-centimeter-by-ten-centimeter area for a period of approximately two minutes. Appropriate personal protective equipment (PPE), including coveralls, gloves, boots, and a High Efficiency Particulate Arrestance (HEPA) filtered respirator were worn by sampling technicians at all times. Samples were placed in a sealed bag and kept cold during collection, holding, and submittal periods to the approved analytical laboratory.

Bulk Dust Sampling Methods

Bulk sampling methods were used to collect dust for a determination of percentages of various silica species, i.e., crystalline versus amorphous. A clean laboratory scoop was utilized to collect representative samples from non-porous surfaces where extensive dust was present. Appropriate PPE, including coveralls, gloves, boots, and HEPA filtered respirators were worn by sampling technicians at all times. At least two such samples were collected from each zone. Samples were placed in a sealed bag and kept cold during collection, holding, and submittal periods to the approved analytical laboratory.

Bulk Carpeting Sampling Methods

A bulk sampling method was employed to collect dioxin and PAH samples from carpet. A clean cutting tool was utilized to remove a ten-centimeter-by-ten-centimeter area using a pre-cut template. Sample locations were determined utilizing the above-described protocol. Appropriate PPE, including coveralls, gloves, boots, and a HEPA filtered respirator were worn by sampling technicians at all times. Samples were placed in a sealed bag and kept cold during collection, holding, and submittal periods to the approved analytical laboratory.

Wipe Sampling Methods

A wipe sampling method was employed to collect PCBs, PAHs, and metals (including mercury) within the zones described above. This was the default sampling method when there was an absence of carpeting. Individual samples (per suitable wipe/matrix/container) for each of these analytes were collected from within a ten-centimeter-by-ten-centimeter area template. PCBs and PAHs were collected on sterile gauze pad treated with a 4:1 acetone/hexane mixture, while metals were collected on a sterile gauze pad treated with deionized water. Appropriate PPE, including coveralls, gloves, boots, and HEPA filtered respirators were worn by sampling technicians at all times. Samples were placed in a sealed bag and kept cold during collection, holding, and submittal periods to the approved analytical laboratory.

Sample Identification and Labeling

Each sample was assigned a unique identification number:

WXYYSZZV	=	Example identification number
W	=	Analyte group (C for Chemical)
X	=	Sampler #
YY	=	Floor #
S	=	Sample (constant)
ZZ	=	Sample number
V	=	Sampling event (e.g., A = 1st time, B = 2nd time, if required)

The sample container was labeled with the sample identification number, date of collection, and the sampler's initials.

Sampling Documentation

The information necessary to relate sample locations for reporting purposes were documented in bound field log books. The following information was completed for each sample collected:

- Client and Facility information;
- Sample identification number;
- Date/time sampled;
- Sampler;
- Room/area from where the sample was taken;
- Equipment/area number, if applicable;
- Description of areas/items sampled; and
- Sketch of sample locations.

A copy of the sample log sheet was forwarded to the Task Manager and QA/QC Manager for review and inclusion in the project file.

Chain of Custody Form

Field personnel completed Chain of Custody Forms for all samples submitted to the laboratory. Following completion, the sampling personnel signed and dated the form and submitted the samples to the laboratory. Each person that successively took possession of the samples then signed and dated the form, providing documentation that the samples were under the control of a designated person at all times. The Chain of Custody Forms, with all signatures, were provided with the final reports from the laboratory.

Samples were treated in an appropriate and suitable manner for delivery to the analytical laboratory. All packaging and labels complied with Federal DOT regulations as provided in 49 C.F.R. 171-178. Specific requirements for sample shipment were outlined in the QAPP.

QA/QC

Data quality was assessed on all field samples and corresponding laboratory QA/QC samples following the recommended procedures outlined in the following documents:

- EPA Region II Standard Operating Procedure (SOP) HW-22: *Validating Semivolatile Organic Compounds by SW-846 Method 8270* (Rev 2, June 2001);
- EPA Region II SOP HW-23B: *Validating PCB Compounds by SW-846 Method 8082* (Rev 1.0, May 2002);
- EPA Region II SOP HW-19: *Validating PCDDs and PCDFs by HRGC/HRMS* (Rev 1.0, October 1994); and
- EPA Contract Laboratory Program (CLP) *National Functional Guidelines for Inorganic Data Review* (February 1994).

The EPA Guidelines were employed for the validation, as the guidelines were written for CLP methodologies and SW-846 methods, which were used for this investigation. Rationale is provided for cases where professional judgment is used to determine data quality. For silica analyses, the data quality was assessed in accordance with the requirements of the National Institute for Occupational Safety and Health (NIOSH) Method 7500. The following information, along with the requirements of the specific methods, was used to assess the quality of the analytical results:

- Holding Times;
- Instrument Tunes (Dioxins, PAHs);
- Initial and Continuing Calibration Data;
- Method Blanks;
- Surrogate Recovery Data;
- Laboratory Control Samples;
- Matrix Spike/Matrix Spike Duplicates;
- Retention Time Data (Dioxins, PCBs);
- Internal Standard Data (PAHs, Dioxins); and
- Duplicate Sample Results.

The number/type of QA/QC samples is presented in Table 2.

Method Detection Limits

Method Detection Limits (MDLs) represent the lowest concentration a laboratory analysis can quantify with confidence. The presence of a detectable analyte in a sample indicates that the concentration of the analyte exceeds the MDL. Non-detectable concentrations indicate that the selected analyte was not present in a concentration that exceeded the MDL, but it does not indicate that the selected contaminant is absent from the sample in concentrations lower than the MDL.

In general, MDLs are established through the analytical method, the measuring instrument's sensitivity, the amount of interference from the sample matrix, the concentration of the analytes, and the Data Quality Objectives of the project. The laboratories contracted for this project established MDLs for each analysis that are consistent with standard industry practice and are sufficiently low (in the absence of matrix interference or elevated concentrations requiring sample dilution) to permit evaluation.

Reporting Units

Upon completion of the analyses, the contract laboratories reported the results by analyte. For wipe, bulk carpeting, and micro-vacuum samples, the analytical results were presented in the ratio of mass of the analyte over the sample collection area. For bulk dust samples, the analytical results were presented in the ratio of the mass of the analyte over the mass of the sample. Table 4 presents the units the laboratory reported by analyte and sample type. To complete the evaluation, the wipe, bulk carpeting, and micro-vacuum sample results were scaled to the industry standard ratio of ug/meter^2 (ug/m^2) or ng/m^2 (nanograms per square meter for dioxins).

TABLE 4
ANALYTE REPORTING UNITS

Analyte	Sample Method			
	Wipe	Bulk Carpeting	Micro-Vacuum	Bulk Dust
Silica	mg/100 cm^2	mg/100 cm^2	mg/100 cm^2	mg/kg
Dioxin	pg/100 cm^2	pg/100 cm^2	pg/100 cm^2	pg/g
PAHs	ug/100 cm^2	ug/100 cm^2	ug/100 cm^2	ug/kg
PCBs	ug/100 cm^2	ug/100 cm^2	ug/100 cm^2	ug/kg
Metals	ug/100 cm^2	ug/100 cm^2	ug/100 cm^2	ug/kg
Mercury	ug/100 cm^2	ug/100 cm^2	ug/100 cm^2	mg/kg

Notes:
mg/100 cm^2 – milligrams per 100 square centimeter sampling area
ug/100 cm^2 – micrograms per 100 square centimeter sampling area
ug/kg – micrograms per kilogram
pg/100 cm^2 – picograms per 100 square centimeter sampling area
pg/g – picograms per gram
mg/kg – milligrams per kilogram

Equipment Decontamination

As primarily disposable tools/media were utilized during the sampling process, limited equipment decontamination procedures were necessary. Berger ensured that dedicated (as opposed to re-usable) sample collection media were utilized for each wipe/dust sample. Examples of measures used to avoid contamination included:

- The outer case holding the sampling pump was wiped with sterile towelettes; and
- The extension cord(s) being utilized were wiped utilizing sterile towelettes.

Mercury Vapor

As an addition to the original scope of work, one hundred fifty-three (153) direct reading samples for mercury vapor were collected using the Jerome Meter 431-X. The Jerome 431-X mercury vapor analyzer uses a patented gold film sensor for accurate detection and measurement of toxic mercury vapor in the air. This portable handheld unit can easily be carried to locations with mercury concerns for applications such as industrial hygiene monitoring, mercury spill clean up and mercury exclusion testing. Simple, push button operation allows users to measure mercury levels from 0.003 to 0.999 mg/m^3 in just seconds. The sampling was performed on ten floors of the building on September 3, 2004 during an approximately 8-hour time period, with approximately four (4) hours of actual sampling time. Each of the ten floors where sampling was performed was divided into approximately 15 areas.

2.4 Visual Mold Inspection

Berger performed an initial visual inspection of readily accessible areas within the Building to assess the presence and, if any, the quantity of mold or mold precursors (e.g., water-damaged building materials or water infiltration). The inspection was performed systematically from the top of the Building to the Basement levels. Accessible surfaces on all floors of the Building were visually inspected for evidence of mold and its precursors. The space above the suspended ceiling (plenum) was only investigated in instances where stained ceiling tiles were noted or where ceiling tiles were missing. All materials suspected of being impacted by mold were quantified in SF in field notebooks and the locations depicted on building floor plans.

3.0 RESULTS

The following subsections present the results of the Asbestos Building Inspection and Material Survey, the Dust Characterization for Asbestos, the Dust Characterization for Other Analytes, and the Visual Mold Inspection. Full data summary tables and final analytical laboratory reports are presented in the Appendices attached to this Report (in separate volumes).

3.1 Asbestos Building Inspection and Material Survey

A summary of the asbestos inspection findings and laboratory results of all building materials sampled and analyzed are presented in two tables located in Appendix B. Table 5 below presents the total quantities of materials being confirmed via laboratory analysis as having an amount greater than one percent asbestos:

- Floor tiles on various floors;
- Associated mastic on floor tiles on various floors;
- Associated mastic on linoleum sheeting on 18th Floor;
- Duct joint caulking on 23rd and 40th Floors;
- Sealant at cable entrances in Basement;
- Pipe insulation on different floors;
- Transite walls on 5th and 40th Floors;
- Wall/floor joint tar material in Gash Area;
- Fan room walls insulation on 40th Floor;
- Caulking material at roof fans;
- Window caulking on roof;
- Exterior sealant and caulking material on curtain wall; and
- Baseboard mastic.

An approximate total of 154,940 SF and 95,150 LF of ACM were identified throughout the Building. A summary of the findings are displayed in the following tables:

TABLE 5
SUMMARY OF INSPECTION RESULTS
FOR CONFIRMED ASBESTOS-CONTAINING BUILDING MATERIALS

CONFIRMED ACM	APPROXIMATE QUANTITY		FRIABILITY†	NOTES / LOCATION
	SF	LF		
12" x 12" Floor Tiles & Associated Mastic	123,780		Non-friable	Approximately 123,780 SF of asbestos-containing "Floor Tiles & Associated Mastic" were identified in the following locations: 30 SF in Basement B; 28,000 SF (2 Layers) in Basement A; 10,500 SF on 1st Floor; 800 SF on 2nd Floor; 4,500 SF on 3rd Floor; 2,000 SF on 5th & 6th Floors; 400 SF on 7th Floor; 10,500 SF on 9th Floor; 900 SF on 10th Floor; 7,000 SF on 11th Floor; 6,150 SF on 14th Floor; 150 SF on 15th Floor; 300 SF on 17th Floor; 350 SF on 18th Floor; 950 SF on 19th Floor; 300 SF on 20th Floor; 600 SF on 22nd Floor; 2,250 SF on 23rd Floor; 260 SF on 24th Floor; 6,000 SF on 25th Floor; 1,000 SF on 26th Floor; 1,620 SF on 28th Floor; 400 SF on 29th Floor; 2,100 SF on 30th Floor; 3,800 SF on 31st Floor; 500 SF on 32nd Floor; 5,700 SF on 33rd Floor; 5,200 SF on 34th Floor; 800 SF on 35th Floor; 50 SF on 36th Floor; 2,550 SF on 37th Floor; 3,120 SF on 38th Floor; 5,500 SF on 39th Floor; and 9,500 SF on 40th and 41st Floors.
Sealant at Cable Entrances	50		Non-friable	Located in Basement A.
24" Pipe Insulation		300	Friable	Located in Basement A.
30" Pipe Insulation		500	Friable	Located in Basement A.
Transite Board Wall	4,500		Non-friable	Located on the 5th and 6th Floor MER.
Pipe Insulation, Greater Than 12"		1,200	Friable	Located on the 5th and 6th Floor MER.
Gash: Wall/Floor Joint Tar Paper	1,710		Non-friable	Located in the North Side Gash area: 250 SF on 7th Floor; 250 SF on 8th Floor; 60 SF on 9th Floor; 200 SF on 10th Floor; 250 SF on 11th Floor; 250 SF on 12th Floor; 100 SF on 15th Floor; 100 SF on 16th Floor; 250 SF on 17th Floor.
Linoleum Sheeting and Mastic	500		Non-friable	Located on the 18th Floor the Linoleum Sheeting material is Non-ACM. However it cannot be separated from the underlying ACM Mastic material without a contaminated residue. Remove as ACM.
Pipe & Fittings Insulation at 6"-12" Pipe		550	Friable	Pipe Fittings are non-ACM but remove and dispose of as ACM since it cannot be separated from the ACM Piping without contamination.
HVAC Duct Caulking (Joint)		1,510	Friable	1,500 LF on the 23rd Floor and 10 LF on the 40th & 41st Floor MER.
Transite Wall	20,000		Non-friable	Located on the 40th & 41st Floors.
Fan Room Walls Insulation (Black)	3,000		Non-friable	
Caulking at Fans		50	Non-friable	Located on the Roof.
Window Caulking		40	Non-friable	

TABLE 5 (continued)
SUMMARY OF INSPECTION RESULTS
FOR CONFIRMED ASBESTOS-CONTAINING BUILDING MATERIALS

CONFIRMED ACM	APPROXIMATE QUANTITY		FRIABILITY†	NOTES / LOCATION
	SF	LF		
Sealant over Weather Stripping at Metal Column Parts		45,500	Non-friable	Located on the Exterior Façade. (Estimated quantity for 38 Floors. Excludes approx. 5,000 LF from Gash area).
Caulking between Column Metal Covers		45,500	Non-friable	
Baseboard Mastic	1,400		Non-friable	500 SF on 7th Floor; 100 SF on 12th Floor; 500 SF on 16th Floor; 300 SF on 23rd Floor.

Notes:
***** All amounts are approximations, not exact measurements.
****** Estimated quantity for 38 floors. Excludes approximately 5,000 LF from the Gash Area.
† Friable ACM is the term given to any material that contains more than one percent asbestos and can be crumbled, pulverized, or reduced to powder by hand pressure as per NYSDOL and the EPA. In New York City, the definition of 'Friable ACM' is the term given to any material that contains more than one percent asbestos and can be crumbled, pulverized, or reduced to powder by hand pressure and/or mechanical means (NYCDEP Title 15 Regulations). It refers to a material's likeliness to release airborne fibers. There is a greater possibility that a friable material will release fibers into the air when disturbed than will a non-friable material (e.g., floor tiles, roofing materials, etc.) thereby causing a potential hazard. For this Table, the EPA/NYSDOL definition of friability was used.

TABLE 6
SUMMARY OF INSPECTION RESULTS FOR ASBESTOS BY FLOOR

FLOOR	CONFIRMED ACM	APPROXIMATE QUANTITY	
		SF	LF
BASEMENT B			
	12" x 12" Black Floor Tiles	30	
	Associated Mastic on Floor Tiles		
BASEMENT A			
	12" x 12" Floor Tile/3rd Layer (Black)	14,000	
	12" x 12" Floor Tile/3rd Layer (Light Brown)		
	Associated Mastic on Floor Tiles		
	12" x 12" Floor Tile/2nd Layer (Dark Grey)	12,000	
	Associated Mastic on Floor Tiles		
	12" x 12" Floor Tile (Black)	2,000	
	Sealant at Cable Entrances	50	
	24" Pipe Insulation		300
	30" Pipe Insulation		500

TABLE 6 (continued)
SUMMARY OF INSPECTION RESULTS FOR ASBESTOS BY FLOOR

FLOOR	CONFIRMED ACM	APPROXIMATE QUANTITY	
		SF	LF
1ST FLOOR			
	12” x 12” Floor Tiles [2 layers]	10,500	
MEZZANINE			
	12”x12” Beige Floor Tiles	800	
2ND FLOOR			
	NONE		
3RD FLOOR			
	12” x 12” Floor Tile	4,500	
	Associated Mastic on Floor Tiles		
4TH FLOOR			
	NONE		
5TH AND 6TH FLOORS MECHANICAL ROOM			
	Transite Board Wall	4,500	
	Pipe Insulation, Greater Than 12”		1,200
	12” x 12” Floor Tiles	2,000	
	Associated Mastic on Floor Tiles		
7TH FLOOR			
	12” x 12” Floor Tiles	400	
	Gash: Wall/Floor Joint Tar Paper	250	
	Associated Mastic on Baseboard (Brown)	500	
8TH FLOOR			
	Gash: Wall/Floor Joint Tar Paper	250	
9TH FLOOR			
	12” x 12” Floor Tiles (Beige)	9,000	
	Associated Mastic on Floor Tiles		
	12” x 12” Floor Tiles 2 Layers (Grey/Composite)	1,500	
	Associated Mastic on Floor Tiles		
	Gash: Wall/Floor Joint Tar Paper	60	
10TH FLOOR			
	12” x 12” Floor Tiles (Beige)	600	
	12” x 12” Floor Tiles (Black)	300	
	Gash: Wall/Floor Joint Tar Paper	200	
11TH FLOOR			
	12” x 12” Floor Tiles 2nd Layer (Black)	7,000	
	Associated Mastic on Floor Tiles		
	Gash: Wall/Floor Joint Tar Paper	250	
12TH FLOOR			

TABLE 6 (continued)
SUMMARY OF INSPECTION RESULTS FOR ASBESTOS BY FLOOR

FLOOR	CONFIRMED ACM	APPROXIMATE QUANTITY	
		SF	LF
	Gash: Wall/Floor Joint Tar Paper	250	
	Associated Mastic on Baseboard (Brown)	100	
14TH FLOOR			
	12” x 12” Floor Tiles 2 Layers (Beige)	6,000	
	12” x 12” Floor Tiles (Black)	150	
15TH FLOOR			
	12” x 12” Floor Tiles 2nd Layer (Black)	150	
	Gash: Wall/Floor Joint Tar Paper	100	
16TH FLOOR			
	Gash: Wall/Floor Joint Tar Paper	100	
	Associated Mastic on Baseboard (Brown)	500	
17TH FLOOR			
	12” x 12” Floor Tiles (Black)	300	
	Mastic associated with 12” x 12” Floor Tiles		
	Gash: Wall/Floor Joint Tar	250	
18TH FLOOR			
	12” x 12” Floor Tiles 2nd Layer (Black)	350	
	Linoleum Sheeting	500	
	Associated Mastic on Linoleum Sheeting		
19TH FLOOR			
	12” x 12” Floor Tiles 1st Layer (Beige)	350	
	12” x 12” Floor Tiles 2nd Layer (Black)	600	
20TH FLOOR			
	Pipe Insulation at 6”-12” Pipe		500
	Pipe Joint Insulation at 1” Pipe		50
	12” x 12” Floor Tiles (Black)	300	
21ST FLOOR			
	NONE		
22ND FLOOR			
	12” x 12” Floor Tiles 2 Layers (Grey)	600	
	Associated Mastic on Floor Tiles		
23RD FLOOR			
	12” x 12” Floor Tiles 2nd Layer (Black)	250	
	Associated Mastic on Floor Tiles		
	12” x 12” Floor Tiles (Grey)	2,000	
	HVAC Duct Caulking (Joint)		1,500
	Associated Mastic on Baseboard (Brown)	300	

TABLE 6 (continued)
SUMMARY OF INSPECTION RESULTS FOR ASBESTOS BY FLOOR

FLOOR	CONFIRMED ACM	APPROXIMATE QUANTITY	
		SF	LF
24TH FLOOR			
	12” x 12” Floor Tiles (Grey)	260	
	Associated Mastic on Floor Tiles		
25TH FLOOR			
	12” x 12” Floor Tiles (Black)	6,000	
26TH FLOOR			
	12” x 12” Floor Tiles (Beige)	1,000	
	Associated Mastic on Floor Tiles		
27TH FLOOR			
	NONE		
28TH FLOOR			
	12” x 12” Floor Tiles (Grey)	1,500	
	12” x 12” Floor Tiles (Light Brown)	120	
29TH FLOOR			
	12” x 12” Floor Tiles (Grey)	400	
	Associated Mastic on Floor Tiles		
30TH FLOOR			
	12”x12” Pink Floor Tiles	800	
	Mastic associated with 12”x12” Pink Floor Tiles		
	12”x12” Black Floor Tiles	1,300	
	Mastic Associated with 12”x12” Black Floor Tiles		
31ST FLOOR			
	12”x12” Black Floor Tiles	3,000	
	12'x12” Beige Floor Tiles	800	
	Mastic associated with 12'x12” Beige Floor Tiles		
32ND FLOOR			
	12”x12” Black Floor Tiles	500	
	Mastic Associated with 12”x12” Black Floor Tiles		
33RD FLOOR			
	12”x12” Black Floor Tiles	3,000	
	Mastic associated with 12”x12” Black Floor Tiles		
	12”x12” Floor Tiles [2-layer composite]	2,500	
	Associated Mastic with 12”x12” composite Floor Tiles		
	12”x12” Grey Floor Tiles	200	
34TH FLOOR			
	12”x12” Grey Floor Tiles [2-layer composite]	1,700	

TABLE 6 (continued)
SUMMARY OF INSPECTION RESULTS FOR ASBESTOS BY FLOOR

FLOOR	CONFIRMED ACM	APPROXIMATE QUANTITY	
		SF	LF
	Mastic associated with 12"12" Grey Floor Tiles		
	12"x12" Black Floor Tiles [1 layer]	3,500	
	Mastic Associated with 12"x12" Black Floor Tiles		
35TH FLOOR			
	12" x 12" Floor Tiles 2 Layers (Beige)	800	
36TH FLOOR			
	12" x 12" Floor Tiles (Black)	50	
	Associated Mastic on Floor Tiles		
37TH FLOOR			
	12" x 12" Floor Tiles (Brown)	2,500	
	Associated Mastic on Floor Tiles		
	12" x 12" Floor Tiles (Beige)	50	
38TH FLOOR			
	12" x 12" Floor Tiles (Grey)	3,000	
	Associated Mastic on Floor Tiles		
	12" x 12" Floor Tiles Composite 3 Layers (Blue)	120	
39TH FLOOR			
	12" x 12" Floor Tiles 2 Layers (Pink and Tan)	1,500	
	Associated Mastic on Floor Tiles		
	12" x 12" Floor Tiles (Grey)	4,000	
	Associated Mastic on Floor Tiles		
40TH AND 41ST FLOORS MECHANICAL ROOM			
	12" x 12" Floor Tiles (Black)	5,000	
	Associated Mastic on Floor Tiles		
	12" x 12" Floor Tiles (Grey)	4,500	
	Associated Mastic on Floor Tiles		
	Transite Wall	20,000	
	Fan Room Walls Insulation (Black)	3,000	
	HVAC Duct Joint Caulking		10
ROOF			
	Caulking at Fans		50
	Window Caulking		40
EXTERIOR FAÇADE			
	Sealant over Weather Stripping at Metal Column Parts		1,500
	Caulking between Column Metal Covers (Grey)		1,500

TABLE 6 (continued)
SUMMARY OF INSPECTION RESULTS FOR ASBESTOS BY FLOOR

FLOOR	CONFIRMED ACM	APPROXIMATE QUANTITY	
		SF	LF
	Sealant over Weather Stripping at Metal Column Parts		44,000
	Caulking between Column Metal Covers (Grey)	TBD	44,000
		95,150	154,940

Notes:
* All amounts are approximations, not exact measurements.
** Estimated quantity for 38 floors. Excludes approximately 5,000 LF from the Gash Area.

Based upon visual observations and experience with similar buildings, Berger also suspects (and until proven not to be present assumes) that there is "Filling Material" and/or "Caulking Material" in the interstitial spaces of curtain walls within the Building. While it was not authorized as part of the initial investigation, exploratory demolition will be conducted prior to deconstruction and a New York City Certified Asbestos Investigator will inspect and collect bulk samples for confirmatory testing if suspect materials are identified.

3.2 Dust Characterization for Asbestos

Settled dust with visible accumulations of less than one quarter of an inch high was identified throughout the Building in locations such as the top of radiator covers, carpets, concrete floors, horizontal surfaces on door frames, reception desks, and HVAC units. Above the suspended ceiling, visible dust was identified on top of ceiling tiles, ceiling grids, HVAC ductwork, electrical lighting fixtures, and sheetrock ceilings. Approximately 815 dust samples were collected from the interior of the Building and the exterior netting and analyzed using the Polarized Light Microscopy (PLM) method. Additionally, 40 random bulk samples of the dust from the interior were collected and analyzed for asbestos using the Transmission Electron Microscopy (TEM) method. Data summary tables are presented in Appendix B and Table 7 presents a summary of the results of the TEM sampling, by floor.

TABLE 7
SUMMARY OF ASBESTOS DUST TEM RESULTS BY FLOOR

Location	Sample Type	No. of Samples	# Detects	% Detects	# Non-Detects	% Non-Detects	Min. Con. (structures /cm²)	Max. Con. (structures /cm²)
Floor 1	Vac	2	2	100.00%	0	0.00%	269,640	3,852,000
Floor M	Vac	1	1	100.00%	0	0.00%	607,760	607,760
Floor 2	Vac	1	1	100.00%	0	0.00%	4,879,200	4,879,200
Floor 3	Vac	2	2	100.00%	0	0.00%	269,640	663,400
Floor 4	Vac	1	1	100.00%	0	0.00%	102,720	102,720
Floor 5	Vac	5	4	80.00%	1	20.00%	<891	1,305,400
Floor 7	Vac	1	1	100.00%	0	0.00%	5,350	5,350
Floor 8	Vac	1	1	100.00%	0	0.00%	178,333	178,333
Floor 9	Vac	1	1	100.00%	0	0.00%	94,160	94,160
Floor 10	Vac	1	1	100.00%	0	0.00%	196,880	196,880
Floor 11	Vac	1	1	100.00%	0	0.00%	64,200	64,200
Floor 14	Vac	1	1	100.00%	0	0.00%	25,680	25,680
Floor 15	Vac	1	1	100.00%	0	0.00%	727,600	727,600
Floor 17	Vac	1	1	100.00%	0	0.00%	299,600	299,600
Floor 18	Vac	1	1	100.00%	0	0.00%	17,833	17,833
Floor 20	Vac	1	1	100.00%	0	0.00%	64,200	64,200
Floor 21	Vac	1	1	100.00%	0	0.00%	205,440	205,440
Floor 22	Vac	1	1	100.00%	0	0.00%	34,240	34,240
Floor 24	Vac	1	0	0.00%	1	100.00%	<891	<891
Floor 25	Vac	1	0	0.00%	1	100.00%	<891	<891
Floor 27	Vac	1	1	100.00%	0	0.00%	11,591	11,591
Floor 28	Vac	1	0	0.00%	1	100.00%	<891	<891
Floor 30	Vac	1	1	100.00%	0	0.00%	203,300	203,300

TABLE 7 (continued)
SUMMARY OF ASBESTOS DUST TEM RESULTS BY FLOOR

Location	Sample Type	No. of Samples	# Detects	% Detects	# Non-Detects	% Non-Detects	Min. Con. (structures /cm^2)	Max. Con. (structures /cm^2)
Floor 31	Vac	1	1	100.00%	0	0.00%	42,800	42,800
Floor 32	Vac	1	1	100.00%	0	0.00%	1,070	1,070
Floor 34	Vac	1	1	100.00%	0	0.00%	<891	<891
Floor 35	Vac	1	1	100.00%	0	0.00%	41,730	41,730
Floor 36	Vac	1	1	100.00%	0	0.00%	67,766	67,766
Floor 39	Vac	1	1	100.00%	0	0.00%	4,280	4,280
Floor 40	Vac	2	2	100.00%	0	0.00%	214,000	273,920
Floor 41	Vac	3	2	66.70%	1	33.30%	<891	3,332,285

3.3 Dust Characterization for Other Analytes

The following subsections present the results for each of the analytes (other than asbestos) in dust sampled during the Study, including silica (quartz and cristobalite), PAHs, dioxins, PCBs, heavy metals, and mercury. Final laboratory analytical reports and a summary of results are included as appendices, which are provided as a separate volume to this report.

3.3.1 *Silica (Quartz and Cristobalite)*

A total of one hundred seventeen (117) wipe and vacuum samples were collected for laboratory analysis for quartz and cristobalite. The results of these analyses are presented in Tables 8 and 9, which are differentiated by zone and above/below plenum. The laboratory reported all results in units of either mg/filter (for vacuum samples) or mg/wipe. These results directly correlate to mg/100 cm^2, as the vacuum samples and the wipe samples collected represent an area of 100 cm^2. In order to convert these results to the standard units of ug/m^2, the laboratory-provided results are multiplied by 100,000 (conversions: 1,000 ug/mg; 10,000 cm^2/m^2). Note that Zones 5 and 6 contain samples that were collected from exterior surfaces, and those results are not included in the above/below the plenum table.

TABLE 8
SUMMARY OF QUARTZ AND CRISTOBALITE SAMPLE ANALYSIS RESULTS BY ZONE

QUARTZ

Zone	Sample Type	No. Samples	# Non Detects	%Non Detects	# Detects	% Detects	Min Conc. ug/m^2	Max Conc. ug/m^2
1	Vac	30	0	0.0%	30	100.0%	71,000	10,000,000
Totals		*30*	*0*	*0.0%*	*30*	*100.0%*		
2	Wipe	1	0	0.0%	1	100.0%	530,000	530,000
	Vac	39	1	2.6%	38	97.4%	500	2,400,000
Totals		*40*	*1*	*2.5%*	*39*	*97.5%*		
3	Vac	34	0	0.0%	34	100.0%	1,000	3,500,000
Totals		*34*	*0*	*0.0%*	*34*	*100.0%*		
4	Vac	7	2	28.6%	5	71.4%	23,000	6,700,000
Totals		*7*	*2*	*28.6%*	*5*	*71.4%*		
5	Vac	4	0	0.0%	4	100.0%	1,500	12,000
Totals		*4*	*0*	*0.0%*	*4*	*100.0%*		
6	Wipe	3	0	0.0%	3	100.0%	320,000	1,800,000
Totals		*3*	*0*	*0.0%*	*3*	*100.0%*		
TOTALS		**118**	**3**	**2.6%**	**115**	**97.4%**	**500**	**10,000,000**

CRISTOBALITE

Zone	Sample Type	No. Samples	# Non Detects	%Non Detects	# Detects	% Detects	Min Conc. ug/m^2	Max Conc. ug/m^2
1	Vac	30	30	100.0%	0	0.0%		
Totals		*30*	*30*	*100.0%*	*0*	*0.0%*		
2	Wipe	1	1	100.0%	0	0.0%		
	Vac	39	39	100.0%	0	0.0%		
Totals		*40*	*40*	*100.0%*	*0*	*0.0%*		
3	Vac	34	34	100.0%	0	0.0%		
Totals		*34*	*34*	*100.0%*	*0*	*0.0%*		
4	Vac	7	6	87.5%	1	12.5%	2,800	2,800
Totals		*7*	*6*	*87.5%*	*1*	*12.5%*		
5	Vac	4	4	100.0%	0	0.0%		
Totals		*4*	*4*	*100.0%*	*0*	*0.0%*		
6	Wipe	3	2	66.7%	1	0.0%	340,000	340,000
Totals		*3*	*2*	*66.7%*	*1*	*0.0%*		
TOTALS		**118**	**116**	**98.3%**	**2**	**1.7%**	**2,800**	**340,000**

TABLE 9
SUMMARY OF QUARTZ AND CRISTOBALITE
SAMPLE ANALYSIS RESULTS ABOVE AND BELOW PLENUM

QUARTZ

A/B Plenum	Sample Type	Total # of Samples	# Non Detects	%Non Detects	# Detects	% Detects	Min Conc. ug/m^2	Max Conc. ug/m^2
Above Plenum	Vac	26	1	3.8%	25	96.2%	1,000	1,200,000
Below Plenum	Wipe	1	0	0.0%	1	100.0%	530,000	530,000
	Vac	84	2	2.4%	82	97.6%	500	10,000,000
TOTALS		**111**	**3**	**2.7%**	**108**	**97.3%**	**500**	**10,000,000**

CRISTOBALITE

A/B Plenum	Sample Type	Total # of Samples	# Non Detects	%Non Detects	# Detects	% Detects	Min Conc. ug/m^2	Max Conc. ug/m^2
Above Plenum	Vac	26	26	100.0%	0	0.0%		
Below Plenum	Wipe	1	1	100.0%	0	0.0%		
	Vac	84	83	98.8%	1	1.2%	2,800	2,800
TOTALS		**111**	**110**	**99.1%**	**1**	**0.9%**	**2,800**	**2,800**

3.3.2 *PAHs*

One hundred twenty-five (125) samples were analyzed for PAHs. A summary of the laboratory analytical results are presented below on Tables 10 and 11, which are differentiated by zone and above/below plenum. The laboratory reported all results in units of either ug/wipe or ug/sample (for bulk samples). These results directly correlate to ug/100 cm^2, as the wipe and the bulk samples collected represent an area of 100 cm^2. In order to convert these results to the standard units of ug/m^2, the laboratory-provided results are multiplied by 100 (conversion: 10,000 cm^2/m^2). The World Health Organization (WHO) has established a convention whereby the results for seven PAH compounds (i.e., benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene) are expressed as a toxicity equivalency concentration (TEQ). The TEQ is based upon toxicity equivalency factors (TEF) referenced to benzo(a)pyrene, which is the most toxic of the PAHs. The TEQ is computed by multiplying the concentration of each compound by the TEF. The products of the individual concentrations and the TEFs are then added to obtain the TEQ for that sample. For this investigation, one-half of the detection limit was used for compounds that were not detected. Note that Zones 5 and 6 contain samples that were collected from exterior surfaces and those results are not included in the above/below plenum table.

TABLE 10
SUMMARY OF PAH
SAMPLE ANALYSIS RESULTS BY ZONE

Zone	Sample Type	No. Samples	# Non Detects	%Non Detects	# Detects	% Detects	Min Conc. ug/m^2 (TEQ)	Max Conc. ug/m^2 (TEQ)
1	Wipe	30	0	0.0%	30	100.0%	3	5,028
	Bulk	2	0	0.0%	2	100.0%	58	58
Totals		*32*	*0*	*0.0%*	*32*	*100.0%*		
2	Wipe	29	0	0.0%	29	100.0%	58	1,857
	Bulk	10	0	0.0%	10	100.0%	58	11,555
Totals		*39*	*0*	*0.0%*	*39*	*100.0%*		
3	Wipe	28	0	0.0%	28	100.0%	578	1,156
	Bulk	9	0	0.0%	9	100.0%	578	578
	Vac	1	0	0.0%	1	100.0%	578	578
Totals		*38*	*0*	*0.0%*	*38*	*100.0%*		
4	Wipe	7	0	0.0%	7	100.0%	1,156	1,156
	Bulk	2	0	0.0%	2	100.0%	5,778	5,778
Totals		*9*	*0*	*0.0%*	*9*	*100.0%*		
5	Wipe	4	0	0.0%	4	100.0%	578	788
Totals		*4*	*0*	*0.0%*	*4*	*100.0%*		
6	Wipe	3	0	0%	3	100.0%	578	1,156
Totals		*3*	*0*	*0%*	*3*	*100.0%*		
TOTALS		**125**	**0**	**0%**	**125**	**100.0%**	**3**	**11,555**

TABLE 11
SUMMARY OF PAH
SAMPLE ANALYSIS RESULTS ABOVE AND BELOW PLENUM

A/B Plenum	Sample Type	Total # of Samples	# Non Detects	%Non Detects	# Detects	% Detects	Min Conc. ug/m^2 (TEQ)	Max Conc. ug/m^2 (TEQ)
Above Plenum	Wipe	26	0	0.0%	26	100.0%	58	578
Below Plenum	Wipe	68	0	0.0%	68	100.0%	3	5,028
	Bulk	24	0	0.0%	24	100.0%	58	11,555
TOTALS		**118**	**0**	**0.0%**	**118**	**100.0%**	**3**	**11,555**

3.3.3 *Dioxin*

One hundred twenty-four (124) samples were analyzed for dioxin concentrations. A summary of the laboratory analytical results is presented below on Tables 12 and 13, which are differentiated by zone and above/below plenum. The laboratory reported all results in units of picograms (pg) per sample. These results directly correlate to pg/100 cm^2, as the wipe and the bulk samples collected represent an area of 100 cm^2. In order to convert these results to the typical units used for dioxin, which is nanograms (standard units of ng/m^2), the laboratory-provided results are multiplied by 0.1 (conversions: 1,000 pg/ng; 10,000 cm^2/m^2). The WHO has established a convention whereby the results for all dioxin compounds are expressed as a toxicity equivalency concentration (TEQ). The TEQ is based upon TEF referenced to 2,3,7,8 TCDD, which is the most toxic of the dioxin compounds. The TEQ is computed by multiplying the concentration of each compound by the TEF. The products of the individual concentrations and the TEFs are then added to obtain the TEQ for that sample. For this investigation, one-half of the detection limit was used for compounds that were not detected. Note that Zones 5 and 6 contain samples that were collected from exterior surfaces and those results are not included in the above/below plenum table.

TABLE 12
SUMMARY OF DIOXIN
SAMPLE ANALYSIS RESULTS BY ZONE

Zone	Sample Type	No. Samples	# Non Detects	%Non Detects	# Detects	% Detects	Min Conc. ng/m^2 (TEQ)	Max Conc. ng/m^2 (TEQ)
1	Wipe	32	0	0.0%	32	100.0%	5.5	33.5
Totals		*32*	*0*	*0.0%*	*32*	*100.0%*		
2	Wipe	29	0	0.0%	29	100.0%	1.22	32.8
	Bulk	9	0	0.0%	9	100.0%	0.67	46.1
Totals		*38*	*0*	*0.0%*	*38*	*100.0%*		
3	Wipe	26	0	0.0%	26	100.0%	2.53	34.8
	Bulk	10	0	0.0%	10	100.0%	1.24	84.8
Totals		*36*	*0*	*0.0%*	*36*	*100.0%*		
4	Wipe	8	0	0.0%	8	100.0%	12.9	22.9
Totals		*8*	*0*	*0.0%*	*8*	*100.0%*		
5	Wipe	4	0	0.0%	4	100.0%	3.92	214
	Bulk	3	0	0.0%	3	100.0%	4.2	26.6
Totals		*7*	*0*	*0.0%*	*7*	*100.0%*		
6	Wipe	3	0	0.0%	3	100.0%	3.11	13.2
Totals		*3*	*0*	*0.0%*	*3*	*100.0%*		
TOTALS		**124**	*0*	**0.0%**	**124**	**100.0%**	**0.67**	**214**

TABLE 13
SUMMARY OF DIOXIN
SAMPLE ANALYSIS RESULTS ABOVE AND BELOW PLENUM

A/B Plenum	Sample Type	Total # of Samples	# Non Detects	%Non Detects	# Detects	% Detects	Min Conc. ng/m^2 (TEQ)	Max Conc. ng/m^2 (TEQ)
Above Plenum	Wipe	29	0	0.0%	29	100.0%	3.22	30.3
Below Plenum	Wipe	58	0	0.0%	57	100.0%	1.2	34.8
	Bulk	18	0	0.0%	18	100.0%	0.67	214
TOTALS		**105**	**0**	**0.0%**	**105**	**100.0%**	**0.67**	**214**

3.3.4 *PCBs*

One hundred and twenty-five (125) samples were collected and analyzed for PCBs. A summary of the laboratory results are presented below on Tables 14 and 15, which are differentiated by zone and above/below plenum. The laboratory reported all results in units of either ug/filter or ug/sample (for bulk samples). These results directly correlate to ug/100 cm^2, as both the wipe area and bulk sample areas correspond to 100 cm^2. In order to convert these results to the standard units of ug/m^2, the laboratory-provided results are multiplied by 100 (conversion: 10,000 cm^2/m^2). Note that Zones 5 and 6 contain samples that were collected from exterior surfaces and those results are not included in the above/below plenum table.

TABLE 14
SUMMARY OF PCB
SAMPLE ANALYSIS RESULTS BY ZONE

Zone	Sample Type	No. Samples	# Non Detects	%Non Detects	# Detects	% Detects	Min Conc. ug/m^2	Max Conc. ug/m^2
1	Wipe	30	25	83.3%	5	16.7%	58	120
	Bulk	2	1	50.0%	1	50.0%	97	110
Totals		*32*	*26*	*81.3%*	*6*	*18.8%*		
2	Wipe	29	28	96.6%	1	3.4%	63	63
	Bulk	10	10	100.0%	0	0.0%		
Totals		*39*	*38*	*97.4%*	*1*	*2.6%*		
3	Wipe	28	28	100.0%	0	0.0%		
	Bulk	10	8	80.0%	2	20.0%	360	360
Totals		*38*	*36*	*94.7%*	*2*	*5.3%*		
4	Wipe	7	6	85.7%	1	14.3%	120	120
	Bulk	2	2	100.0%	0	0.0%		
Totals		*9*	*8*	*88.9%*	*1*	*11.1%*		
5	Wipe	4	4	100.0%	0	0.0%		

TABLE 14 (continued)
SUMMARY OF PCB
SAMPLE ANALYSIS RESULTS BY ZONE

Zone	Sample Type	No. Samples	# Non Detects	%Non Detects	# Detects	% Detects	Min Conc. ug/m^2	Max Conc. ug/m^2
Totals		*4*	*4*	*100.0%*	*0*	*0.0%*		
6	Wipe	3	3	100.0%	0	0.0%		
Totals		*3*	*3*	*100.0%*	*0*	*0.0%*		
TOTALS		**125**	**115**	**92.0%**	**10**	**8.0%**	**58**	**360**

TABLE 15
SUMMARY OF PCB
SAMPLE ANALYSIS RESULTS ABOVE AND BELOW PLENUM

A/B Plenum	Sample Type	Total # of Samples	# Non Detects	%Non Detects	# Detects	% Detects	Min Conc. ug/m^2	Max Conc. ug/m^2
Above Plenum	Wipe	26	25	96.2%	1	3.8%	63	63
Below Plenum	Wipe	68	62	91.2%	6	8.8%	58	120
	Bulk	23	21	87.0%	3	13.0%	97	360
TOTALS		**117**	**107**	**91.5%**	**10**	**8.5%**	**58**	**360**

3.3.5 *Heavy Metals*

One hundred twenty-five (125) samples were collected and analyzed for heavy metals, specifically, barium, beryllium, cadmium, chromium, copper, lead, manganese, nickel, and zinc. A summary of the analytical results are presented below in Tables 16 and 17, which are differentiated by zone and above/below plenum. The laboratory reported all results in units of either ug/filter or ug/sample (for bulk samples). These results directly correlate to ug/100 cm^2, as both the wipe area and bulk sample areas correspond to 100 cm^2. In order to convert these results to the standard units of ug/m^2, the laboratory-provided results are multiplied by 100 (conversion: 10,000 cm^2/m^2). Note that Zones 5 and 6 contain samples that were collected from exterior surfaces and those results are not included in the above/below plenum table.

TABLE 16
SUMMARY OF HEAVY METALS
SAMPLE ANALYSIS RESULTS BY ZONE

BARIUM								
Sampling Zone	**Sample Type**	**No. of Samples***	**No. of Non-Detects**	**% of Non-Detects**	**Detects**	**% of Detects**	**Min. Conc. ug/m²**	**Max Conc. ug/m²**
1	Wipe	30	0	0.0%	30	100.0%	1,340	42,800
	Bulk	2	0	0.0%	2	100.0%	32,800	44,700
Totals		*32*	*0*	*0.0%*	*32*	*100.0%*		
2	Wipe	29	0	0.0%	29	100.0%	290	5,790
	Bulk	10	0	0.0%	10	100.0%	2,380	149,000
Totals		*39*	*0*	*0.0%*	*39*	*100.0%*		
3	Wipe	28	0	0.0%	28	100.0%	130	44,000
	Bulk	10	0	0.0%	10	100.0%	1,290	64,700
Totals		*38*	*0*	*0.0%*	*38*	*100.0%*		
4	Wipe	7	0	0.0%	7	100.0%	1,050	28,400
	Bulk	2	0	0.0%	2	100.0%	2,620	5,440
Totals		*9*	*0*	*0.0%*	*9*	*100.0%*		
5	Wipe	4	0	0.0%	4	100.0%	390	650
Totals		*4*	0	*0.0%*	*4*	*100.0%*		
6	Wipe	3	0	0.0%	3	100.0%	2,180	14,200
Totals		*3*	*0*	*0.0%*	3	*100.0%*		
TOTALS		**125**	**0**	**0.0%**	**125**	**100.0%**	**130**	**149,000**

BERYLLIUM								
Sampling Zone	**Sample Type**	**No. of Samples***	**No. of Non-Detects**	**% of Non-Detects**	**Detects**	**% of Detects**	**Min. Conc. ug/m²**	**Max Conc. ug/m²**
1	Wipe	30	22	73.3%	8	26.7%	32	390
	Bulk	2	2	100.0%	0	0.0%		
Totals		*32*	*24*	*75.0%*	*8*	*25.0%*		
2	Wipe	29	29	100.0%	0	0.0%		
	Bulk	10	10	100.0%	0	0.0%		
Totals		*39*	*39*	*100.0%*	*0*	0.0%		
3	Wipe	28	28	100.0%	0	0.0%		
	Bulk	10	9	90.0%	1	10.0%	35	35
Totals		*38*	*37*	*97.4%*	*1*	2.6%		
4	Wipe	7	7	100.0%	0	0.0%		
	Bulk	2	2	100.0%	0	0.0%		
Totals		*9*	*9*	*100.0%*	*0*	0.0%		
5	Wipe	4	4	100.0%	0	0.0%		
Totals		*4*	*4*	*100.0%*	*0*	0.0%		
6	Wipe	3	3	100.0%	0	0.0%		
Totals		*3*	*3*	*100.0%*	*0*	*0.0%*		

TABLE 16 (continued)
SUMMARY OF HEAVY METALS
SAMPLE ANALYSIS RESULTS BY ZONE

BERYLLIUM (continued)

Sampling Zone	Sample Type	No. of Samples*	No. of Non-Detects	% of Non-Detects	Detects	% of Detects	Min. Conc. ug/m^2	Max Conc. ug/m^2
TOTALS		**125**	**116**	**92.8%**	**9**	**7.2%**	**32**	**390**

CADMIUM

Sampling Zone	Sample Type	No. of Samples*	No. of Non-Detects	% of Non-Detects	Detects	% of Detects	Min. Conc. ug/m^2	Max Conc. ug/m^2
1	Wipe	30	3	10.0%	27	90.0%	140	7,830
	Bulk	2	2	100.0%	0	0.0%		
Totals		*32*	*5*	*15.6%*	*27*	*84.4%*		
2	Wipe	29	25	86.2%	4	13.8%	51	400
	Bulk	10	10	100.0%	0	0.0%		
Totals		*39*	*35*	*89.4%*	*4*	*10.6%*		
3	Wipe	28	10	35.7%	18	64.3%	61	970
	Bulk	10	6	60.0%	4	40.0%	110	3,490
Totals		*38*	*16*	*42.1%*	*22*	*57.9%*		
4	Wipe	7	4	57.1%	3	42.9%	310	370
	Bulk	2	2	100.0%	0	0.0%		
Totals		*9*	*6*	*66.7%*	*3*	*33.3%*		
5	Wipe	4	4	100.0%	0	0.0%		
Totals		*4*	*4*	*100.0%*	*0*	*0.0%*		
6	Wipe	3	1	33.3%	2	66.7%	290	1,110
Totals		*3*	*1*	33.3%	2	66.7%		
TOTALS		**125**	**67**	**53.6%**	**58**	**46.4%**	**51**	**7,830**

CHROMIUM

Sampling Zone	Sample Type	No. of Samples*	# Non Detects	%Non Detects	# Detects	% Detects	Min Conc. ug/m^2	Max Conc. ug/m^2
1	Wipe	30	0	0.0%	30	100.0%	570	35,100
	Bulk	2	0	0.0%	2	100.0%	5,600	7,000
Totals		*32*	*0*	*0.0%*	*32*	*100.0%*		
2	Wipe	29	1	3.4%	28	96.6%	95	2,920
	Bulk	10	0	0.0%	10	100.0%	910	77,500
Totals		*39*	*1*	*2.6%*	*38*	*97.4%*		
3	Wipe	28	0	0.0%	28	100.0%	49	16,800
	Bulk	10	0	0.0%	10	100.0%	530	118,000
Totals		*38*	*0*	*0.0%*	*38*	*100.0%*		
4	Wipe	7	0	0.0%	7	100.0%	1,850	11,800
	Bulk	2	2	100.0%	0	0.0%		
Totals		*9*	*2*	*22.2%*	*7*	*77.8%*		
5	Wipe	4	1	25.0%	3	75.0%	110	9,300
Totals		*4*	*1*	*25.0%*	*3*	*75.0%*		

TABLE 16 (continued)
SUMMARY OF HEAVY METALS
SAMPLE ANALYSIS RESULTS BY ZONE

CHROMIUM (continued)

Sampling Zone	Sample Type	No. of Samples*	No. of Non-Detects	% of Non-Detects	Detects	% of Detects	Min. Conc. ug/m^2	Max Conc. ug/m^2
6	Wipe	3	0	0.0%	3	100.0%	4,690	8,200
Totals		*3*	*0*	*0.0%*	*3*	*100.0%*		
TOTALS		**125**	**4**	**3.2%**	**121**	**96.8%**	**49**	**118,000**

COPPER

Sampling Zone	Sample Type	No. of Samples*	# Non Detects	%Non Detects	# Detects	% Detects	Min Conc. ug/m^2	Max Conc. ug/m^2
1	Wipe	30	0	0.0%	30	100.0%	5,780	114,000
	Bulk	2	0	0.0%	2	100.0%	5,570	23,600
Totals		*32*	*0*	*0.0%*	*32*	*100.0%*		
2	Wipe	29	1	3.4%	28	96.6%	340	94,900
	Bulk	10	1	11.1%	9	88.9%	2,680	103,000
Totals		*39*	*2*	*5.3%*	*37*	*94.7%*		
3	Wipe	28	0	0.0%	28	100.0%	120	145,000
	Bulk	10	0	0.0%	10	100.0%	1,890	45,200
Totals		*38*	*0*	*0.0%*	*38*	*100.0%*		
4	Wipe	7	0	0.0%	7	100.0%	1,760	21,900
	Bulk	2	1	50.0%	1	50.0%	3,360	3,360
Totals		*9*	*1*	*11.1%*	*8*	*88.9%*		
5	Wipe	4	2	50.0%	2	50.0%	450	560
Totals		*4*	*2*	*50.0%*	*2*	*50.0%*		
6	Wipe	3	0	0.0%	3	100%	3,680	18,600
Totals		*3*	*0*	*0.0%*	*3*	*100%*		
TOTALS		**125**	**5**	**4.0%**	**120**	**96.0%**	**120**	**145,000**

LEAD

Sampling Zone	Sample Type	No. of Samples	# Non Detects	%Non Detects	# Detects	% Detects	Min Conc. ug/m^2	Max Conc. ug/m^2
1	Wipe	30	0	0.0%	30	100.0%	2,470	101,000
	Bulk	2	0	0.0%	2	100.0%	7,630	27,800
Totals		*32*	*0*	*0.0%*	*32*	*100.0%*		
2	Wipe	29	0	0.0%	29	100.0%	270	10,600
	Bulk	10	2	22.2%	7	77.8%	2430	71,200
Totals		*39*	*2*	*5.3%*	*36*	*94.7%*		
3	Wipe	28	0	0.0%	28	100.0%	150	57,000
	Bulk	10	1	12.5%	7	87.5%	1,600	72,400
Totals		*38*	*1*	*2.7%*	*36*	*97.3%*		
4	Wipe	7	0	0.0%	7	100.0%	1,200	29,600
	Bulk	2	0	0.0%	2	100.0%	2,300	3,360
Totals		*9*	*0*	*0.0%*	*9*	*100.0%*		

TABLE 16 (continued)
SUMMARY OF HEAVY METALS
SAMPLE ANALYSIS RESULTS BY ZONE

LEAD (continued)

Sampling Zone	Sample Type	No. of Samples*	No. of Non-Detects	% of Non-Detects	Detects	% of Detects	Min. Conc. ug/m^2	Max Conc. ug/m^2
5	Wipe	4	0	0.0%	4	100.0%	500	2,070
Totals		*4*	*0*	*0.0%*	*4*	*100.0%*		
6	Wipe	3	0	0.0%	3	100.0%	6,940	29,800
Totals		*3*	*0*	*0.0%*	*3*	*100.0%*		
TOTALS		**125**	**3**	**2.4%**	**122**	**97.6%**	**150**	**101,000**

MANGANESE

Sampling Zone	Sample Type	No. of Samples*	# Non Detects	%Non Detects	# Detects	% Detects	Min Conc. ug/m^2	Max Conc. ug/m^2
1	Wipe	30	0	0.0%	30	100.0%	3,080	187,000
	Bulk	2	0	0.0%	2	100.0%	4,090	17,400
Totals		*32*	*0*	*0.0%*	*32*	*100.0%*		
2	Wipe	29	0	0.0%	29	100.0%	280	15,300
	Bulk	10	0	0.0%	10	100.0%	19,800	320,000
Totals		*39*	*0*	*0.0%*	*39*	*100.0%*		
3	Wipe	28	0	0.0%	28	100.0%	180	17,700
	Bulk	10	0	0.0%	10	100.0%	3,910	228,000
Totals		*38*	*0*	*0.0%*	*38*	*100.0%*		
4	Wipe	7	0	0.0%	7	100.0%	7,660	176,000
	Bulk	2	1	50.0%	1	50.0%	3,010	3,010
Totals		*9*	*1*	*11.1%*	*8*	*88.9%*		
5	Wipe	4	2	50.0%	2	50.0%	230	370
Totals		*4*	*2*	*50.0%*	*2*	*50.0%*		
6	Wipe	3	0	0.0%	3	100.0%	4,390	30,600
Totals		*3*	*0*	*0.0%*	*3*	*80.0%*		
TOTALS		**125**	**3**	**2.4%**	**122**	**97.6%**	**180**	**320,000**

NICKEL

Sampling Zone	Sample Type	No. of Samples*	# Non Detects	%Non Detects	# Detects	% Detects	Min Conc. ug/m^2	Max Conc. ug/m^2
1	Wipe	30	0	0.0%	30	100.0%	460	10,500
	Bulk	2	0	0.0%	2	100.0%	2,840	4,250
Totals		*32*	*0*	*0.0%*	*32*	*100.0%*		
2	Wipe	29	3	10.3%	26	89.7%	61	1,340
	Bulk	10	1	10.0%	9	90.0%	1,310	9,740
Totals		*39*	*4*	*9.8%*	*35*	*91.2%*		
3	Wipe	28	0	0.0%	28	100.0%	46	4,290
	Bulk	10	2	12.5%	8	87.5%	300	25,800
Totals		*38*	*2*	*2.7%*	*36*	*97.3%*		
4	Wipe	7	0	0.0%	7	100.0%	1,630	13,400

TABLE 16 (continued)
SUMMARY OF HEAVY METALS
SAMPLE ANALYSIS RESULTS BY ZONE

NICKEL (continued)

Sampling Zone	Sample Type	No. of Samples*	No. of Non-Detects	% of Non-Detects	Detects	% of Detects	Min. Conc. ug/m^2	Max Conc. ug/m^2
	Bulk	2	1	50.0%	1	50.0%	1,820	1,820
Totals		*9*	*1*	*11.1%*	*8*	*88.9%*		
5	Wipe	4	0	0.0%	4	100.0%	120	410
Totals		*4*	*0*	*0.0%*	*4*	*100.0%*		
6	Wipe	3	0	0.0%	3	100.0%	580	2,920
Totals		*3*	*0*	*0.0%*	*3*	*100.0%*		
TOTALS		**125**	**7**	**5.6%**	**118**	**94.4%**	**46**	**25,800**

ZINC

Sampling Zone	Sample Type	No. of Samples*	# Non Detects	%Non Detects	# Detects	% Detects	Min Conc. ug/m^2	Max Conc. ug/m^2
1	Wipe	30	0	0.0%	30	100.0%	22,000	1,040,000
	Bulk	2	0	0.0%	2	100.0%	36,800	114,000
Totals		*32*	*0*	*0.0%*	*32*	*100.0%*		
2	Wipe	29	0	0.0%	29	100.0%	5,260	421,000
	Bulk	10	1	10.0%	9	90.0%	9,810	38,600
Totals		*39*	*1*	*3.9%*	*38*	*96.1%*		
3	Wipe	28	0	0.0%	28	100.0%	2,550	644,000
	Bulk	10	0	0.0%	10	100.0%	11,500	1,140,000
Totals		*38*	*0*	*0.0%*	*38*	*100.0%*		
4	Wipe	7	0	0.0%	7	100.0%	10,500	186,000
	Bulk	2	1	50.0%	1	50.0%	12,800	12,800
Totals		*9*	*1*	*11.1%*	*8*	*88.9%*		
5	Wipe	4	0	0.0%	4	100.0%	4,440	6,280
Totals		*4*	*0*	*0.0%*	*4*	*100.0%*		
6	Wipe	3	0	0.0%	3	100.0%	16,700	101,000
Totals		*3*	*0*	*20.0%*	*3*	*100.0%*		
TOTALS		**125**	**2**	**1.6%**	**123**	**98.4%**	**2,550**	**1,140,000**

TABLE 17
SUMMARY OF HEAVY METALS SAMPLE ANALYSIS RESULTS
ABOVE AND BELOW PLENUM

BARIUM

A/B Plenum	Sample Type	Total # of Samples	# Non Detects	%Non Detects	# Detects	% Detects	Min Conc. ug/m^2	Max Conc. ug/m^2
Above Plenum	Wipe	26	0	0.0%	26	100.0%	150	10,300
Below Plenum	Wipe	68	0	0.0%	68	100.0%	130	44,000
	Bulk	24	0	0.0%	24	100.0%	1,290	149,000
TOTALS		**118**	**0**	**0.0%**	**118**	**100.0%**	**130**	**149,000**

BERYLLIUM

A/B Plenum	Sample Type	Total # of Samples	# Non Detects	%Non Detects	# Detects	% Detects	Min Conc. ug/m^2	Max Conc. ug/m^2
Above Plenum	Wipe	26	26	100.0%	0	0.0%		
Below Plenum	Wipe	68	60	88.2%	8	11.8%	32	390
	Bulk	24	1	4.2%	23	95.8%	35	35
TOTALS		**118**	**87**	**73.7**	**31**	**26.3%**	**32**	**390**

CADMIUM

A/B Plenum	Sample Type	Total # of Samples	# Non Detects	%Non Detects	# Detects	% Detects	Min Conc. ug/m^2	Max Conc. ug/m^2
Above Plenum	Wipe	26	18	69.2%	8	30.8%	84	620
Below Plenum	Wipe	68	24	35.3%	44	64.7%	51	7,830
	Bulk	24	20	83.3%	4	16.7%	110	3,490
TOTALS		**118**	**62**	**52.5%**	**56**	**47.5%**	**51**	**7,830**

CHROMIUM

A/B Plenum	Sample Type	Total # of Samples	# Non Detects	%Non Detects	# Detects	% Detects	Min Conc. ug/m^2	Max Conc. ug/m^2
Above Plenum	Wipe	26	1	3.8%	25	96.2%	78	5,840
Below Plenum	Wipe	68	0	0.0%	68	100.0%	49	35,100
	Bulk	24	3	12.5%	21	87.5%	530	118,000
TOTALS		**118**	**4**	**2.6%**	**114**	**97.4%**	**49**	**118,000**

COPPER

A/B Plenum	Sample Type	Total # of Samples	# Non Detects	%Non Detects	# Detects	% Detects	Min Conc. ug/m^2	Max Conc. ug/m^2
Above Plenum	Wipe	26	1	3.8%	25	96.2%	290	94,900
Below Plenum	Wipe	68	0	0.0%	68	100.0%	120	145,000
	Bulk	24	2	8.3%	22	91.7%	1890	103,000
TOTALS		**118**	**3**	**2.5%**	**115**	**97.5%**	**120**	**145,000**

LEAD

A/B Plenum	Sample Type	Total # of Samples	# Non Detects	%Non Detects	# Detects	% Detects	Min Conc. ug/m^2	Max Conc. ug/m^2
Above Plenum	Wipe	26	0	0.0%	26	100.0%	350	10,900
Below	Wipe	68	0	0.0%	68	100.0%	150	101,000

Plenum	Bulk	24	3	12.5%	21	87.5%	1600	72,400

TABLE 17 (continued)
SUMMARY OF HEAVY METALS SAMPLE ANALYSIS RESULTS
ABOVE AND BELOW PLENUM

LEAD (continued)								
A/B Plenum	**Sample Type**	**Total # of Samples**	**# Non Detects**	**%Non Detects**	**# Detects**	**% Detects**	**Min Conc. ug/m²**	**Max Conc. ug/m²**
TOTALS		**118**	**3**	**2.5%**	**115**	**97.5%**	**150**	**101,000**
MANGANESE								
A/B Plenum	**Sample Type**	**Total # of Samples**	**# Non Detects**	**%Non Detects**	**# Detects**	**% Detects**	**Min Conc. ug/m²**	**Max Conc. ug/m²**
Above Plenum	Wipe	26	0	0.0%	26	100.0%	180	15,300
Below Plenum	Wipe	68	0	0.0%	68	100.0%	300	187,000
	Bulk	24	1	4.2%	23	95.8%	3010	320,000
TOTALS		**118**	**1**	**0.8%**	**117**	**99.2%**	**180**	**320,000**
NICKEL								
A/B Plenum	**Sample Type**	**Total # of Samples**	**# Non Detects**	**%Non Detects**	**# Detects**	**% Detects**	**Min Conc. ug/m²**	**Max Conc. ug/m²**
Above Plenum	Wipe	26	2	7.7%	24	92.3%	46	1,850
Below Plenum	Wipe	68	1	1.5%	67	98.5%	56	13,400
	Bulk	24	4	16.7%	20	83.3%	300	25,800
TOTALS		**118**	**7**	**6.3%**	**111**	**93.7%**	**46**	**25,800**
ZINC								
A/B Plenum	**Sample Type**	**Total # of Samples**	**# Non Detects**	**%Non Detects**	**# Detects**	**% Detects**	**Min Conc. ug/m²**	**Max Conc. ug/m²**
Above Plenum	Wipe	26	0	0.0%	26	100.0%	2,550	421,000
Below Plenum	Wipe	68	0	0.0%	68	100.0%	2,700	1,040,000
	Bulk	24	2	8.3%	22	91.7%	9,810	1,140,000
TOTALS		**118**	**2**	**1.7%**	**116**	**98.3%**	**2,550**	**1,140,000**

3.3.6 *Mercury*

One hundred twenty-five (125) dust samples were collected and analyzed for mercury. A summary of the analytical results are presented below in Tables 18 and 19, which are differentiated by zone and above/below plenum. The laboratory reported all results in units of either ug/filter or ug/sample (for bulk samples). These results directly correlate to ug/100 cm^2, as both the wipe area and bulk sample areas correspond to 100 cm^2. In order to convert these results to the standard units of ug/m^2, the laboratory-provided results are multiplied by 100 (conversion: 10,000 cm^2/m^2). Note that Zones 4, 5 and 6 contain samples that were collected from exterior surfaces and those results are not included in the above/below plenum table.

TABLE 18
SUMMARY OF MERCURY
SAMPLE ANALYSIS RESULTS BY ZONE

MERCURY								
Zone	**Sample Type**	**No. Samples**	**# Non Detects**	**%Non Detects**	**# Detects**	**% Detects**	**Min Conc. ug/m^2**	**Max Conc. ug/m^2**
1	Wipe	30	12	40.0%	18	60.0%	1.8	28
	Bulk	2	1	50.0%	1	50.0%	54	54
Totals		*32*	*13*	*40.6%*	*19*	*59.4%*		
2	Wipe	29	15	51.7%	14	48.3%	0.84	38
	Bulk	10	10	100.0%	0	0.0%		
Totals		*39*	*25*	*64.1%*	*14*	*35.9%*		
3	Wipe	28	5	17.9%	23	82.1%	0.84	160
	Bulk	10	6	66.7%	4	33.3%	7.4	98
Totals		*38*	*11*	*28.9%*	*27*	*71.1%*		
4	Wipe	7	5	71.4%	2	28.6%	1.3	2.2
	Bulk	2	2	100.0%	0	0.0%		
Totals		*9*	*7*	*77.8%*	*2*	*22.2%*		
5	Wipe	4	1	25.0%	3	75.0%	0.84	1.3
Totals		*4*	*1*	*25.0%*	*3*	*75.0%*		
6	Wipe	3	1	33.3%	2	66.7%	5.4	5.8
Totals		*3*	*1*	*33.3%*	*2*	*66.7%*		
TOTALS		**125**	**58**	**46.4%**	**67**	**53.6%**	**0.84**	**160**

TABLE 19
SUMMARY OF MERCURY
SAMPLE ANALYSIS RESULTS ABOVE AND BELOW PLENUM

MERCURY								
A/B Plenum	**Sample Type**	**Total # of Samples**	**# Non Detects**	**%Non Detects**	**# Detects**	**% Detects**	**Min Conc. ug/m^2**	**Max Conc. ug/m^2**
Above Plenum	Wipe	26	9	34.6%	17	65.4%	1.1	160
Below Plenum	Wipe	68	28	41.2%	40	58.8%	0.84	160
	Bulk	24	19	79.2%	5	20.8%	7.4	98
TOTALS		**118**	**56**	**47.5%**	**62**	**52.5%**	**0.84**	**160**

In addition to the dust wipe samples, one hundred fifty three direct reading samples for Mercury Vapor were collected using the Jerome Meter 431-X. As described in Section 2.0, the Jerome 431-X mercury vapor analyzer uses a patented gold film sensor for accurate detection and measurement of toxic mercury vapor in the air. This portable handheld unit can easily be carried to locations with mercury concerns for applications such as industrial hygiene monitoring, mercury spill clean up, and mercury exclusion testing. Simple, push button operation allows users to measure mercury levels from 0.003 to 0.999 mg/m3 in just seconds. A summary of the results are presented below in Table 20, which is differentiated by floors.

TABLE 20
SUMMARY OF MERCURY VAPOR RESULTS

		MERCURY						
Floor	**Sample Type**	**Total # of Readings**	**# Non Detects**	**%Non Detects**	**# Detects**	**% Detects**	**Min Conc. mg/m^3**	**Max Conc. mg/m^3**
5 & 6th Floor MER	Direct Reading	17	17	100 %	0	0	<0.003	<0.003
14	Direct Reading	17	17	100 %	0	0	<0.003	<0.003
17	Direct Reading	14	14	100 %	0	0	<0.003	<0.003
20	Direct Reading	16	16	100 %	0	0	<0.003	<0.003
32	Direct Reading	22	22	100 %	0	0	<0.003	<0.003
35	Direct Reading	17	17	100 %	0	0	<0.003	<0.003
38	Direct Reading	17	17	100 %	0	0	<0.003	<0.003
40th & 41st Floor MER	Direct Reading	33	33	100 %	0	0	<0.003	<0.003
TOTALS		**153**	**153**	**100 %**	**0**	**0 %**	**<0.003**	**<0.003**

Note: MER = Mechanical Equipment Room

3.4 Visual Mold Inspection

The non-intrusive visual inspection was performed during May 2004 and building components and materials inspected included:

- Sprayed-on fireproofing ceiling material;
- Suspended ceiling tiles;
- Sheetrock wall material;
- Wall stucco;
- Carpet;
- Pipe and fittings insulation material;
- Water tank insulation wrap material;
- HVAC duct insulation; and

- Other miscellaneous materials.

No evidence of significant water-damaged building materials or active water infiltration was noted in the Building, with two exceptions: the Gash Area located on the 7th through 24th Floors and Basement B. The Gash Area is open to the elements and some water infiltration was noted; however, the Gash Area has been stripped of finish materials and the presence of water on the exposed concrete and steel surfaces has not resulted in mold growth. In the Basement B, standing water was observed in low lying areas of the floor. Based on conversations with Building contractor personnel, the water enters this Building level through the slab and walls, and the rate of entry increases after precipitation events. Berger observed distinct layers of mineral deposits on the first row of cinder blocks; however, no mold was observed on the concrete floors and low walls in or around the standing water in the Basement B, except where noted. Interstitial spaces and normally concealed areas were not inspected during this initial investigation. For deconstruction, previously concealed areas will be made accessible for a detailed inspection.

4.0 FINDINGS

The following subsections present the findings of the Asbestos Building Inspection and Material Survey, the Dust Characterization for Asbestos, the Dust Characterization for Other Analytes, and the Visual Mold Inspection.

4.1 Asbestos Building Inspection and Material Survey

The Asbestos Building Inspection and Material Survey was conducted to facilitate the proposed cleaning and deconstruction of the Building and to enable compliance with required environmental, health, and safety practices, including, but not limited to, the applicable OSHA requirements; TSCA Title II AHERA/ASHARA; New York City Department of Buildings (NYCDOB); NYCDEP Title 15; NYSDOL Industrial Code Rule 56; and the EPA's NESHAP. The EPA has set the criteria by which all materials confirmed or assumed to have greater than one percent (1%) asbestos are considered to be ACM.

Approximately 2,000 bulk samples of suspect building materials were collected and analyzed for asbestos using the Polarized Light Microscopy (PLM) and/or Transmission Electron Microscopy (TEM). The majority of samples tested negative for asbestos, including spray-on fire-proofing, wall-board, roofing materials, and most thermal insulation for piping and ducts. Other building materials tested contained greater than one percent asbestos and are considered asbestos-containing materials.

An approximate total of 155,000 SF and 95,000 LF of ACM were identified throughout the Building, as follows:

- Approximately 123,780 SF of asbestos-containing "Floor Tiles & Associated Mastic" were identified.

  The Floor Tiles and associated Mastic are considered non-friable materials as per the definition by the EPA and NYSDOL. These materials, however, can be rendered friable if impacted using mechanical means as per the NYCDEP definition of friability. Up to a total quantity of 160 SF may be removed using NYCDEP Title 15 non-friable methods. Amounts greater than 160 SF, have to be removed utilizing full containment methods. The NYCDEP have implemented an approved work procedure for removing such materials called Attachment FT, which requires the filing of an NYCDEP Asbestos Control Program (ACP) Form ACP-7.

- Approximately 50 SF of asbestos-containing "Sealant at Cable Entrances" was identified in Basement A.

- Approximately 300 LF of asbestos-containing "24-inch O.D. Pipe Insulation" was identified in Basement A.

- Approximately 500 LF of asbestos-containing "30-inch O.D. Pipe Insulation" was identified in Basement A.

- Approximately 4,500 SF of asbestos-containing "Transite Wall Board" was identified in the 5th and 6th Floor Mechanical Room.

- Approximately 1,200 LF of asbestos-containing "Pipe Insulation (12-20 inch) O.D." was identified in the 5th and 6th Floor Mechanical Room.

- Approximately 1,700 SF of asbestos-containing "Wall & Floor Joint Tar Paper" was identified in the North Side Gash area.

- Approximately 500 SF of asbestos-containing "Linoleum Flooring and Mastic" was identified on the 18th Floor.

- Approximately 500 LF of asbestos-containing "Pipe Insulation (6-12 inch) O.D." was identified on the 20th Floor.

- Approximately 1,510 LF of asbestos-containing "HVAC Duct Joint Caulking" was identified on the 23rd Floor and in the Mechanical Rooms.

- Approximately 20,000 SF of asbestos-containing "Transite Wall Material" was identified on the 40th and 41st Floors.

- Approximately 3,000 SF of asbestos-containing "Wall Insulation Material" was identified in the Fan Room in the 40th and 41st Floor Mechanical Rooms.

- Approximately 50 LF of asbestos-containing "Caulking Material" was identified on the fan units on the roof.

- Approximately 40 LF of asbestos-containing "Window Caulking Material" was identified in the masonry openings on the roof.

- Approximately 1,400 SF of asbestos-containing "Baseboard Mastic" was identified.

- Approximately 45,500 LF of asbestos-containing “Sealant Material” was identified over the weather stripping at metal column parts located on the exterior façade. This is an estimated quantity for 38 Floors, excluding approximately 5,000 LF from the Gash Area.

  Exterior “Sealant Material” is considered non-friable material as per the definition of the EPA and NYSDOL. This material, however, may be rendered friable if impacted using mechanical means as per the NYCDEP definition of friability. As such the NYCDEP has established specific work procedures using friable removal methods for the handing and disposal of this material. This work procedure is called Attachment EC and includes the filing of an NYCDEP ACP Form ACP-7.

- Approximately 45,500 LF of asbestos-containing “Exterior Caulking Material” was identified between the column metal covers located on the exterior façade. This is an estimated quantity for 38 floors, excluding approximately 5,000 LF from the Gash Area.

  Exterior “Caulking Materials” are considered non-friable materials as per the definition of the EPA and NYSDOL. These materials, however, may be rendered friable if impacted using mechanical means as per the NYCDEP definition of friability. As such the NYCDEP has established specific work procedures using friable removal methods for the handing and disposal of such materials. This work procedure is called Attachment EC and includes the filing of an NYCDEP ACP Form ACP-7.

Based upon visual observations and experience with similar buildings, Berger also suspects (and until proven not to be present assumes) that there is “Filling Material” and/ or “Caulking Material” in the interstitial spaces of curtain walls within the Building. The confirmation of the presence of these materials via exploratory demolition will be conducted prior to disturbing them through deconstruction activities and a New York City Certified Asbestos Investigator, who is also a NYSDOL certified asbestos inspector, will inspect and collect bulk samples for confirmatory testing if suspect materials are identified.

4.2 Dust Characterization for Asbestos

The Dust Characterization for Asbestos was also conducted to facilitate the proposed deconstruction of the Building and to enable compliance with required environmental, health, and safety practices including, but not limited to, the applicable OSHA requirements; TSCA Title II AHERA/ASHARA; NYCDOB; NYCDEP Title 15; NYSDOL Industrial Code Rule 56; and the EPA’s NESHAP. The EPA has set the criteria by which all materials confirmed or assumed to have greater than one percent (1%) asbestos are considered to be ACM.

A total of 815 bulk samples of the settled dust were collected and analyzed at a laboratory via PLM analysis. The PLM analysis is specified by the EPA and NYCDEP for quantifying asbestos in bulk dust samples. Although trace amounts of asbestos were identified in some of the samples, there were no samples that contained greater than one percent asbestos by PLM.

In addition to PLM testing, the Study also included TEM testing. The EPA (AHERA) and NYSDOH recognize TEM as being a more precise methodology; PLM is not the best analytical technique available to determine concentrations of asbestos fibers in WTC dust. Friable WTC dust in concentrations less than or equal to 1% asbestos still have a significant potential to generate elevated airborne concentrations when disturbed. Forty (40) supplemental screening samples of the settled dust were collected from porous and non-porous surfaces and analyzed for asbestos using TEM. The results revealed detectable levels of asbestos above the residential background level of 6,192 structures/cm^2 identified in the EPA *World Trade Center Background Study Report Interim Final* (April 2003). The highest concentrations of asbestos were identified in the first and second floors, fifth floor mechanical room, and the 40^{th}/41^{st} floor mechanical room. Asbestos was detected in dust at concentrations in excess of 6,192 structures/cm^2 on 24 of the 31 floors sampled by TEM analysis (77%). The samples containing asbestos ranged from a minimum concentration of less than 891 structures/cm^2 (from Floors 5, 24, 25, 28, 34, and 41) to a maximum concentration of 4,879,200 structures/cm^2 (from Floor 2).

4.3 Dust Characterization for Other Analytes

A multi-agency task force was formed following the collapse of the WTC on September 11, 2001 to develop interim guidance in support of re-occupancy decisions for nearby buildings. This task force evaluated impacted indoor environments for the presence and implications of contaminants that might pose long-term health risks to local residents. As part of this evaluation, a task force committee was established to identify contaminants of health concern and establish health-based benchmarks for those contaminants in support of ongoing cleanup efforts in Lower Manhattan prior to reoccupancy by residents. One outcome of these efforts was the final report entitled *World Trade Center Indoor Environment Assessment: Selecting Contaminants of Potential Concern and Setting Health-Based Benchmarks* (May 2003), prepared by the COPC Committee of the World Trade Center Indoor Air Task Force Working Group, which the COPC Committee used in selecting the compounds of concern for Lower Manhattan clean-up efforts. In part, this report stated:

> A systematic risk-based approach was used to select COPC. The process began with the review of an extremely large environmental data set, including indoor and outdoor air and dust data. This was followed by a two-level screening which

considered individual contaminant toxicity, the prevalence of a contaminant within and across media, and the likelihood that a detected contaminant was related to the WTC disaster. The goal of the process was to identify those contaminants most likely to be present within indoor environments at levels of health concern.

The Committee identified asbestos, dioxins, lead, PAHs, fibrous glass, and crystalline silica as the principal COPCs. These potential contaminants were found to be most consistent in WTC dust at levels of health concern in the Lower Manhattan area from previous sampling and testing programs conducted by the EPA. The COPC Committee has also established health-based criteria for reoccupancy of residential buildings contaminated with these COPCs.

Results of the Study regarding the WTC dust COPCs (with the exception of asbestos, which is presented in Section 4.2), as well as other analytes that were suspected to be present in the Building (namely PCBs, heavy metals, and mercury), are described below:

Silica (Quartz and Cristobalite) - Silica is the second most common mineral in the earth's crust and is a major component of natural sand, rock, and mineral ores. It is a common component of building materials as it is present in sand, concrete, and other materials. The natural crystalline forms of silica include quartz and cristobalite.

Quartz--There was significant variation in the quartz testing results collected from the Building dust samples. Quartz was detected in 115 of the 118 samples tested. The samples containing quartz ranged from a low concentration of 500 ug/m^2 (from Zone 2) to a maximum concentration of 10,000,000 ug/m^2 (in Zone 1). This variation in quartz concentrations is consistent with the level of disturbance that has occurred within the Building, including the cleaning of the "Gash Area," since September 11, 2001. The EPA has published residential background levels (estimated pre-existing levels) and residential benchmark levels (potential health-based cleanup target levels) for many contaminants in WTC-related reports. While these levels are not directly applicable to a commercial deconstruction project, these studies can be used to put the results of this Study into relative context. The *Interim Final World Trade Center Background Study Report*, dated April 2003, identified a representative mean background concentration for Manhattan residential buildings for quartz of 79.6 ug/ft^2 (approximately 857 ug/m^2). The "Benchmarks" table, resulting from the study entitled *World Trade Center Indoor Air Assessment: Selecting Contaminants of Potential Concern and Setting Health-Based Benchmarks*, dated May 2003, did not specifically identify a residential health-based benchmark for quartz. This Study has identified quartz concentrations within the Building that exceed the background residential level in 111 of the 118 samples analyzed (94%).

Cristobalite--There was significant variation in the cristobalite testing results collected from the Building dust samples. Cristobalite was detected in only two of the 118 samples tested. The samples containing cristobalite ranged from a low concentration of 2,800 ug/m^2 (from Zone 4) to a maximum concentration of 340,000 ug/m^2 (in Zone 6). The EPA has published residential background levels (estimated pre-existing levels) and residential benchmark levels (potential health-based cleanup target levels) for many contaminants in WTC-related reports. While these levels are not directly applicable to a commercial deconstruction project, these studies can be used to put the results of this Study into relative context. The *Interim Final World Trade Center Background Study Report*, dated April 2003, identified a representative mean background concentration for Manhattan residential buildings for cristobalite of 103.7 ug/ft^2 (approximately 1,116 ug/m^2). The "Benchmarks" table, resulting from the study entitled *World Trade Center Indoor Air Assessment: Selecting Contaminants of Potential Concern and Setting Health-Based Benchmarks*, dated May 2003, did not specifically identify a residential health-based benchmark for cristobalite. This Study has identified cristobalite concentrations within the Building that exceed the background residential level, although only in two of 118 samples (2%).

Polycyclic Aromatic Hydrocarbons (PAHs) - PAHs are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are very commonly identified constituents in materials such as plastic building materials and furnishings, as well as asphalt pavement and roofing/sealing materials. In accordance with conventions established by the World Health Organization (WHO), Toxicity Equivalency Factors (TEFs) are applied to seven PAH compounds and a Toxicity Equivalency Concentration (TEQ) for PAHs is derived. This convention was applied to the data obtained for this investigation; thus, the PAH concentrations reported are the TEQs.

There was significant variation in the PAH testing results collected from the Building dust samples. The samples containing PAH ranged from a low concentration of 3 ug/m^2 (from Zone 1) to a maximum concentration of 11,555 ug/m^2 (in Zone 2). This variation in PAH concentrations is consistent with the level of disturbance that has occurred within the Building, including the cleaning of the "Gash Area," since September 11, 2001. The EPA has published residential background levels (estimated pre-existing levels) and residential benchmark levels (potential health-based cleanup target levels) for many contaminants in WTC-related reports. While these levels are not directly applicable to a commercial deconstruction project, these studies can be used to put the results of this Study into relative context. The *Interim Final World Trade Center Background Study Report*, dated April 2003, did not specifically identify a representative mean background concentration for Manhattan residential buildings for PAH. The "Benchmarks" table, resulting from the study entitled *World Trade Center Indoor Air*

Assessment: Selecting Contaminants of Potential Concern and Setting Health-Based Benchmarks, dated May 2003, identifies a residential health-based benchmark for PAHs of 150 ug/m^2. This Study has identified PAH concentrations within the Building that exceed the health based benchmark identified in the EPA study in 100 of the 125 samples tested (80%).

Dioxin - Dioxin is a general term that describes a group of hundreds of chemicals that are highly persistent in the environment. Dioxin is formed as an unintentional by-product of many industrial processes involving chlorine such as waste incineration, chemical and pesticide manufacturing, and pulp and paper bleaching, and by burning chlorine-based chemical compounds with hydrocarbons. In accordance with conventions established by WHO, TEFs are applied to all dioxin compounds and a TEQ for dioxins is derived. This convention was applied to the data obtained for this investigation; thus, the dioxin concentrations reported are the TEQs.

There was significant variation in the dioxin testing results collected from the Building dust samples. Dioxin was detected in all 124 samples tested. The samples containing dioxin ranged from a low concentration of 1 ng/m^2 (from Zone 2) to a maximum concentration of 214 ng/m^2 (in Zone 5). These results are consistent with the highly variable nature of WTC dust. This variation in dioxin concentrations is consistent with the level of disturbance that has occurred within the Building, including the cleaning of the "Gash Area," since September 11, 2001. The EPA has published residential background levels (estimated pre-existing levels) and residential benchmark levels (potential health-based cleanup target levels) for many contaminants in WTC-related reports. While these levels are not directly applicable to a commercial deconstruction project, these studies can be used to put the results of this Study into relative context. The *Interim Final World Trade Center Background Study Report*, dated April 2003, identified a representative mean background concentration for Manhattan residential buildings for dioxin of 0.693 ng/m^2. The "Benchmarks" table, resulting from the study entitled *World Trade Center Indoor Air Assessment: Selecting Contaminants of Potential Concern and Setting Health-Based Benchmarks*, dated May 2003, identifies a residential health-based benchmark for dioxin of 2 ng/m^2. This study has identified dioxin concentrations within the Building. One hundred twenty-three of the 124 samples analyzed for dioxin (99%) exceed both the background residential level and the health-based benchmark identified in the EPA studies.

Polychlorinated Biphenyls (PCBs) - PCBs are a group of synthetic organic chemicals that are either oily liquids or solids and are colorless to light yellow. PCBs were detected in 10 of 125 samples tested (8%). The samples containing PCBs ranged from a low concentration of 58 ug/m^2 (from Zone 1) to a maximum concentration of 360 ug/m^2 (in Zone 3). These results are consistent with the highly variable nature of WTC dust. This variation in PCB concentrations is consistent with the level of disturbance that has occurred within the Building, including the cleaning of the "Gash Area," since September 11, 2001. The EPA has published PCB spill clean-up criteria for industrial properties of 1,000 ug/m^2. While this level is not directly applicable to a commercial deconstruction project, it can be used to put the results of this Study into relative context. This Study did not identify PCB concentrations within the Building that exceed this criterion.

Heavy Metals (Barium, Beryllium, Cadmium, Chromium, Copper, Lead, Manganese, Nickel, and Zinc) - Metals are a common component of building materials as well as many natural materials. Metals concentrations were detected in all zones for the following metals: barium, copper, chromium, lead, manganese, nickel, and zinc. Beryllium concentrations were detected in Zones 1 and 3, and cadmium concentrations were detected in Zones 1 through 4, and 6. Metals concentrations detected above and below the plenum varied, depending on the metal, and are summarized as shown in Table 21 that follows.

TABLE 21
HEAVY METAL CONCENTRATIONS DETECTED
ABOVE AND BELOW PLENUM

Metal	Above Plenum	Below Plenum
Barium	150 – 10,300 ug/m^2	130 – 149,000 ug/m^2
Beryllium	Not Detected	32 – 390 ug/m^2
Cadmium	84 – 620 ug/m^2	51 – 7,830 ug/m^2
Chromium	78 – 5,840 ug/m^2	49 – 118,000 ug/m^2
Copper	290 – 94,900 ug/m^2	120 – 145,000 ug/m^2
Lead	350 – 10,900 ug/m^2	150 – 101,000 ug/m^2
Manganese	180 – 15,300 ug/m^2	300 – 320,000 ug/m^2
Nickel	46 – 1,850 ug/m^2	56 – 25,800 ug/m^2
Zinc	2,550 – 421,000 ug/m^2	2,700 – 1,114,000 ug/m^2

Barium--There was significant variation in the barium testing results collected from the Building dust samples. Barium was detected in all 125 samples tested. The samples containing barium ranged from a low concentration of 130 ug/m^2 (from Zone 3) to a maximum concentration of 149,000 ug/m^2 (in Zone 2). This variation in barium concentrations is consistent with the level of disturbance that has occurred within the Building, including the cleaning of the "Gash Area," since September 11, 2001. The EPA has published residential benchmark levels (potential health-based cleanup target levels) for many contaminants in WTC-related reports. While these levels are not directly applicable to a commercial deconstruction project, these studies can be used to put the results of this Study into relative context. The "Benchmarks" table, resulting from the study entitled *World Trade Center Indoor Air Assessment: Selecting Contaminants of Potential Concern and Setting Health-Based Benchmarks,* dated May 2003, identifies a residential health-based benchmark for barium of 110,000 ug/m^2. This Study has identified barium concentrations within the Building that exceed the health-based benchmark identified in the EPA study in only three of the 125 samples tested (2.4%).

Beryllium-- There was significant variation in the beryllium testing results collected from the Building dust samples. Beryllium was detected in nine of the 125 samples tested. The samples containing beryllium ranged from a low concentration of 32 ug/m^2 (from Zone 1) to a maximum concentration of 390 ug/m^2 (in Zone 1). This variation in beryllium concentrations is consistent with the level of disturbance that has occurred within the Building, including the cleaning of the "Gash Area," since September 11, 2001. The EPA has published residential benchmark levels (potential health-based cleanup target levels) for many contaminants in WTC-related reports. While these levels are not directly applicable to a commercial deconstruction project, these studies can be used to put the results of this Study into relative context. The "Benchmarks" table, resulting from the study entitled *World Trade Center Indoor Air Assessment: Selecting Contaminants of Potential Concern and Setting Health-Based Benchmarks*, dated May 2003, identifies a residential health-based benchmark for beryllium of 3,140 ug/m^2. This Study has not identified beryllium concentrations within the Building that exceed the health-based benchmark identified in the EPA study.

Cadmium--There was significant variation in the cadmium testing results collected from the Building dust samples. Cadmium was detected in 58 of the 125 samples tested. The samples containing cadmium ranged from a low concentration of 51 ug/m^2 (from Zone 2) to a maximum concentration of 7,830 ug/m^2 (in Zone 1). This variation in cadmium concentrations is consistent with the level of disturbance that has occurred within the Building, including the cleaning of the "Gash Area," since September 11, 2001. The EPA has published residential benchmark levels (potential health-based cleanup target levels) for many contaminants in WTC-related reports. While these levels are not directly applicable to a commercial deconstruction project, these studies can be used to put the results of this Study into relative context. The "Benchmarks" table, resulting from the study entitled *World Trade Center Indoor Air Assessment: Selecting Contaminants of Potential Concern and Setting Health-Based Benchmarks*, dated May 2003, identifies a residential health-based benchmark for cadmium of 1,560 ug/m^2. This Study has identified cadmium concentrations within the Building that exceed the health-based benchmark identified in the EPA study in six of the 125 samples tested (4.8%).

Chromium--There was significant variation in the chromium testing results collected from the Building dust samples. Chromium was detected in 121 of the 125 samples tested. The samples containing chromium ranged from a low concentration of 49 ug/m^2 (from Zone 3) to a maximum concentration of 118,000 ug/m^2 (in Zone 3). This variation in chromium concentrations is consistent with the level of disturbance that has occurred within the Building, including the cleaning of the “Gash Area,” since September 11, 2001. The EPA has published residential benchmark levels (potential health-based cleanup target levels) for many contaminants in WTC-related reports. While these levels are not directly applicable to a commercial deconstruction project, these studies can be used to put the results of this Study into relative context. The “Benchmarks” table, resulting from the study entitled *World Trade Center Indoor Air Assessment: Selecting Contaminants of Potential Concern and Setting Health-Based Benchmarks*, dated May 2003, identifies a residential health-based benchmark for chromium of 4,700 ug/m^2. This Study has identified chromium concentrations within the Building that exceed the health based benchmark identified in the EPA study in 38 of the 125 samples tested (30%).

Copper--There was significant variation in the copper testing results collected from the Building dust samples. Copper was detected in 120 of the 125 samples tested. The samples containing copper ranged from a low concentration of 120 ug/m^2 (from Zone 3) to a maximum concentration of 145,000 ug/m^2 (in Zone 3). This variation in copper concentrations is consistent with the level of disturbance that has occurred within the Building, including the cleaning of the “Gash Area,” since September 11, 2001. The EPA has published residential benchmark levels (potential health-based cleanup target levels) for many contaminants in WTC-related reports. While these levels are not directly applicable to a commercial deconstruction project, these studies can be used to put the results of this Study into relative context. The “Benchmarks” table, resulting from the study entitled *World Trade Center Indoor Air Assessment: Selecting Contaminants of Potential Concern and Setting Health-Based Benchmarks*, dated May 2003, identifies a residential health-based benchmark for copper of 62,700 ug/m^2. This Study has identified copper concentrations within the Building that exceed the health-based benchmark identified in the EPA study in six of the 125 samples tested (4.8%).

Lead--There was significant variation in the lead testing results collected from the Building dust samples. Lead was detected in 122 of 125 samples tested. The samples containing lead ranged from a low concentration of 150 ug/m^2 (from Zone 3) to a maximum concentration of 101,000 ug/m^2 (in Zone 1). This variation in lead concentrations is consistent with the level of disturbance that has occurred within the Building, including the cleaning of the “Gash Area,” since September 11, 2001. The EPA has published residential background levels (estimated pre-existing levels) and residential benchmark levels (potential health-based cleanup target levels) for many contaminants in WTC-related reports. While these levels are not directly applicable to a commercial deconstruction project, these studies can be used to put the results of this Study into relative context. The *Interim Final World Trade Center Background Study Report*, dated April 2003, identified a representative mean background concentration for Manhattan residential buildings for lead of 1.78 ug/ft^2 (approximately 19 ug/m^2). The “Benchmarks” table, resulting from the study entitled *World Trade Center Indoor Air Assessment: Selecting Contaminants of*

Potential Concern and Setting Health-Based Benchmarks, dated May 2003, identifies a residential health-based benchmark for lead of 25 ug/ft^2 (approximately 270 ug/m^2). This Study has identified lead concentrations within the Building that exceed both the background residential level and the health-based benchmark identified in the EPA studies in 121 of the 125 samples tested (97%).

Manganese--There was significant variation in the manganese testing results collected from the Building dust samples. Manganese was detected in 122 of the 125 samples tested. The samples containing manganese ranged from a low concentration of 180 ug/m^2 (from Zone 3) to a maximum concentration of 320,000 ug/m^2 (in Zone 2). This variation in manganese concentrations is consistent with the level of disturbance that has occurred within the Building, including the cleaning of the "Gash Area," since September 11, 2001. The EPA has published residential benchmark levels (potential health-based cleanup target levels) for many contaminants in WTC-related reports. While these levels are not directly applicable to a commercial deconstruction project, these studies can be used to put the results of this Study into relative context. The "Benchmarks" table, resulting from the study entitled *World Trade Center Indoor Air Assessment: Selecting Contaminants of Potential Concern and Setting Health-Based Benchmarks*, dated May 2003, identifies a residential health-based benchmark for manganese of 31,400 ug/m^2. This Study has identified manganese concentrations within the Building that exceed the health-based benchmark identified in the EPA study in 26 of the 125 samples tested (21%).

Nickel--There was significant variation in the nickel testing results collected from the Building dust samples. Nickel was detected in 118 of the 125 samples tested. The samples containing nickel ranged from a low concentration of 46 ug/m^2 (from Zone 3) to a maximum concentration of 25,800 ug/m^2 (in Zone 3). This variation in nickel concentrations is consistent with the level of disturbance that has occurred within the Building, including the cleaning of the "Gash Area," since September 11, 2001. The EPA has published residential benchmark levels (potential health-based cleanup target levels) for many contaminants in WTC-related reports. While these levels are not directly applicable to a commercial deconstruction project, these studies can be used to put the results of this Study into relative context. The "Benchmarks" table, resulting from the study entitled *World Trade Center Indoor Air Assessment: Selecting Contaminants of Potential Concern and Setting Health-Based Benchmarks*, dated May 2003, identifies a residential health-based benchmark for nickel of 31,400 ug/m^2. This Study has not identified nickel concentrations within the Building that exceed the health-based benchmark identified in the EPA study.

Zinc--There was significant variation in the zinc testing results collected from the Building dust samples. Zinc was detected in 123 of the 125 samples tested. The samples containing zinc ranged from a low concentration of 2,550 ug/m^2 (from Zone 3) to a maximum concentration of 1,140,000 ug/m^2 (in Zone 3). This variation in zinc concentrations is consistent with the level of disturbance that has occurred within the Building, including the cleaning of the "Gash Area," since September 11, 2001. The EPA has published residential background levels (estimated pre-existing levels) and residential benchmark levels (potential health-based cleanup target levels) for many contaminants in WTC-related reports. While these levels are not directly applicable to a commercial deconstruction project, these studies can be used to put the results of this Study into relative context. The "Benchmarks" table, resulting from the study entitled *World Trade Center Indoor Air Assessment: Selecting Contaminants of Potential Concern and Setting Health-Based Benchmarks*, dated May 2003, identifies a residential health-based benchmark for zinc of 470,000 ug/m^2. This Study has identified zinc concentrations within the Building that exceed the health-based benchmark identified in the EPA study in six of the 125 samples tested (4.8%).

Mercury - Mercury is a naturally occurring metal that has several forms. It is used in electrical and temperature controls as well as computer display monitors. Elemental mercury is a shiny, silver-white, odorless liquid. If heated, it is a colorless, odorless gas. There was significant variation in the mercury testing results collected from the Building dust samples. Mercury was detected in 67 of the 125 samples tested. The samples containing mercury ranged from a low concentration of 1 ug/m^2 (from Zone 2) to a maximum concentration of 160 ug/m^2 (in Zone 3). This variation in mercury concentrations is consistent with the level of disturbance that has occurred within the Building, including the cleaning of the "Gash Area," since September 11, 2001. The EPA has published residential benchmark levels (potential health-based cleanup target levels) for many contaminants in WTC-related reports. While these levels are not directly applicable to a commercial deconstruction project, these studies can be used to put the results of this Study into relative context. The "Benchmarks" table, resulting from the study entitled *World Trade Center Indoor Air Assessment: Selecting Contaminants of Potential Concern and Setting Health-Based Benchmarks*, dated May 2003, identifies a residential health-based benchmark for mercury of 157 ug/m^2. This Study has identified mercury concentrations within the Building that exceed the health-based benchmark identified in the EPA study in two of the 125 samples tested (1.6%).

As described in Section 3.3.6, mercury vapor was not detected in any samples above the instrument detection limit. Results of sampling are shown in Table 22. All results were non-detectable, i.e. less than 0.003 mg/m^3 and therefore below all relevant occupational exposure limits. Relevant exposure limits for elemental mercury vapor are as follows:

TABLE 22
MERCURY VAPOR OCCUPATIONAL EXPOSURE LIMITS

Organization	Type of Exposure Limit	Exposure Limit
OSHA(1)	Ceiling	0.1 mg/m^3
ACGIH(2)	8 Hour Time Weighted Average	0.025 mg/m^3
NIOSH(3)	8 Hour Time Weighted Average	0.05 mg/m^3

(1) OSHA = Occupational Safety and Health Administration
(2) ACGIH = American Conference of Governmental Industrial Hygienists
(3) NIOSH = National Institute for Occupational Safety and Health

Results indicate that mercury vapor cartridges for respiratory protection are not required during routine activities in the building, i.e., walking around the building to conduct visual surveys. The results do not apply to non-routine activities, i.e., construction, where dust and other materials that may contain significant levels of elemental mercury could be disturbed. The results identified above, along with subsequent studies, will be utilized in the development of cleaning and deconstruction plans that will be protective of workers as well as the general public.

4.4 Visual Mold Inspection (Exposed Surfaces Only)

The EPA and NYCDOH have both published guidance documents on assessing and remediating mold in indoor environments. The EPA Office of Air and Radiation, Indoor Environments Division published *Mold Remediation in Schools and Commercial Buildings* in March 2001 to present recommendations on mold remediation. The NYCDOH published *Guidelines on Assessment and Remediation of Fungi in Indoor Environments* in January 2002. Neither the EPA nor the NYCDOH regulates mold or mold spores in indoor air. Both agencies have established recommended work practices in assessing and remediating mold in indoor environments for the purpose of building reoccupancy. Additionally, although handling measures for mold-impacted or water-damaged building materials are recommended by the EPA and NYCDOH, these materials may be safely and legally disposed of as construction and demolition debris.

The visual mold inspection done as part of this initial Study revealed the presence of mold-impacted building materials on exposed surfaces in seven locations distributed over five different floors (11^{th}, 7^{th}, 3^{rd}, Basement A, and Basement B). The extent of mold at each location ranged from six to 24 SF, and in total, 105 SF of mold-impacted building materials were identified. No evidence of significant water-damaged building materials was noted in the Building, although active water infiltration was noted in Basement B. Inspection was not performed for non-exposed surfaces (i.e., concealed interstitial spaces) and will be performed as part of the supplemental investigations that are being executed in conjunction with the cleaning and deconstruction plan development.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The results of the sampling and testing performed for this initial characterization Study revealed levels of contaminants that should be cleaned in connection with the deconstruction of the Building. Throughout the Building, ACM was positively identified in various materials. Detectable levels of asbestos, silica, PAHs, dioxins, PCBs, and heavy metals (including mercury) were also identified in dust above and below the suspended ceilings. The results indicating varying contaminant levels are consistent with the highly variable nature of WTC dust. This variation is also consistent with the level of activity that has occurred within the Building, including the cleaning of the "Gash Area," since September 11, 2001.

As described herein, there are specific regulations that address ACM for demolition activities and ACM have been positively identified in various materials throughout the Building. Additionally, detectable levels of asbestos, silica, PAHs, dioxin, PCBs, and heavy metals (including mercury) were also identified above and below the suspended ceilings. To varying degrees, exposure to, and/or the potential release of, these materials and chemical constituents give rise to the need for appropriate planning, engineering controls, monitoring, and other health and safety measures to protect workers and to avoid exposure to the surrounding community.

The findings of this report can therefore serve as a reference document that will be used by LMDC and the deconstruction contractor to determine appropriate methods for the cleaning and deconstruction program, such as: planning; permitting; engineering controls; cleaning; monitoring; and waste handling/disposal. In addition, this Study will serve as a baseline for the development and execution of any further sampling and testing and/or exposure assessments that might be deemed appropriate.

Further testing is necessary to completely develop the cleaning and deconstruction plan. To this end, LMDC and Berger are currently working to develop and implement a supplemental investigation program that, at a minimum, will involve obtaining access to previously inaccessible surfaces and interstitial spaces—including the curtain wall, interior walls, the exterior of the Building, and cell systems and raceways within the concrete slabs–for testing of all of the constituents addressed in the initial characterization study (asbestos and other analytes as well as visual inspection for mold). Berger also recommends additional testing to characterize waste materials to be removed for purposes of handling, transportation, storage, and disposal or recycling. The additional information provided from this supplemental testing and inspection program will be shared with the deconstruction contractor, regulatory authorities, and the public, as part of the finalization and implementation of the cleaning and deconstruction plan.

Based on the results of this Study, Berger offers the following recommendations:

- LMDC should continue to maintain a health and safety plan and external air monitoring program. LMDC should review and modify its health and safety plan and external air monitoring program as appropriate to address all of the conditions identified in this Study;

- LMDC should continue to review and address the potential for release of contaminants from the Building;

- LMDC should further develop and implement an emergency action plan for the Building;

- LMDC should conduct further testing as recommended in this Study;

- LMDC should further develop its plan for cleaning and deconstruction and address the contaminants identified in this Study and in the further testing;

- LMDC should continue to consult with all appropriate regulatory agencies (e.g., New York City Department of Environmental Protection (NYCDEP), NYSDOL, EPA, New York State Department of Environmental Conservation (NYSDEC), and Occupational Safety and Health Association (OSHA)) in order to prepare specific cleaning, deconstruction, and environmental monitoring protocols;

- In connection with the deconstruction plan, LMDC should further develop appropriate site-specific health and safety plan documents (including establishing the organizational and procedural safeguards to be implemented to ensure the protection of site workers and the surrounding community);

- In connection with the deconstruction plan, LMDC should further develop appropriate work and site operations plan documents to cover such items as work area controls/limitations, decontamination facilities, engineered containment and control systems, monitoring programs, emergency/contingency plans, waste management, and assurances that the work will comply with all applicable federal, state, and local regulations;

- LMDC should file appropriate notifications and obtain necessary permits, including the Asbestos Control Program 7 (ACP-7), from the appropriate regulatory agencies;

- As currently contemplated, LMDC should engage a contractor with a NYSDOL asbestos handling license, as necessary, to perform the work; and

- LMDC should conduct appropriate monitoring and quality assurance/quality control inspections throughout the cleaning and deconstruction process.

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GLOSSARY OF TERMS/ACRONYMS

ug	Micrograms A unit of measure; associated, for the purposes of this report, with quantities of COPCs. Specifically, a microgram is equivalent to $1x10^{-6}$ grams.
ACM	Asbestos-containing Materials
AHERA	The Federal Asbestos Hazard Emergency Response Act
Asbestos	For the purposes of this report, any material analyzed and found to contain one percent or more asbestos content is considered to be asbestos and can be classified as ACM.
ASHARA	The Federal Asbestos School Hazard Abatement Reauthorization Act
Berger	The Louis Berger Group, Inc. Environmental Consulting firm under contract with LMDC
the Building	For the purposes of this report, this term refers to the specific structure physically located at 130 Liberty Street, New York, New York, and within which this *Initial Building Characterization Study* was conducted.
BUR	Built-Up Roof system
CLP	Contract Laboratory Program Run by EPA
COPC	Contaminants of Potential Concern as defined by the EPA's Contaminants of Potential Concern (COPC) Committee of the World Trade Center Indoor Air Task Force Working Group in their report *World Trade Center Indoor Environment Assessment: Selecting Contaminants of Potential Concern and Setting Health-Based Benchmarks* (May 2003), including asbestos, dioxins, lead, PAHs, fibrous glass, and silica. COPCs also refers to other analytes suspected of being present in the Building including PCBs, heavy metals (barium, beryllium, cadmium, chromium, copper, manganese, nickel, and zinc), and mercury.
Damage Condition	1- If the extent of the damage is roughly ten percent of the material and is evenly distributed throughout the material, then the material is considered significantly damaged. 2- If the extent of the damage is roughly 25 percent of the material and is localized, then the material is considered significantly damaged.
Demolition	The total razing of a building or an entire portion thereof. Section 56-1.4(ac) of NYSDOL

Dioxin	A type of COPC for the purposes of this report
DOT	Federal Department of Transportation
ELAP	Environmental Laboratory Approval Program Run by NYSDOH
EPA	The United States Environmental Protection Agency
SF	Square foot/feet A unit of measure defining a two-dimensional area encompassing a one foot length by a one foot width
Friable ACM	For purposes of this report, friable is a term given to a material that contains more than one percent asbestos and can be crumbled, pulverized or reduced to powder when dry by hand pressure as per the definition by the Environmental Protection Agency and the New York State Department of Labor. In New York City, the definition of friable ACM refers to any material that contains more than one percent asbestos and can be crumbled, pulverized or reduced to powder by hand or other mechanical pressure.
HASP	Health and Safety Plan
Heavy metals	For the purposes of this report, heavy metals are a type of COPC. In particular, the following elements are included under this category: barium, beryllium, cadmium, chromium, copper, lead, manganese, nickel, and zinc.
HEPA	High Efficiency Particulate Arrestance Also known as High Efficiency Particulate Air, this device is a filter designed to very efficiently remove minute particles from the air.
Homogenous group	For the purposes of this report, a homogenous group is a number of samples assumed to be of the same material that have been obtained from a homogenous area, which are considered for analytical purposes to be nearly identical. This type of group classification makes it possible to take advantage of NA/PS analysis methods.
HVAC	Heating, Ventilation, and Air-Conditioning
LF	Linear Foot/Feet A unit of measure defining a one dimensional length of area
LMDC	Lower Manhattan Development Corporation

m^2	Meter(s) squared
	A unit of measure defining a two-dimensional area encompassing a one meter length by a one meter width
MEP	Mechanical, Electrical, and Plumbing
Mercury	A type of COPC for the purposes of this report
NA/PS	Not Analyzed/Positive Stop
	Efficient and economically beneficial analytical method that reduces the need for repetitive analysis of homogenous samples by testing only a limited number of samples in the group, as opposed to testing them all
ND	Not detected above the Method Detection Limit (MDL)
	For the purposes of this report, when a COPC is not detected using methods established in this report to test for specific COPCs within a sample
NESHAP	National Emissions Standards for Hazardous Air Pollutants
	Set forth by the EPA
Ng	Nanograms
	A unit of measure; associated, for the purposes of this report, with quantities of COPCs. Specifically, a nanogram is equivalent to $1x10^{-9}$ grams.
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
NOB	Non-friable, Organically Bound material
Non-asbestos-containing material	For the purposes of this report, this is any material that has less than one percent asbestos content as per the EPA-NESHAP.
NVLAP	National Voluntary Laboratory Accreditation Program
	Run by NIST cooperatively with the NYSDOH ELAP
NYCDEP	New York City Department of Environmental Protection
NYCDOB	New York City Department of Buildings
NYCDOH	New York City Department of Health
NYSDOH	New York State Department of Health

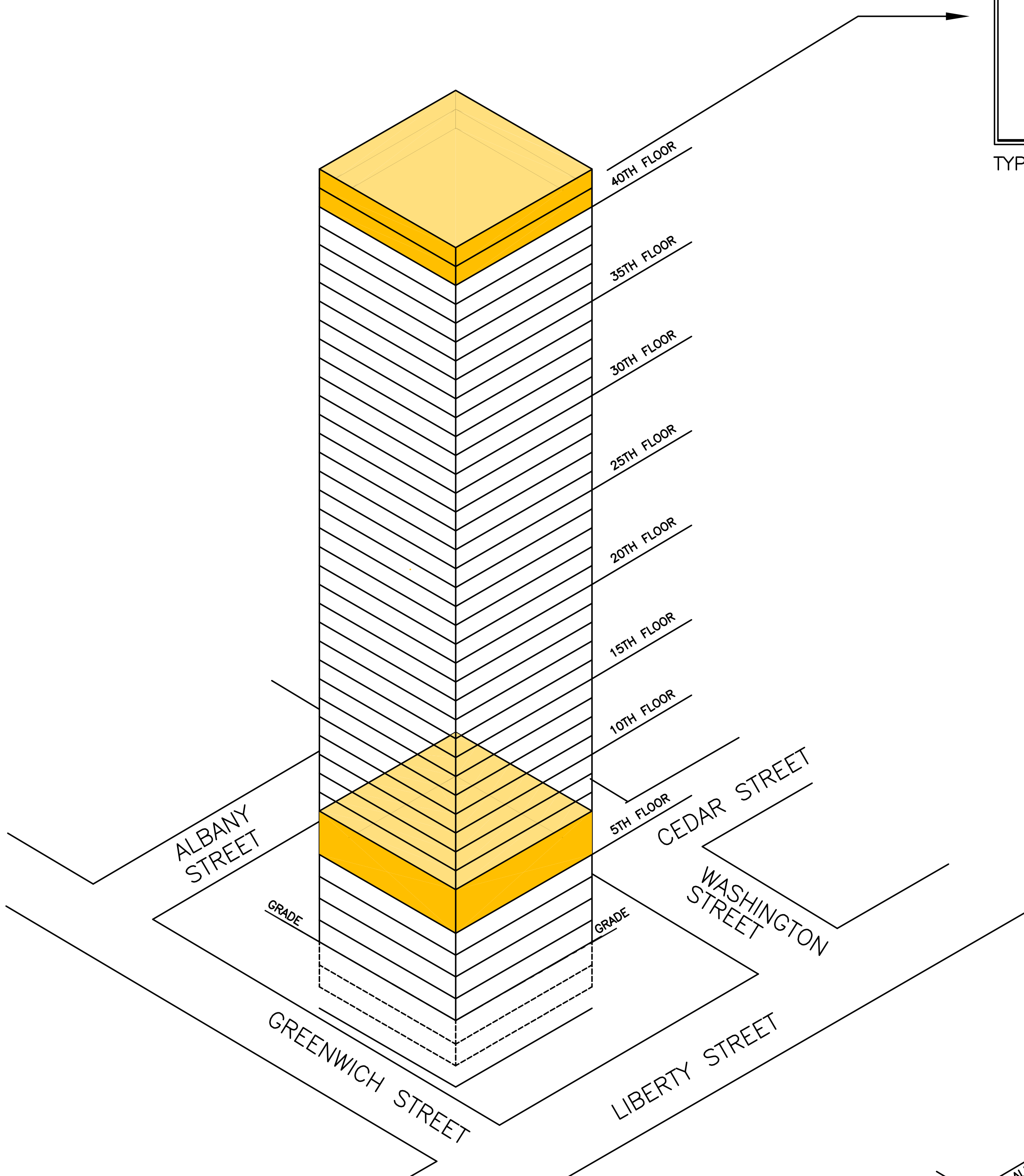
NYSDOL	New York State Department of Labor
OSHA	Occupational Safety and Health Administration
PAHs	Polycyclic Aromatic Hydrocarbons A type of COPC for the purposes of this report
PCBs	Polychlorinated Biphenyls A type of COPC for the purposes of this report
PEL	Permissible Exposure Limit Set forth by OSHA for workers engaged in activities, such as demolitions, which would bring them into contact with COPCs. For the purposes of this report, PEL refers to airborne COPCs.
Plenum	A type of suspended ceiling commonly found throughout the Building and used as a sampling site on various floors. Samples were collected from either above the plenum, or below it.
PLM	Polarized Light Microscopy An optical microscope utilizing wavelengths of light to obtain information on the studied suspected material. A suspect material immersed in a solution of known refraction index and subjected to illumination by polarized light. The resulting characteristic color display enables mineral identification.
PPE	Personal Protective Equipment
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
SAP	Sampling and Analysis Plan
Silica	A type of COPC for the purposes of this report
SOP	Standard Operating Procedure
TEM	Transmission Electron Microscopy The use of TEM addresses the principle that the limit of an optical microscope's ability to detect objects is affected by the wavelengths of light. TEM's extremely short wavelength, coupled with simple image presentation, yields resolvable images of even the smallest fibers with a resolution of up to 20,000 X.

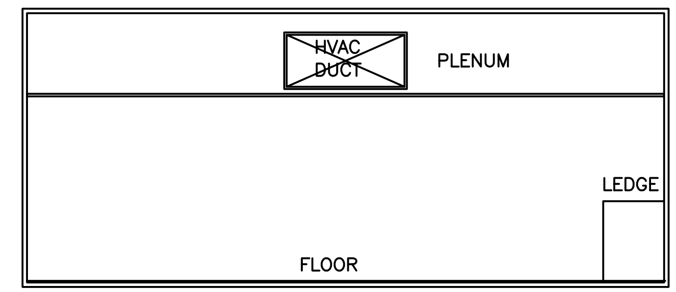
With much greater optical magnification than PLM, TEM is considered the only reliable method that can be used to report true negative results from PLM analysis of NOB samples as per the NYSDOH ELAP 198.4 Methods.

TSCA The Federal Toxic Substances Control Act

WTC World Trade Center

FIGURES



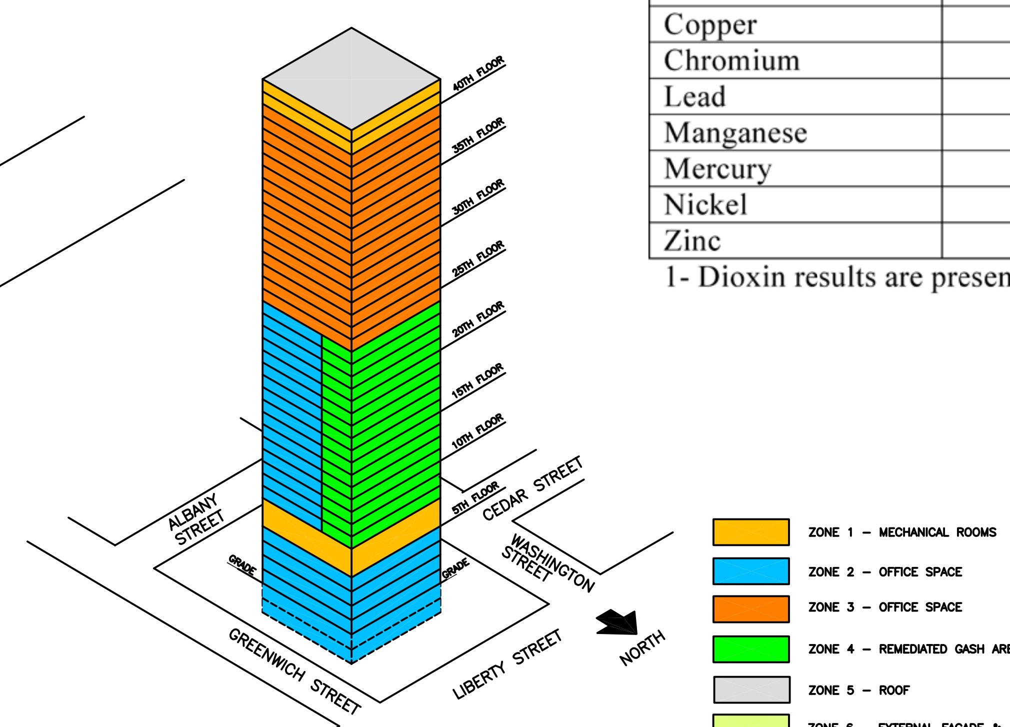


TYPICAL FLOOR SECTION

Zone 1 – Summary of Detected Concentrations

Analyte	Percent of Samples with Detections	Minimum Detected Concentration ($\mu g/m^2$)	Maximum Detected Concentration ($\mu g/m^2$)
Silica (Quartz)	100%	71,000	10,000,000
PAH	100%	3	5,028
Dioxin[1]	100%	5.5	33.5
PCBs	18.8%	60	120
Barium	100%	1,340	44,700
Beryllium	25%	32	390
Cadmium	84.4%	50	7,830
Copper	100%	5,570	114,000
Chromium	100%	570	35,100
Lead	100%	2,470	101,000
Manganese	100%	3,080	187,000
Mercury	59.4%	25	54
Nickel	100%	460	10,500
Zinc	100%	22,000	1,040,000

1- Dioxin results are presented in ng/m^2



THE LOUIS BERGER GROUP, INC.

WTC DUST SAMPLING LOCATIONS (TASK 4) ZONE 1

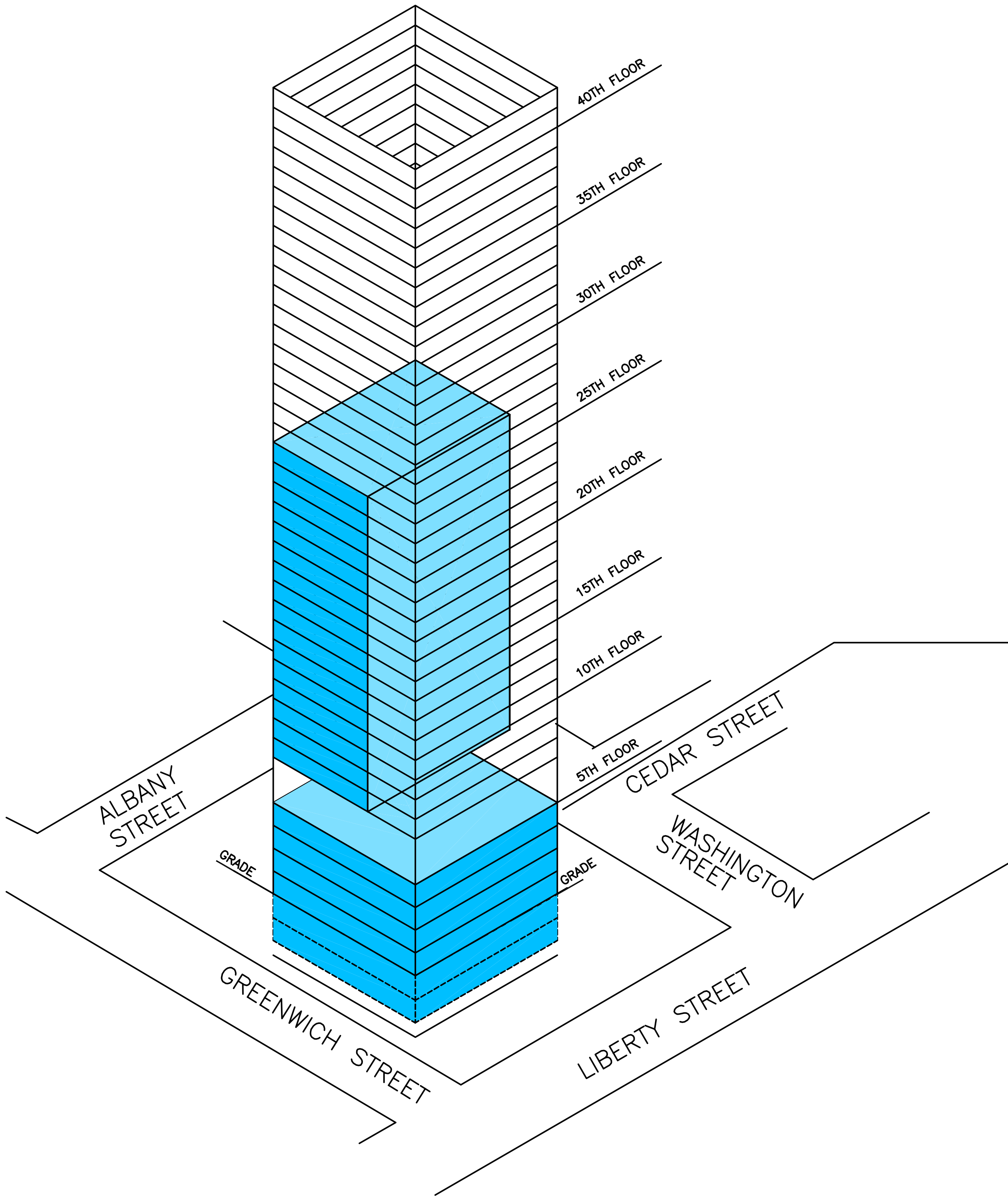
130 LIBERTY STREET
NEW YORK, NEW YORK

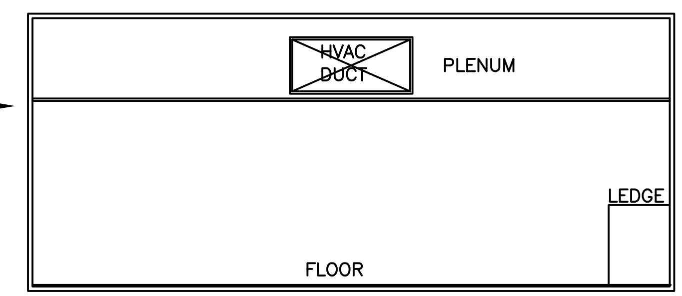
Scale: N.T.S.	08/04/04	FIG. 1

Zone 2 – Summary of Detected Concentrations

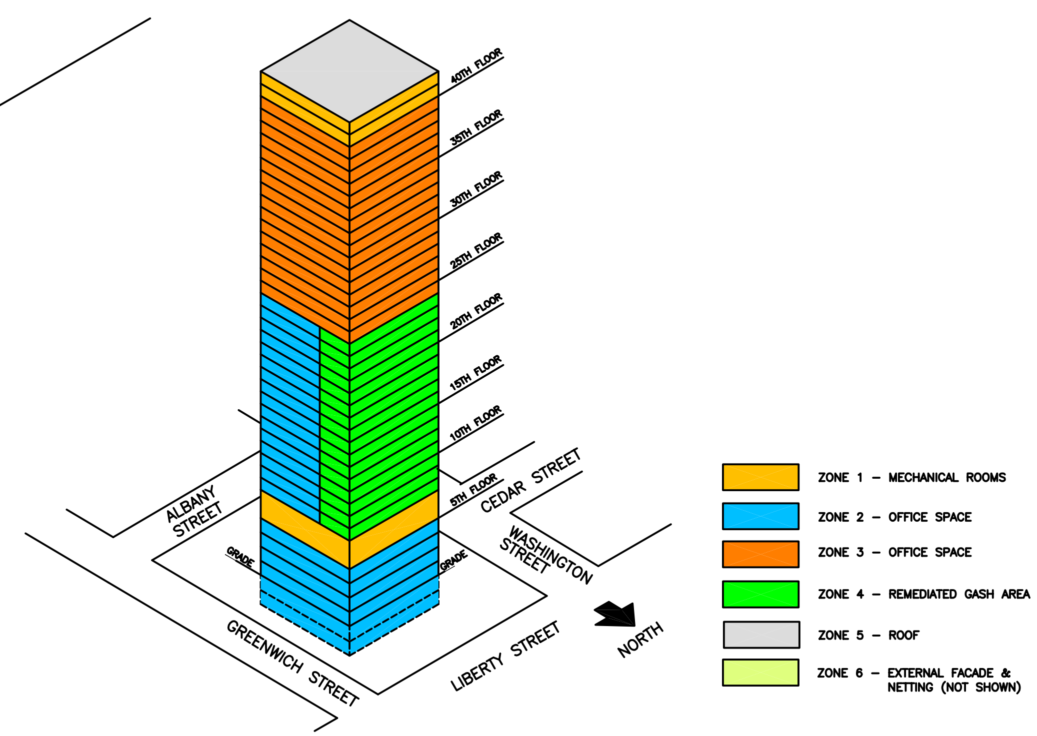
Analyte	Percent of Samples with Detections	Minimum Detected Concentration ($\mu g/m^2$)	Maximum Detected Concentration ($\mu g/m^2$)
Silica (Quartz)	97.5%	500	2,400,000
PAH	100%	58	11,555
Dioxin[1]	100%	0.67	46.1
PCBs	2.6%	63	63
Barium	100%	290	149,000
Beryllium	0%	--	--
Cadmium	10.6%	25	400
Copper	94.7%	340	103,000
Chromium	97.4%	375	76,900
Lead	94.7%	270	71,200
Manganese	100%	280	320,000
Mercury	35.9%	0.84	38
Nickel	91.2%	61	9,740
Zinc	96.1%	5,260	421,000

1- Dioxin results are presented in ng/m^2





TYPICAL FLOOR SECTION

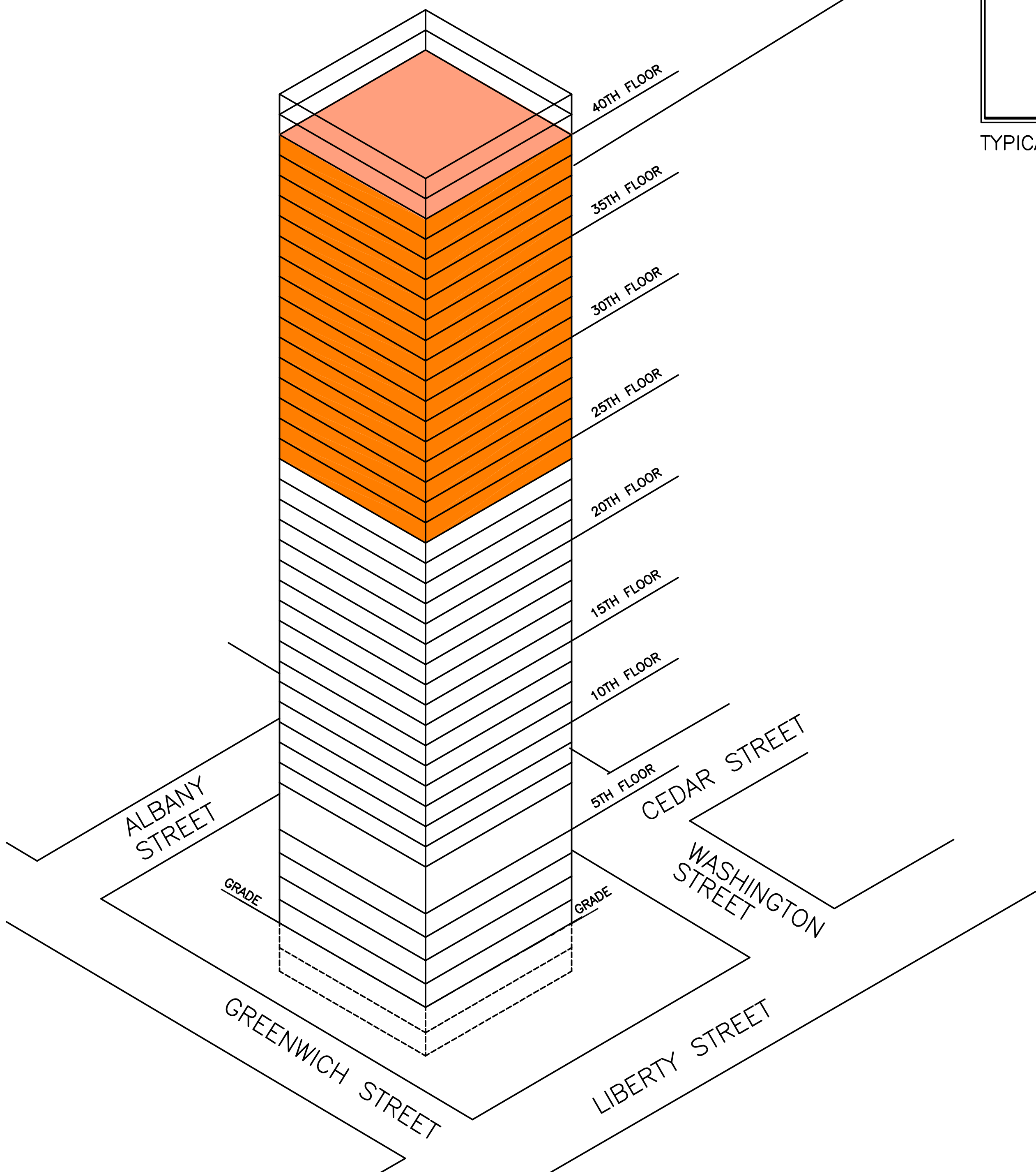


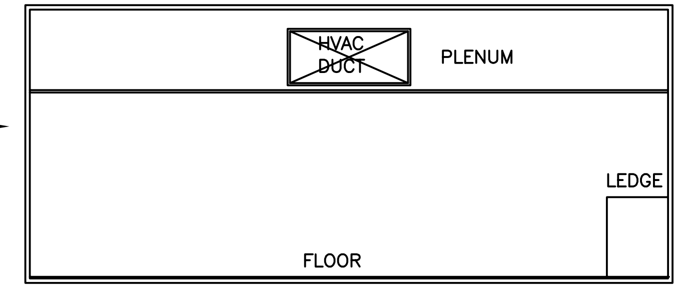
THE LOUIS BERGER GROUP, INC.

WTC DUST SAMPLING LOCATIONS (TASK 4) ZONE 2

130 LIBERTY STREET
NEW YORK, NEW YORK

Scale: N.T.S.	08/04/04	FIG. 2



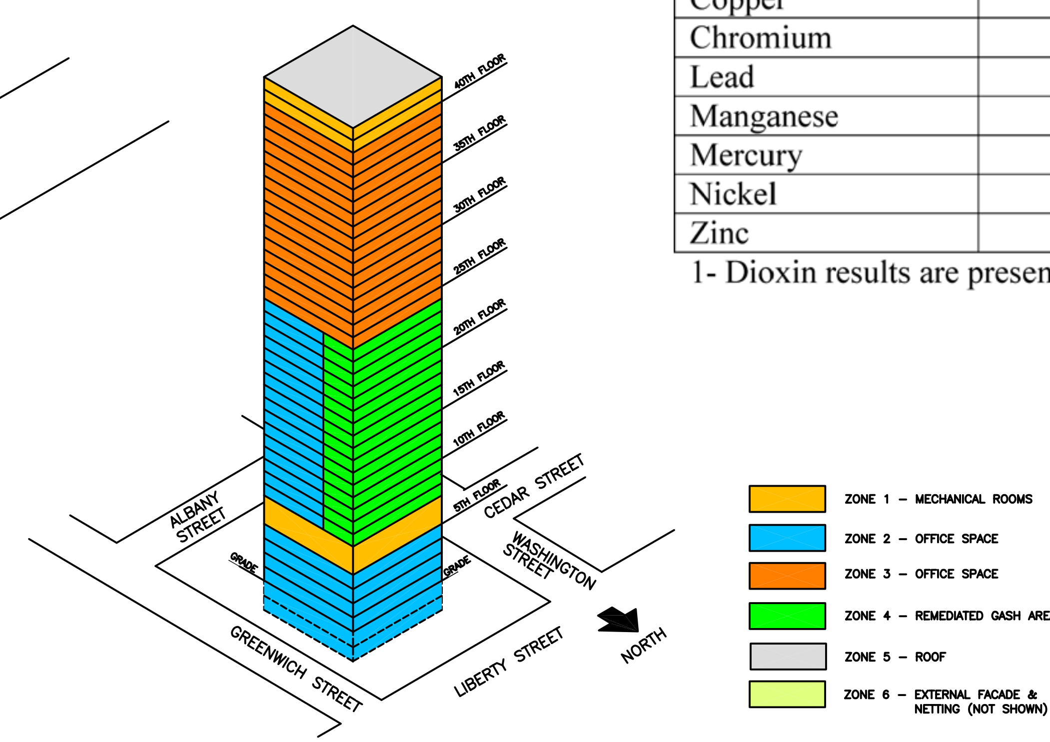


TYPICAL FLOOR SECTION

Zone 3 – Summary of Detected Concentrations

Analyte	Percent of Samples with Detections	Minimum Detected Concentration (µg/m²)	Maximum Detected Concentration (µg/m²)
Silica (Quartz)	100%	1,000	3,500,000
PAH	100%	578	1,156
Dioxin[1]	100%	1.24	84.8
PCBs	5.3%	360	360
Barium	100%	130	60,900
Beryllium	2.6%	35	35
Cadmium	57.9%	110	3,490
Copper	100%	120	145,000
Chromium	100%	49	118,000
Lead	97.3%	150	72,400
Manganese	100%	180	228,000
Mercury	71.1%	1.1	160
Nickel	97.3%	46	25,800
Zinc	100%	2,550	1,140,000

1- Dioxin results are presented in ng/m²

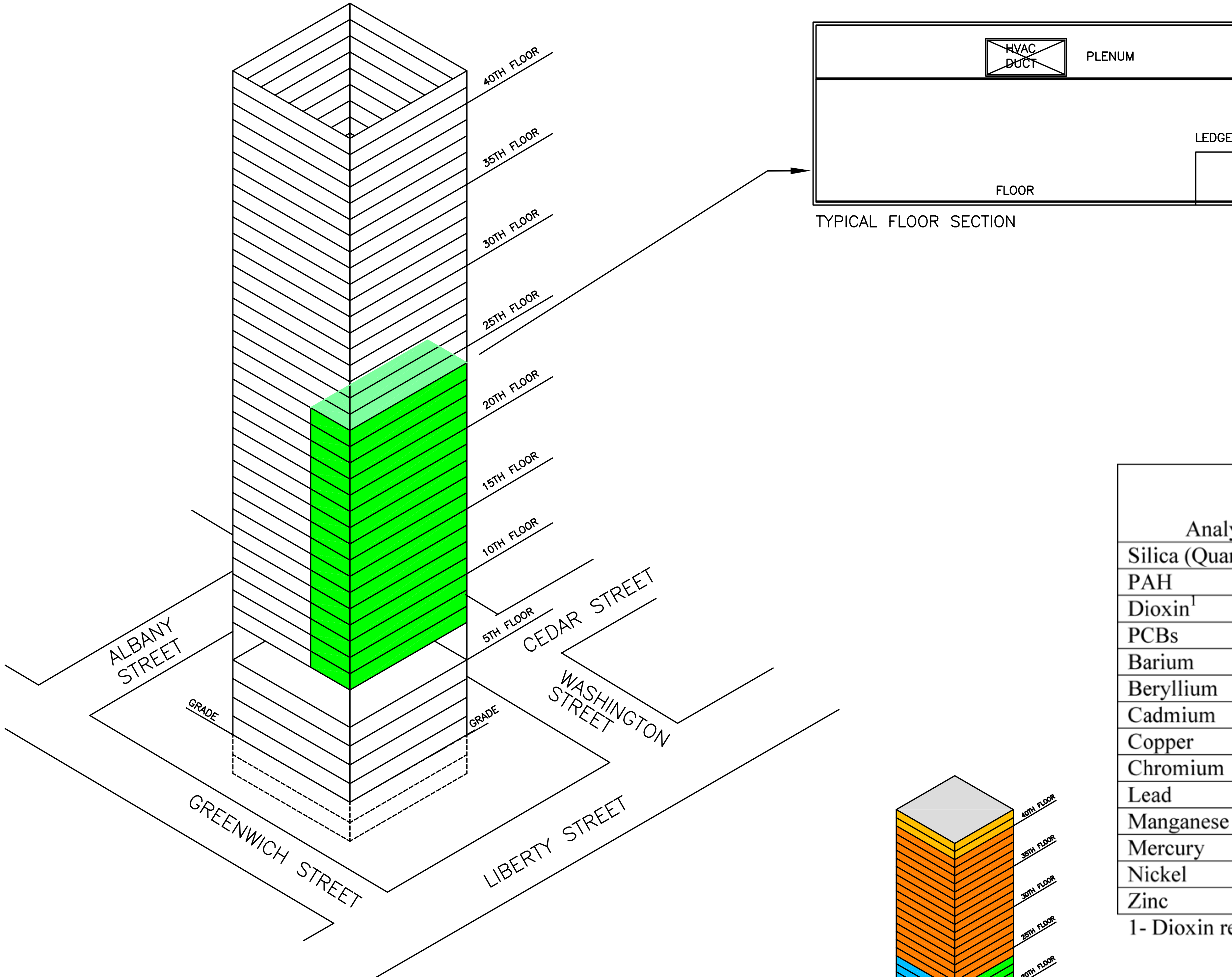


THE LOUIS BERGER GROUP, INC.

WTC DUST SAMPLING LOCATIONS (TASK 4) ZONE 3

130 LIBERTY STREET
NEW YORK, NEW YORK

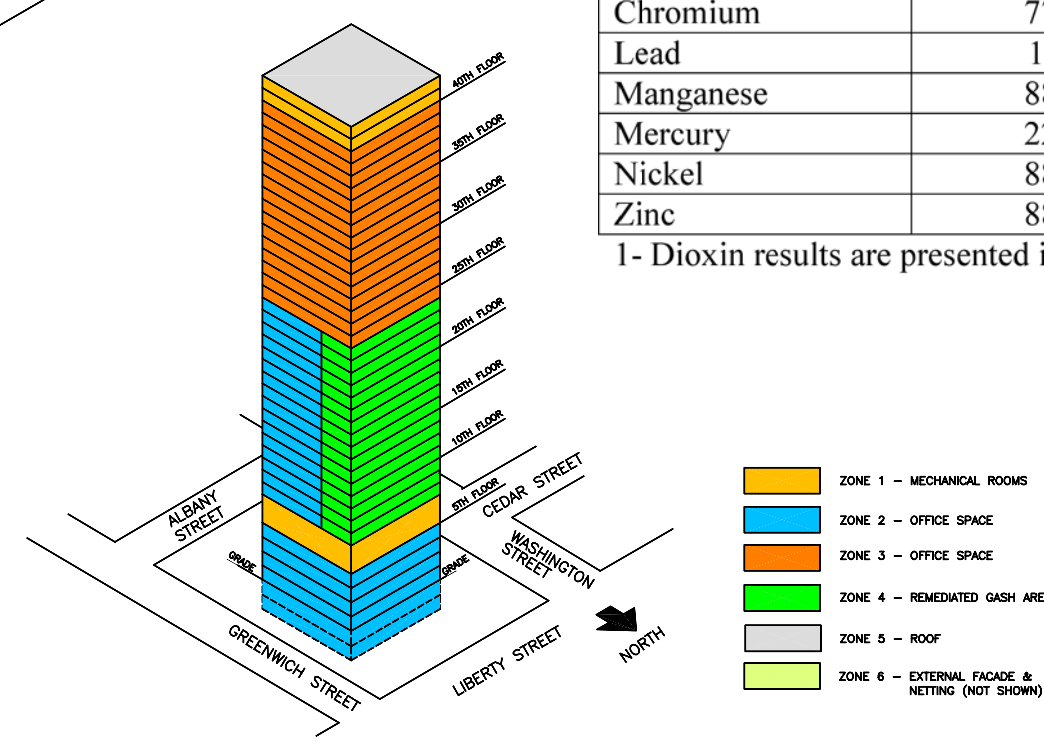
Scale: N.T.S.	08/04/04	FIG. 3



Zone 4 – Summary of Detected Concentrations

Analyte	Percent of Samples with Detections	Minimum Detected Concentration (µg/m^2)	Maximum Detected Concentration (µg/m^2)
Silica (Quartz)	71.4%	250	6,700,000
PAH	100%	1,156	5,778
Dioxin[1]	100%	12.9	22.9
PCBs	11.1%	120	120
Barium	100%	1,050	28,400
Beryllium	0%	--	--
Cadmium	33.3%	310	370
Copper	88.9%	1,760	21,900
Chromium	77.8%	500	11,800
Lead	100%	1,200	29,600
Manganese	88.9%	3,010	176,000
Mercury	22.2%	1.3	2.2
Nickel	88.9%	1,630	13,400
Zinc	88.9%	10,500	186,000

1- Dioxin results are presented in ng/m^2

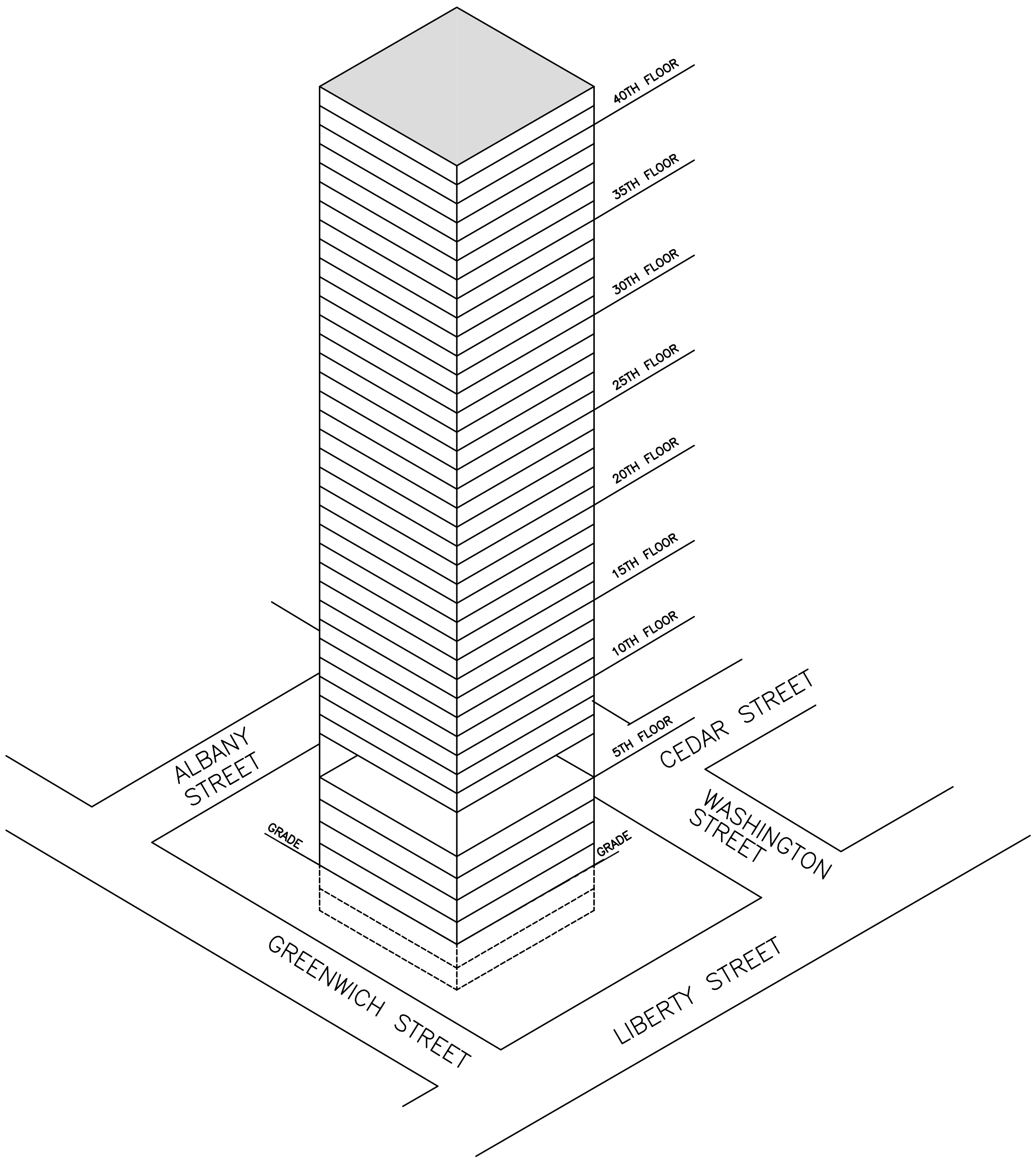


THE LOUIS BERGER GROUP, INC.

WTC DUST SAMPLING LOCATIONS (TASK 4)
ZONE 4

130 LIBERTY STREET
NEW YORK, NEW YORK

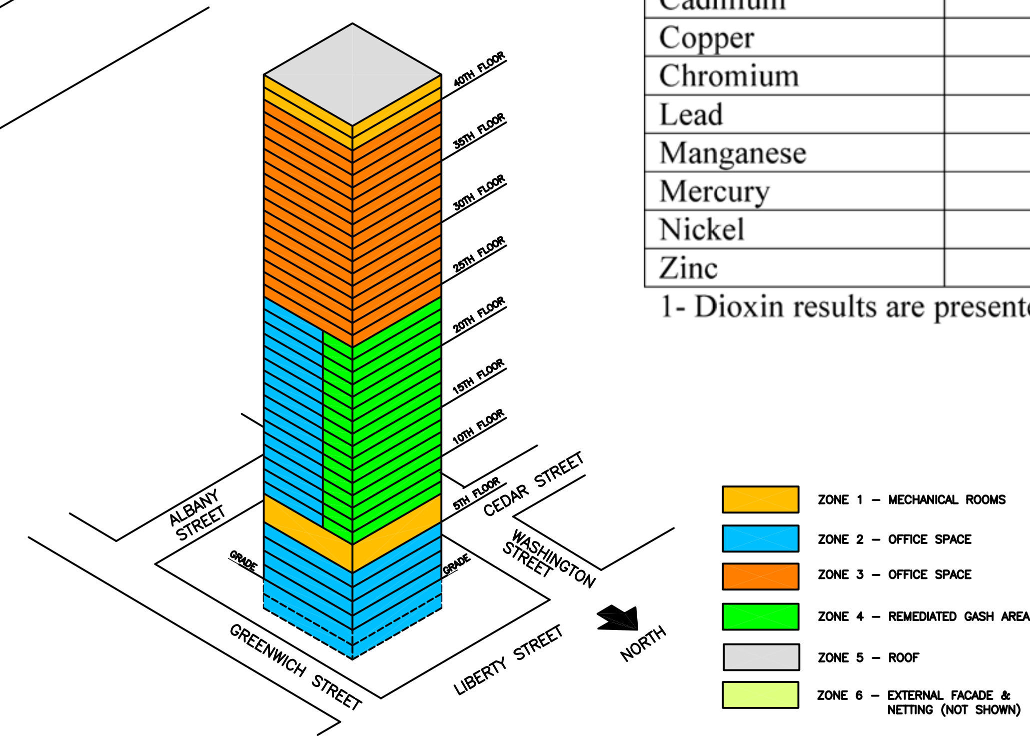
Scale: N.T.S.	08/04/04	FIG. 4



Zone 5 – Summary of Detected Concentrations

Analyte	Percent of Samples with Detections	Minimum Detected Concentration (µg/m^2)	Maximum Detected Concentration (µg/m^2)
Silica (Quartz)	100%	1,500	12,000
PAH	100%	578	788
Dioxin[1]	100%	3.92	214
PCBs	0%	--	--
Barium	75%	390	650
Beryllium	0%	--	--
Cadmium	0%	--	--
Copper	50%	450	560
Chromium	75%	110	9,300
Lead	100%	500	2,070
Manganese	50%	230	370
Mercury	75%	0.84	1.3
Nickel	75%	120	410
Zinc	100%	4,440	6,280

1- Dioxin results are presented in ng/m^2

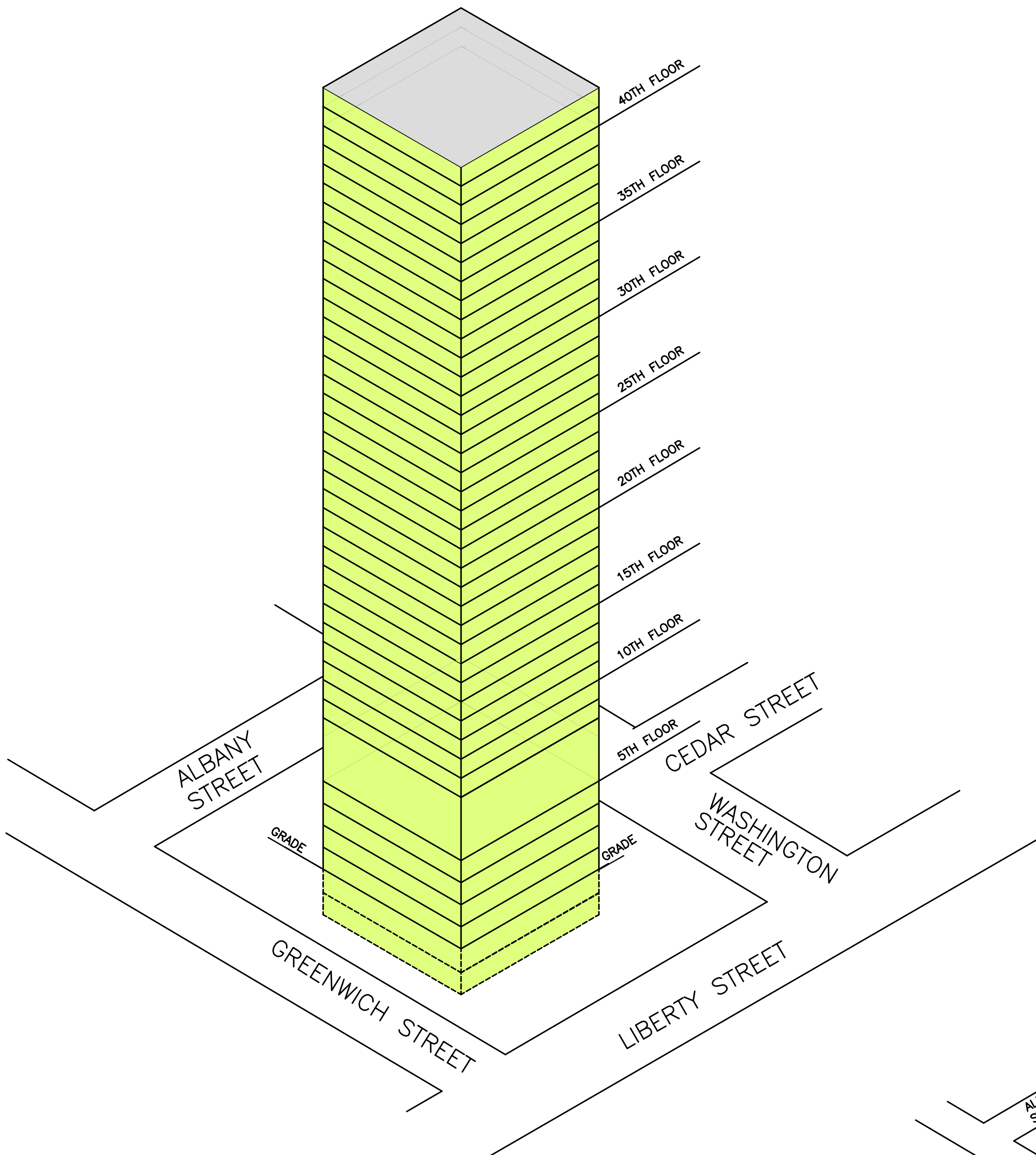


THE LOUIS BERGER GROUP, INC.

WTC DUST SAMPLING LOCATIONS (TASK 4) ZONE 5

130 LIBERTY STREET
NEW YORK, NEW YORK

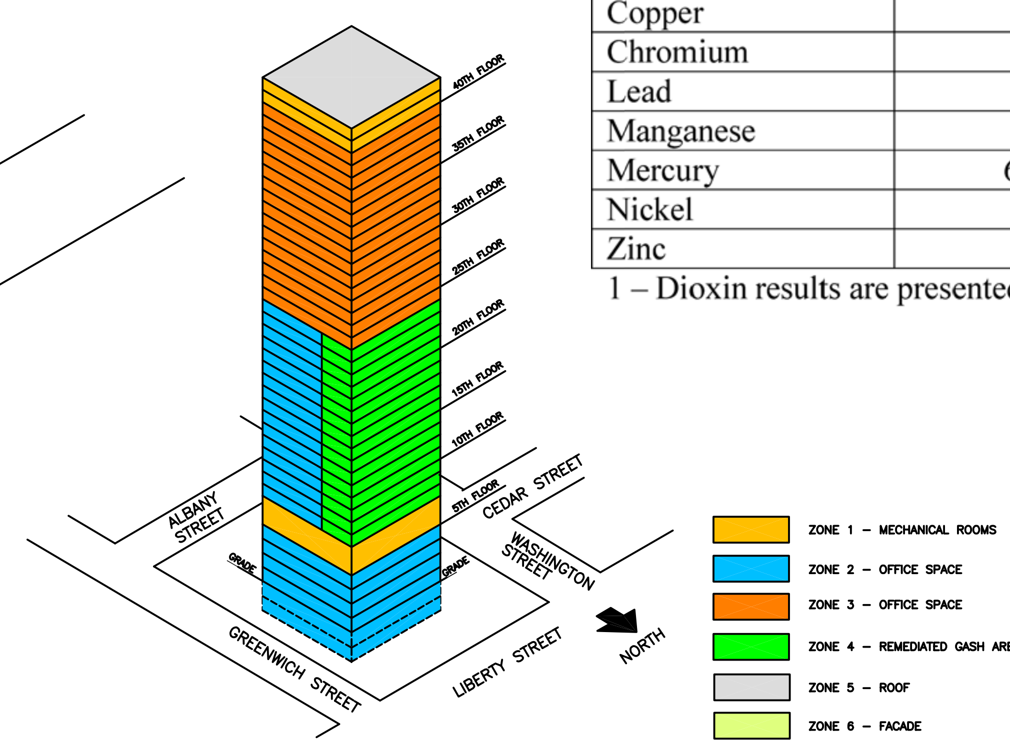
Scale: N.T.S.	08/04/04	FIG. 5



Zone 6 – Summary of Detected Concentrations

Analyte	Percent of Samples with Detections	Minimum Detected Concentration (µg/m²)	Maximum Detected Concentration (µg/m²)
Silica (Quartz)	100%	320,000	1,800,000
PAH	0%	--	--
Dioxin[1]	100%	3.11	13.2
PCBs	0%	--	--
Barium	100%	2,180	14,200
Beryllium	0%	--	--
Cadmium	66.7%	290	1,100
Copper	100%	3,680	18,600
Chromium	100%	4,690	8,200
Lead	100%	6,940	29,800
Manganese	80%	4,390	30,600
Mercury	66.7%	5.4	5.8
Nickel	100%	580	2,920
Zinc	100%	16,700	101,000

1 – Dioxin results are presented in ng/m²



THE LOUIS BERGER GROUP, INC.

WTC DUST SAMPLING LOCATIONS (TASK 4)
ZONE 6

130 LIBERTY STREET
NEW YORK, NEW YORK

Scale: N.T.S.	08/04/04	FIG. 6

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