UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
SOLID WASTE AND EMERGENCY
RESPONSE

September 3, 2003

The Honorable Jerrold Nadler
U.S. House of Representatives
Washington, DC 20515

Re: EPA/NYCDEP clean-up of WTC dust at 114 Liberty Street

1. **They left visible dust with high levels of asbestos after the clean-up and pronounced the building safe to re-occupy.**
2. **They ignored residents' own testing which contradicted their claims.**
3. **They ignored the presence of silica, a known human carcinogen, at hazardous levels.**
4. **They refuse to re-clean.**

Dear Congressman Nadler:

As requested, the following are my comments on the letter dated 8/4/03 from both the NYC Department of Environmental Protection (NYCDEP) and the U.S. Environmental Protection Agency (EPA) to the Federal Emergency Management Agency (FEMA). My comments also address EPA's 4/18/03 letter and report on the 114 Liberty clean-up, as well as the 4/24/03 letter from the NYCDEP transmitting EPA's report to the residents.

These letters reviewed the cleaning and testing measures undertaken by EPA/NYCDEP at 114 Liberty St. in lower Manhattan in April of 2003 after the World Trade Center (WTC) collapse. The letters also addressed subsequent testing by residents on their own initiative at 114 Liberty St. after the EPA/NYCDEP had completed its abatements.

My comments arise from my personal concern over misrepresentations by EPA and their deviations from their criteria for the clean-up of WTC contaminants The conclusions and opinions are those of the author and do not necessarily reflect those of the U.S. Environmental Protection Agency.

These comments are also being transmitted to the EPA Office of the Inspector General (OIG), because they augment those charges presented to the OIG in my 7/4/03 report on the WTC clean-up.[1]

114 Liberty St. Building History

Building history prior to 9/11/01

The 114 Liberty St. building is an eleven floor building on the south border of Ground Zero, which dates from the turn of the century. In 1998, the upper 9 floors were converted from office space to residential condominiums. Commercial tenants in the first two and one half floors remained intact during the renovation.

Before the renovation, the upper floors had vinyl asbestos tiles. The ceilings were plastered brick vaults between steel I-beams. The lower floor commercial spaces had and continue to have dropped loose tile grid ceilings. The lower floor commercial spaces have a separate cooling and ventilation system. All spaces share a steam heating system.

The renovation and conversion to condominiums covered all the floor tiles with new flooring, primarily wood, with some areas of stone or ceramic tiles.

The ceiling was lowered with drywall suspended from the original steel beams on the ceilings. This created an open space above the suspended ceiling which is used for the return air flow for the ventilation and air conditioning system. Non-asbestos fireproofing was sprayed onto the original ceilings before installing the suspended drywall.

Damage and contamination caused by the WTC collapse

All of the front windows, and a few in the rear of the building, were broken by the WTC blast. In the rooms in front of the building facing Ground Zero, there were inches of WTC dust. Towards the rear of the building, the dust layers were not as thick, with a coating of around ¼ inch or less.

The ventilation system was operating that day, and thus pulled a large amount of dust throughout the system, including the open return air system above the suspended drywall ceilings. The spaces between the walls of the residential units (drywall construction using galvanized steel supports) provided an open path to the space above the ceiling. WTC dust penetrated into these wall spaces as well as into the plenum above the ceiling.

There was structural damage on the face of the building approximately 20 feet high by 40 feet wide, where the building was hit by larger pieces of the collapsing WTC. Iron beams were bent, and bricks were loosened. At the center of the damage, there was a hole spanning 3 window widths from floor to ceiling.

The building was evacuated and not re-occupied because it was in the "frozen zone" where citizens had to show identification for entry. The building was also not re-occupied because of the structural damage, which was not repaired until late 2002/early 2003.

Decontamination prior to EPA/NYCDEP abatement

Residents had some floors of the building individually abated during the months of November to December, 2001. At the end of December, 2001, the whole building was professionally abated again, and the windows were boarded up. This cleaning was not up to specifications, as it left pockets of visible WTC dust in spaces like cabinets.

EPA/NYCDEP building clean-up in March, 2003

The 114 Liberty St. building underwent an addition abatement in March, 2003 as part of the EPA voluntary WTC dust clean-up program. The residents negotiated a whole-building clean-up. As part of the agreement, EPA/NYCDEP contractors removed the drywall from the suspended ceiling ventilation air return system, and also removed one side of each wall so that the contaminated interior wall spaces were accessible for cleaning.

EPA/NYCDEP contractors cleaned the residential units two times, because testing after the first cleaning demonstrated that air levels were still unsafe.

Resident testing after EPA/NYCDEP clean-up

After EPA/NYCDEP completed the two abatements, the residents performed their own additional testing. This was motivated by the fact that EPA/NYCDEP contactors had not abated areas of clearly visible dust in the exposed wall spaces and elsewhere.

Dusts underneath floorboards were also tested, because cracks in the floor boards had allowed lines of WTC dust to settle in visible lines both in and under these cracks, which were not removed by the abatements. It was feared that future vacuuming of the floors, impacts from foot traffic, contraction of the wood, or other normal activities would resuspend the dust lying in the cracks and under the floor boards. Residents had tried to get EPA/NYCDEP to address this contamination in the floorboards during the cleaning program, but EPA/NYCDEP refused.

Residents had both wipe and microvacuum testing performed under the floorboards and on the horizontal surfaces of the exposed wall and ceiling support systems. Note that wipe sampling is the preferred method for testing for residual asbestos or other dust-laden contaminants on smooth surfaces which have been cleaned with any wet wiping or washing techniques. The quantitative wipe method for asbestos is ASTM Method 6480, and was the method used by EPA in its 110

Liberty St. cleaning study.[2] The microvacuum method, ASTM Method 5755 is only suitable for freshly deposited dust layers that have not be touched by wet wiping, washing, etc. This is because water and detergents will temporarily bind residual dust-borne contaminants to the surface so that they will not be picked up by the dry vacuuming technique used in the ASTM microvacuum method. As discussed in my 12/19/01 memorandum,[3] wipe testing has been demonstrated to pick up 4 times or more asbestos from smooth surfaces compared to microvacuum sampling.

EPA/NYCDEP failed to abate visible dust at 114 Liberty St.

On 8/4/03, EPA/NYCDEP jointly wrote to FEMA to defend the adequacy of its cleaning efforts at 114 Liberty St. This defense was in response to your inquiry on behalf of the residents at this address. EPA/NYCDEP stated the following:

> The U.S. Environmental Protection Agency (EPA) and the NYC Department of Environmental Protection (DEP) are in receipt of the analytical test results supplied to the Federal Emergency Management Agency (FEMA) by residents of 114 Liberty Street via Congressman Jerrold Nadler's office. … As explained below we believe that the extensive data collected by DEP and its contractors to clear this building are valid.
> …
> DEP developed the scope of work … sampling was done for the contaminants of potential concern following EPA protocols established specifically for EPA's WTC Residential Confirmation Cleaning Study. The analytical results were compared to health-based benchmarks established by EPA's Interagency Indoor Air Task Force. The contaminants of potential concern included: asbestos, lead, dioxin, PAHs (Poly Aromatic Hydrocarbons), fibrous glass and crystalline silica.
>
> The clean-up started on March 6, 2003 and was completed on March 29, 2003. The test results were reviewed and indicated that all the primary clearance levels were achieved.

As discussed in greater detail below, EPA/NYCDEP did not clean up 114 Liberty St. according to the EPA specifications in regard to either visible dust, asbestos, or silica.

EPA/NYCDEP left clearly visible dust in readily accessible areas

EPA was incorrect in its 4/24/03 letter asserting that the clean-up at 114 Liberty St. met the requirements:

> This is to confirm, the Department of Environmental Protection has completed the clean-up activities as per the clean up and monitoring specifications and access agreements for 114 Liberty St.

The EPA Statement of Work requires the contractor to re-clean if there is any visible dust: [4]

> After the removal of debris, all surfaces will be cleaned in accordance with the procedures specified in Scope A. After all surfaces have been cleaned, a second

> cleaning shall be performed. This results in two full cleanings of all surfaces … Surfaces include but are not limited to walls, floors, ceilings, ledges, trims, appliances, equipment and furnishings.
> …
> The cleaning contractor shall notify the monitoring contractor immediately upon completion of the cleaning. The Monitoring Contractor will conduct a thorough visual inspection to verify the absence of visible dust accumulations. If dust is observed the cleaning contractor will reclean as necessary at no additional cost.
> …
> [Scope A surface cleaning procedures:] Residences will be cleaned using HEPA vacuums, water extraction cleaners and wet wiping as described below. Surfaces to be cleaned include but are not limited to walls, floors, ceilings, ledges, trims, furnishings, appliances, equipment, etc. … All surfaces including but not limited to floors, walls, curtains, fabric window treatments, upholstery and other materials that are not cleaned by wet methods (wet wiping and water extraction cleaning) will be HEPA vacuumed two times.

The EPA/NYCDEP contractor did not remove all visible dust even after two cleaning events at 114 Liberty. Residents, their architect, and their environmental consultants clearly identified visible dust layers on horizontal surfaces on the galvanized steel wall framing system and ceiling support system. These surfaces were easily accessible, because as stated earlier, EPA/NYCDEP had removed the ceiling and one side of the walls for the purpose of making them accessible.

Some of these exposed, accessible wall and ceiling framing and support surfaces with visible dust were tested. The residents' consultant demonstrated high levels of asbestos, an indication that that visible dust remained. The locations where these visible dust layers were tested were described as wall, ceiling and floor tracking, an area on the exposed column beneath a light switch, an exposed ceiling I-beam, an area on the floor in the center of a column, and a pipe shaft, all had visible dust.

Resident testing was demonstration of failure to remove visible dust

The surfaces tested by the residents at 114 Liberty showed elevated levels of asbestos, most from 10,000 to over 1 million structures per square centimeter (s/cm^2). These laboratory results demonstrate the presence of significant dust after the two abatements by EPA/NYCDEP.

Newly abated hard surfaces typically show no detectable asbestos, or extremely low levels. Surfaces were also tested after the same EPA/NYCDEP contractors abated 110 Liberty St., a few feet away from 114 Liberty St., and almost as severely impacted by WTC dust. The EPA 110 Liberty cleaning study[5] showed that smooth surfaces only had asbestos in the thousands of structures per square centimeter (1000 to around 5000 s/cm^2) after only one cleaning. Since most of the units at 110 Liberty had to be re-cleaned from two up to four times, the concentrations of asbestos on surfaces would have been even lower with each successive cleaning. (EPA did not provide data on the surface levels of asbestos after the additional cleanings in its report).

EPA/NYCDEP stated in their 8/4/03 letter to FEMA that wipe and microvacuum testing of surfaces after abatement served the purpose of demonstrating abatement effectiveness:

> EPA's use of surface wipe and microvacuum sampling at its WTC Residential Confirmation Cleaning Study site (110 Liberty) was intended to provide a measure of cleaning effectiveness, and not a risk-based health assessment.

Thus, EPA must accept the residents' testing as a sufficient demonstration that the EPA/NYCDEP abatement was not effective at 114 Liberty St.

EPA erroneously dismissed tenant testing as representing inaccessible areas; cleanup of HVAC systems required by the EPA contract specifications

EPA/NYCDEP's 8/4/03 letter to FEMA dismissed the testing submitted by the residents with a the false claim that areas tested were inaccessible, and that any asbestos found in these inaccessible areas came from asbestos containing building materials already present in 114 Liberty before the collapse of the WTC:

> [I]t appears many samples were collected from inaccessible areas below the hardwood flooring, or from areas of unknown accessibility such as, wall tracking, pipe shafts, and I-beams. The scope of the work developed for the clean up activities was designed for the removal of debris from the collapse of the World Trade Center and did not include the removal or remediation of pre-existing building materials.
> …
> Asbestos containing materials (ACMs), such as floor tiles, were observed during DEP's cleaning of the building. Some of the ACMs may be present under the hardwood flooring, thus samples collected from this location may be more representative of the building materials contained within the building rather than indicating contamination from other sources. Additionally, DEP noted and reported the presence of thermal system insulation and damaged asbestos-containing fireproofing within the building.

Clearly EPA made no attempt to determine the accessibility of the areas tested by the residents before dismissing them as being from previously existing asbestos containing building materials. A simple inquiry to the on-scene coordinator would have revealed this fact. The areas with high dust accumulations were inside the exposed ventilation and air conditioning system, which was exposed and made accessible by EPA/NYCDEP for the express purpose of abatement.

Prior to the clean-up, EPA/NYCDEP agreed to remove the suspended drywall ceilings and one side of the walls to gain accessibility to the ventilation and AC system. As stated earlier, the system used an open return through the ceiling plenum above a suspended drywall ceiling, which was open to the wall spaces. Opening the ceiling and one side of each wall was the only way to make the system accessible for cleaning. These spaces were intentionally made accessible.

The EPA contractual Statement of Work[6] requires that the whole of any impacted HVAC system be cleaned, as follows:

> Cleaning of HVAC Systems
> HVAC systems that are determined by the Monitoring Contractor to be impacted by dust or debris from the collapse of the World Trade Center will be cleaned in accordance with the site-specific scope of work prepared by the Monitoring Contractor and approved by

> EPA. HVAC systems cleaning, if warranted, shall be completed prior to the initiation of the cleaning of common space or residences within an affected building. In the event that the HVAC system for an entire building requires cleaning, a separate, site specific contract will be awarded by DEP for this work. If only a portion of an HVAC system requires cleaning, then the cleaning contractor will conduct the cleaning utilizing specialized labor trained and experienced in duct cleaning.
>
> HVAC cleaning shall be conducted in accordance with National Air Duct Cleaners Association (NADCA) General Specification for the Cleaning of Commercial Heating, Ventilating and Air Conditioning Systems and the NADCA Assessment, Cleaning and Restoration Standard (ACR 2002). Verification of the effectiveness of HVAC system cleaning will be determined by the Monitoring Contractor. If dust or other contaminants are evident through visual inspection, those portions of the system where dust or other contaminants are present shall be recleaned and subjected to reinspection for cleanliness. If the cleaning contractor is not a member of the NADCA, a subcontractor that is a member may perform this portion of the work.

EPA erroneously attributed the high asbestos levels to pre-existing asbestos materials

EPA also tried to attribute the high asbestos levels found by the residents as being from previously installed asbestos containing building materials. This is also untrue. An easy inquiry on the part of EPA would have revealed that this could not be the case.

There were no other asbestos-containing materials in the upper condominium floors of the building, except for floor tiles which were sealed beneath paper, and then covered over with either wood flooring or stone or ceramic in 1998. In addition to the visible dust on the wall and ceiling supports, the asbestos-laden dust tested by the residents was clearly visible as lines of dust in and on top of the paper directly under the cracks of the floorboards. It is absurd to postulate that the dust came from the floor tiles, which were under a layer of paper under the wood. It would need to have migrated upwards through the paper and arrange itself into discrete lines aligned with the cracks in the floor boards.

It should be noted that EPA/NYCDEP refused to remove floorboards to clean dust that sifted through the cracks. The residents had requested this, because they could see the WTC dust in the cracks of the floor boards.

The only other asbestos in the building was from the first floor pizzeria, where the asbestos could not have migrated to upper floors. EPA/NYCDEP themselves demonstrated that the asbestos from the pizzeria was a completely different type of asbestos (amosite) than that found by the residents in the upper floor condominium (chrysotile, which is associated with the WTC).

Nearby building must be demolished because of similar penetration of WTC dust

Another building a few feet away, the Deutsche Bank Building at 130 Liberty St., also has WTC dust contamination "in every crack and crevice." They tried usual asbestos and other toxic abatement procedures, but these procedures failed. Demolition of the building is planned

because cleaning of the enclosed spaces behind walls and above ceilings would cost more than rebuilding. The following press stories describe the situation:[7, 8]

> The bank says in court papers that the building is too badly contaminated with toxic materials like asbestos and mercury to ever be reoccupied
> …
> But Deutsche Bank has said that the main reason the building could not be reoccupied was because of contamination from dust spiked with asbestos and other contaminants. It wrote in its claim that the building was subject to tornado-force winds, earthquake-like shaking and pressure waves that forced dust into "every crack and crevice" in the building.

> The bank has taken tens of thousands of samples from the building and told insurers that it is too contaminated to reoccupy.
> …
> The bank stated in a lawsuit filed in state Supreme Court in Manhattan that tornado-force winds from the fallen 110- story towers distributed asbestos and other contaminants throughout the building, making it impossible to safely repair.

EPA claimed resident's testing irrelevant to health risks

Although acknowledging that dust testing was useful in determining abatement effectiveness, EPA/NYCDEP dismissed the residents' asbestos dust testing as being irrelevant to showing that there were any risks from, or hazards associated with the high levels of asbestos in the dust after the cleanings at 114 Liberty. Their 8/4/03 joint letter stated:

> Based on the results that were received [*from the residents at 114 Liberty*], it appears that eleven wipe samples and sixteen microvacuum samples were collected by Ambient Group Inc. and analyzed by EMSL Analytical Inc. for asbestos.
> …
> The interpretation of these results is constrained by the scientific uncertainty regarding the potential for the measured concentrations in settled dust to become airborne. There are no standards currently available for assessing potential health consequences from asbestos through the evaluation of wipe or microvacuum samples. … EPA's use of surface wipe and microvacuum sampling at its WTC Residential Confirmation Cleaning Study site (110 Liberty St.) was intended to provide a measure of the cleaning effectiveness, and not a risk-based health assessment.

EPA Region 2 used dust testing as the sole basis for determining there was an asbestos risk in need of professional abatement at their own 290 Broadway building in Manhattan

The claim by EPA Region 2 that settled dust testing cannot be related to risks, and that only air testing is valid to project health effects from asbestos, is directly contradicted by their own actions in the wake of 9/11.

On 9/14/01, EPA Region 2 evacuated its office building at 290 Broadway in lower Manhattan because it found traces of asbestos in settled dust. The tests were only qualitative – EPA had no idea how concentrated the asbestos was. EPA only knew there was asbestos at some undetermined level. For all EPA knew, it could have been at levels lower than background. The thickness of the dust was so small that there was not enough for testing actual concentrations.

But this was enough to set off a panic by EPA Region 2 to evacuate its building for two weeks for professional abatement. EPA also bought respirators for its own employees.

What is relevant is the fact that all the many, many air tests at 290 Broadway from September through December showed no asbestos at all above the detection limit, with one exception: In one TEM air test, the level was 25 structures per square millimeter (25 s/mm^2), right at the detection limit, and far below what EPA was telling the public was safe (70 s/mm^2). In press statements at the time, EPA clearly stated that the air concentrations at its building at 290 Broadway were safe. However, EPA Region 2 was silent to the press about the fact that it had found asbestos in settled dust at 290 Broadway.

It is a double standard for EPA to now claim that the dust testing at 114 Liberty St. by the residents is irrelevant to risks. The risk from settled dust may not be accurately quantifiable to exact risk levels, but it does clearly represent a risk. EPA policy and government statutes state that any exposure to asbestos is unsafe.

The EPA IG report also noted EPA's unusual abatement procedures at its 290 Broadway building:[9]

> EPA's Region 2 office, about a half-mile from the WTC site, was evacuated and not re-opened until 2 weeks after the attacks. … On September 13, 2001, EPA tested for asbestos in its building located at 290 Broadway.

See Section N of my 7/4/03 report for a complete description of the testing, evacuation, professional abatement, and press statements about EPA's Region 2 offices at 290 Broadway.[10] Note that Appendix K of the 8/21/03 EPA IG report contains incorrect information about the 290 Broadway air test results, incorrectly stating that elevated asbestos levels were found in some air tests. See the references for a detailed explanation.[11]

EPA Inspector General believes EPA should consider settled dust levels for risk assessment

The EPA Inspector General (IG) also does not agree with EPA that settled dust test levels should be ignored, and recommended that EPA develop a standard to establish risk levels for settled dust tests:[12]

> We believe EPA should … develop health-related screening levels for asbestos in dust K-factors

For the reasons given above, EPA should acknowledge the fact that the elevated levels of asbestos found by the residents at 114 Liberty St. represents a health risk, although of uncertain exact numerical magnitude, as it demonstrates that asbestos is above background levels.

EPA/NYCDEP air sampling may not have been aggressive

EPA/NYCDEP claimed in their 8/4/03 letter to FEMA that aggressive air testing was performed at 114 Liberty St.:

> Primarily, risk from asbestos is directly related to its concentration in air. Consequently, post-cleaning aggressive (i.e., use of a leaf blower and fans) air sampling was conducted at 114 Liberty St. by DEP's contractors to insure that asbestos levels in air met regulatory-based and risk-based clearance criteria.

The EPA contractual Statement of Work[13] requires the following procedures for aggressive air sampling, namely directing a one-horsepower leaf blower at all surfaces:

> Before beginning aggressive air sampling, a 1 horsepower electric leaf blower shall be used to direct exhaust air against walls, ceilings, floors and other surfaces. This shall continue for at least five minutes per 1,000 square feet of floor. When directing the exhaust, caution shall be taken to minimize disturbance and potential damage to furnishings and personal belongings
> …
> At least one 20-inch fan shall be placed in the center of each room sampled. One fan per 10,000 cubic feet of room space shall be used. The fans shall be operated on slow speed and pointed toward the ceiling. The fans shall run for at least 15 minutes prior to the start of sampling. The fans shall operate continuously throughout sampling and shall not be turned off until sampling is completed.

Because there were still pockets of visible dust in the exposed steel framing of the walls and ceiling supports after the EPA/NYCDEP contractors allegedly conducted the aggressive sampling, it is highly unlikely that aggressive air sampling was actually performed. The visible pockets of dust would not have remained if a leaf blower actually had been directed at these surfaces.

EPA ignored silica over benchmarks after two abatements

In their 8/4/03 letter to FEMA, EPA/NYCDEP claimed that all levels of tested contaminants at 114 Liberty St. were below health benchmarks:

> Sampling was done for the contaminants of potential concern following EPA protocols established specifically for EPA's WTC Residential Confirmation Cleaning Study. The analytical results were compared to health-based benchmarks established by EPA's Interagency Indoor Air Task Force. The contaminants of potential concern included: asbestos, lead, dioxin, PAHs (Poly Aromatic Hydrocarbons), fibrous glass and crystalline silica.

For silica, the levels EPA/NYCDEP found were much higher than their own health benchmarks, and as discussed later, even higher than the NIOSH benchmark for healthy male workers. EPA excused these levels on the false claim that they were within background levels, albeit unsafe background levels. EPA stated the following in its 4/18/03 report of testing at 114 Liberty, admitting the levels did not meet health benchmarks:

> The secondary clearance level for crystalline silica was met in 64% of the areas tested; however the remaining areas were similar to background values observed from a USEPA background study. Since all of the primary clearance values have been met, the building can be released back to the owner. [*from cover letter*]
> …
> Silica – Eleven air samples were collected and analyzed for crystalline silica at a detection limit of 11 µg/m^3. Seven samples were below the detection limit and four samples were above the detection limit, with values of 17.3, 19.6, 22.1, and 22.1 µg/m^3. The numeric criterion that USEPA has proposed in the COPC document, which was adopted as a secondary clearance value for this project, is 1 µg/m^3. Although the value chosen for this project was 1 µg/m^3, the analytical detection limit available for analyzing crystalline silica in indoor air samples is higher than this value, therefore a result that is below the detection limit is considered to be protective of public health. Four out of eleven samples (36%) were above the detection limit of 11 µg/m^3, ranging from 17.2 to 22.1 µg/m^3. These values are also above the secondary clearance value.
>
> Although these values are above the clearance value, they are similar to concentrations detected in a background study conducted by USEPA. In the US EPA background study, there was a frequency of detection of 25%, with a range of 4 to 259 µg/m^3. Further, the values from the background study without the maximum value of 259 µg/m^3, provide a range of 4 to 28 µg/m^3. This indicates that the range of values observed in 114 Liberty Street are similar to those observed in the background study. Based on this, it has been determined that the crystalline silica results are similar to background values and therefore additional cleaning is not necessary.

Unfortunately, at 114 Liberty, the silica test method detection limit of 11 µg/m^3 was much higher than the health-based benchmark set by EPA (1 µg/m^3), and also higher than detection limits in tests EPA used in other affected residences and it its background study of midtown Manhattan (detection limit of 4 µg/m^3).

Furthermore, the detection limit was even lower for EPA's cleaning study at EPA's 110 Liberty St cleaning study.[14] The detection limit was 0.007 µg/m^3, and silica was quantifiable at 0.008 µg/m^3. Undoubtedly, the detection limits were very low at 110 Liberty St. because the building had undergone several rigorous abatements by EPA/NYCDEP.[15]

It could well be that EPA/NYCDEP used much better cleaning methods at 110 Liberty St. than it did at 114 Liberty St. This is because the detection limit for silica is related to the "dirtiness" of the sample, or sample overload. If EPA had conducted a thorough enough cleaning at 114 Liberty, this overloading problem would not have occurred, and the silica detection limits would have been lower.

EPA was obligated to address any analytical problems when it could not detect silica at the levels of concern by additional abatement, just as it does when the filters are overloaded after asbestos tests.

NIOSH silica standards also exceeded after EPA cleanings

EPA has never addressed silica benchmarks prior to 9/11. After the WTC, EPA evaluated the supporting documents for the recommended occupational exposure limit for silica developed by the National Institute for Occupational Safety and Health (NIOSH). EPA concluded there should be an added a margin of safety over the NIOSH standard to protect against the longer exposure periods and the exposures of more vulnerable populations such as children:[16]

> Developing Benchmark Levels Based on Occupational Health Standards
> For contaminants that lacked environmental toxicity criteria from sources listed in Section 3.2, occupational standards served as the starting point for benchmark development. Additional safety factors were added to account for higher exposure and greater sensitivity within the general population. The health-based benchmarks for fibrous glass and crystalline silica in indoor air were developed in this manner.
> …
> Silica. No threshold has been established and it is possible health effects occur below the NIOSH REL of 50 µg/m^3 .

This NIOSH Recommended Exposure Limit (REL) of 50 µg/m^3 assumes a limited workplace exposure time of only 40 hours per week, with no significant exposures during non-working hours. It also assumes workers do not remain employed in silica-contaminated industries for the whole of their lifetime. If the same NIOSH standard of 50 µg/m^3 were averaged out for the entire week, the standard would be 12 µg/m^3. [17]

At 114 Liberty, the detection limit was 11 µg/m^3. This level is essentially the same as the NIOSH standard of 12 µg/m^3 for a whole-week exposure. Thus, even when EPA could not detect silica at 114 Liberty, it could not say that the level was below the NIOSH standard designed for healthy adults, much less EPA's desired health benchmark of 1 µg/m^3.

This EPA standard of 1 µg/m^3 does not take into account the carcinogenicity of silica. As discussed later, the old 1974 NIOSH standard of 50 µg/m^3 was developed long before it was established that silica was a known human carcinogen, causing lung cancer. NIOSH itself is now saying that its old standard of 50 µg/m^3 may not even protect against silicosis, not even addressing the carcinogenicity issue.

Most importantly, for 4 of the 11 tests at 114 Liberty, silica levels were found to be 17.2, 19.6, 22.1, and 22.1 µg/m^3. These levels are nearly two times the NIOSH week-long standard of 12 µg/m^3. Levels this high at 114 Liberty are clearly dangerous.

EPA incorrectly compared silica levels with their background study

EPA's 4/18/03 report and cover letter to the residents excused the high silica levels found at 114 Liberty St. by claiming they were similar to its background study:[18]

> The secondary clearance level for crystalline silica was met in 64% of the areas tested; however the remaining areas were similar to background values observed from a USEPA background study.
> …
> Silica – Eleven air samples were collected and analyzed for crystalline silica at a detection limit of 11 µg/m^3. Seven samples were below the detection limit and four samples were above the detection limit, with values of 17.3, 19.6, 22.1, and 22.1 µg/m^3. ... Four out of eleven samples (36%) were above the detection limit of 11 µg/m^3, ranging from 17.2 to 22.1 µg/m^3. These values are also above the secondary clearance value.
>
> Although these values are above the clearance value, they are similar to concentration detected in a background study conducted by USEPA. In the USEPA background study, there was a frequency of detection of 25%, with a range of 4 to 259 µg/m^3. Further, the values from the background study without the maximum value of 259 µg/m3, provide a range of 4 to 28 µg/m^3. This indicates that the range of values observed in 114 Liberty Street are similar to those observed in the background study. Based on this, it has been determined that the crystalline silica results are similar to background values and therefore additional cleaning is not necessary.

This comparison by EPA is irresponsible. Comparing the ranges of values is irrelevant. Looking at the distribution of values within the range, however, does provide a valid mechanism for comparison. The following is the more accurate way to compare the silica levels found by EPA at 114 Liberty with the EPA background study:

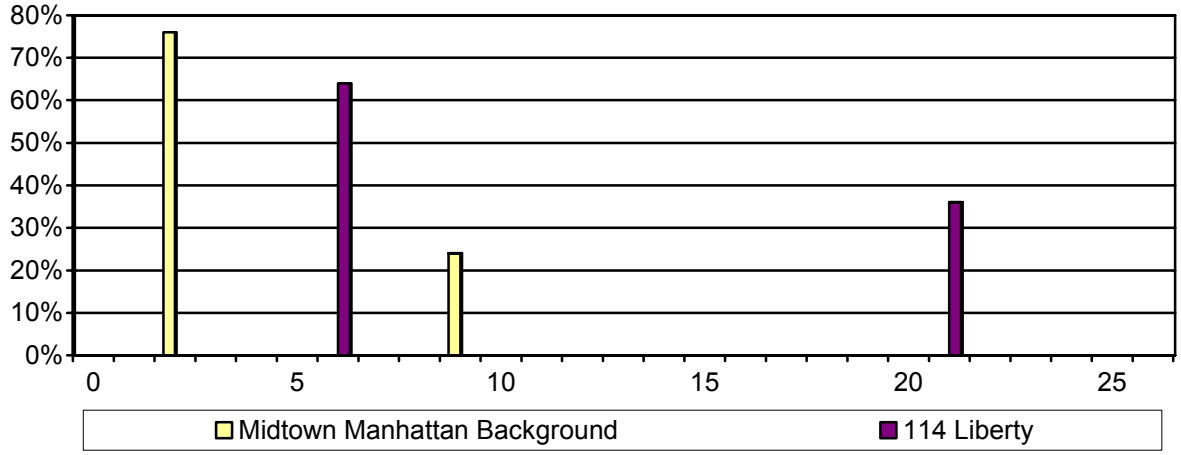
The average (arithmetic mean) concentration for silica in air at 114 Liberty was 11 µg/m^3, which is 3 times the average level of 3.6 µg/m^3 found in the EPA background study. (The reason the 114 Liberty average concentration is right at the detection limit is because EPA always assumes that the actual value is only ½ of the detection limit for the "non-detect" samples. The average is thus the average of 7 values of 5.5 µg/m^3 (1/2 the detection limit of 11 µg/m^3) and 4 values at 17.3, 19.6, 22.1, and 22.1 µg/m^3. See the references for an explanation of the calculations.[19])

Furthermore, the majority (76%) of the samples in EPA's background study were below 4 µg/m^3, which was the detection limit for the background study. However, only 64% of the samples at 114 Liberty were below a much higher detection limit of 11 µg/m^3.

The table below provides the relevant levels found at 114 Liberty and in EPA's background study: All the averages (arithmetic means) are calculated using the assumption in the EPA background study as well as EPA's other WTC risk assessments that the actual value for any "non-detect" samples is ½ of the detection limit.[20]

	114 Liberty St.		**EPA background study of lower Manhattan**	
AVERAGE FOR ALL SAMPLES (both detects and non-detects)	11 samples 100%	**11 µg/m^3**	45 samples 100%	**3.6 µg/m^3** High outlier of 259 µg/m^3 omitted, as per EPA choice to omit this value
AVERAGE FOR NON-DETECTS	7 samples 64%	**5.5 µg/m^3** (arithmetic mean of ½ the detection limit of 11 µg/m^3)	34 samples 76%	**2 µg/m^3** (arithmetic mean of ½ the detection limit of 4 µg/m^3)
AVERAGE FOR SAMPLES WHERE SILICA WAS DETECTED	4 samples 36%	**20.85 µg/m^3** (arithmetic mean of 17.2, 19.6, 22.1, 22.1)	11 samples 24%	**8.7 µg/m^3** High outlier of 259 µg/m^3 omitted, as per EPA assumption

The chart below shows graphically the very marked difference in the distribution between the silica concentrations found at the 114 Liberty building after the EPA cleaning and the EPA background study. Two levels are given for both the 114 Liberty address, and also for the EPA background study. The first value is ½ the detection limit in air, coupled with the percentage of samples with levels below the detection limit. The second value is the average air concentration for those samples where silica was detected, coupled with the percentage of these samples. As can be seen, there is no similarity or significant overlap in the distributions whatsoever.



<u>EPA cannot revoke its silica criterion at 114 Liberty based on false contention that background levels in NYC are already at unsafe levels</u>

Even if silica background levels in midtown Manhattan are in fact above benchmarks, EPA cannot excuse similar high levels at 114 Liberty and claim that it has no responsibility for abating it. If EPA has in fact identified silica health risks in other NYC residences not impacted

by the WTC collapse, then EPA should address these problems through either the CERCLA or other statutes.

As discussed in my 7/4/03 report,[21] the EPA background study itself of midtown Manhattan is invalid for several reasons. First, the buildings were not selected at random. EPA staff actually knocked on doors of their own choosing to solicit participation in the study, and EPA has a history of biasing of data Second, the data itself has no statistical significance – there is too high a variability to permit any conclusions about actual background levels in midtown Manhattan.

EPA Misrepresentation of silica health effects – a carcinogen

EPA has been misrepresenting the health effects of silica in its documents related to the World Trade Center. EPA has carefully avoided any reference to the fact that it is a known human carcinogen and is linked to some auto-immune diseases, as well as causing silicosis and chronic bronchitis.

EPA's statements about silica are given below, followed by the evaluations of the health effects of silica by NIOSH and the National Toxicology Program (NTP):

EPA's statements about the health effects of silica after the WTC disaster

The only information that EPA provided on the health effects of silica in WTC-related documents is in its Contaminants of Potential Concern.[22] In this document, EPA acknowledges that asbestos and other WTC contaminants will cause cancer, but EPA says nothing whatsoever about lung cancer from silica. EPA only mentions that silica will cause "point of contact toxicity" in the lung:

> Target organs and critical effects resulting from ingestion and dermal exposures generally differ across individual COPC, though lead, dioxins, and PAHs are all considered potential human carcinogens via the ingestion route. Each of these contaminants can affect a wide range of biological systems, but each generally exerts its effects via different mechanisms.
>
> At high concentrations, inhalation exposure to several of the COPC (asbestos, PAHs, fibrous glass, and crystalline silica), as well as the small particulate matter released during the WTC disaster, has been shown to result in point of contact toxicity to the lung. Specific lung effects vary across these substances, ranging from acute irritant effects produced by fibrous glass to cancers of the lung associated with asbestos.

Furthermore, EPA's October, 2002 draft risk assessment for the WTC disaster is totally silent about the health effects of silica.[23] In marked contrast, this same October, 2002 draft risk assessment provides considerable detail on the carcinogenicity of other WTC toxic constituents, such as asbestos. From this absence of any health information on silica, the reader is given the distinct impression that crystalline silica is neither a carcinogen nor a substance that will cause other long term permanent health effects.

EPA's Contaminants of Potential Concern[24] document for the WTC does refer to the NIOSH Recommended Exposure Limit (REL) for silica of 50 µg/m^3. However, it must be emphasized that NIOSH set this level of 50 µg/m^3 in 1974, long before silica was proven to be a human carcinogen. Thus, this NIOSH level does not take into account the carcinogenic effects of silica. It is probable that silica exerts additive, if not synergistic carcinogenic effects by similar biological mechanisms in the lung with asbestos.

NIOSH determination of health effects of silica, including cancer

NIOSH includes silica on its Carcinogen List.[25] NIOSH states the following about the carcinogenic potential of silica as well as its links to auto-immune diseases: [26]

> Silicosis, an irreversible but preventable disease, is the illness most closely associated with occupational exposure to the material, which also is known as silica dust. Recent data indicate that a risk of silicosis, over a working lifetime, may occur even at the current NIOSH recommended exposure limit. Some studies also have linked respirable crystalline silica with risks for lung cancer and some auto-immune diseases.
> …
> Available sampling and analytical methods are not accurate enough to quantify exposures below NIOSH's recommended exposure limit of 0.05 milligrams [*same as 50 µg/m^3*] of respirable crystalline silica per cubic meter of air. As a result, scientists currently lack the tools to determine, with confidence, what levels of exposure below 0.05 mg/m^3 may or may not pose a health risk.
> …
> Findings from numerous recent studies support NIOSH's longstanding policy that respirable crystalline silica should be considered a potential occupational carcinogen.

NIOSH describes the permanent, irreversible lung scarring condition called silicosis as follows:[27]

> Silicosis, a nodular pulmonary fibrosis caused by inhalation and pulmonary deposition of particles of free silica has also been known as dust consumption, ganister disease, grinders' asthma, grinders' consumption, grinders' rot, grit consumption, masons' disease, miners' asthma, miners' phthisis, potters' rot, rock tuberculosis, stonehewers' phthisis, and stonemasons' disease.
> …
> The first account of the pathology of what is now called silicosis came in 1672 from van Diemerbroeck who described how several stone cutters died of asthma. At necropsy he found that to cut their lungs was like cutting a mass of sand. Ramazini (1713) describes how stone cutters breathe in small splinters and turn asthmatic and consumptive.
> …
> The clinical signs of silicosis are not unique. Symptoms may be progressive with continued exposure to quantities of dust containing free silica, with advancing age, and with continued smoking habits. Symptoms may also be exacerbated by pulmonary infections and cardiac decompensation.
>
> Pulmonary symptomatology usually begins insidiously. Symptoms include presence of cough, dyspnea, wheezes, and repeated nonspecific chest illnesses. Impairment of pulmonary function may be progressive.
> …

> Other factors, chemical or biological, can influence the rate of reaction of the free silica with the tissue and can create problems in diagnosis. One of the most frequent complications in the past was the occurrence of tuberculosis with silicosis, in which case the disease was called silicotuberculosis or tuberculosilicosis.
> …
> Another common finding around the nodule is perifocal emphysema, *i.e.*, destruction of alveolar walls with a concomitant increase in the sizes of alveolar sacs and ducts. These pathologic features decrease the blood flow and ventilation in the lung.

NIOSH stated the following about chronic bronchitis and silica in its 2002 Hazard Review, noting similar effects on lung function between silica, asbestos, and other dusts. This NIOSH document provides information on the other health effects as well:[28]

> Chronic bronchitis is clinically defined as the occurrence of chronic or recurrent bronchial hypersecretion (i.e., a productive cough) on most days of the week for at least 3 months of 2 sequential years … An association between reduced ventilatory function and bronchitic symptoms has been reported in studies of workers exposed to coal dust, asbestos, or dust that contained crystalline silica.

NTP evaluation of silica health effects

The National Toxicology Program (NTP) of the US Public Health Service, Department of Health and Human Services, classifies crystalline silica as a known human carcinogen.[29] The NTP 2002 10th Report on Carcinogens states the following:

> Silicosis, a marker for exposure to silica dust, is associated with elevated lung cancer rates, with relative risks of 2.0 to 4.0. Elevated risks have been seen in studies that accounted for smoking or asbestos exposure, and confounding is unlikely to explain these results (IARC *[International Agency for Research on Cancer]* 1997).
> …
> RCS *[respirable crystalline silica]* deposited in the lungs causes epithelial injury and macrophage activation, leading to inflammatory responses and cell proliferation of the epithelial and interstitial cells. In humans, RCS persists in the lungs, culminating in the development of chronic silicosis, emphysema, obstructive airway disease, and lymph node fibrosis. RCS stimulates (1) release of cytokines and growth factors from macrophages and epithelial cells; (2) release of reactive oxygen and nitrogen intermediates; and (3) oxidative stress in lungs. All these pathways contribute to lung disease. Marked and persistent inflammation, specifically inflammatory cell-derived oxidants, may provide a mechanism by which RCS exposure can result in genotoxic effects in the lung parenchyma.

Conclusions

It appears that the EPA/NYCDEP contractors responsible for the clean-up at 114 Liberty were on a tight schedule, which took precedent over performing the abatement to specifications. The exposed structural supports in the exposed walls and ceilings would have required the use of nozzles attached to HEPA vacuums and wet wiping of small area surfaces. This detail work

would had consumed much more time than cleaning large flat surfaces like floors and walls. The contractors also may have violated the sampling protocols themselves (not using-aggressive sampling, and/or not pulling the specified volume of air during sampling) so as to bias the laboratory test results.

It also appears that EPA does not want the trouble and added expense that would be entailed by additional abatements at 114 Liberty, even to the extent of misrepresenting test results in its reports and statements to FEMA. This was done even to the extent of knowingly exposing residents at 114 Liberty Street to silica, a human carcinogen, at levels higher than EPA's criterion and the NIOSH benchmark as well. This was also done at the expense of dismissing resident testing of dusts for asbestos which proved that visible dust accumulations were still present, and at higher asbestos concentrations than background.

EPA has also been misrepresenting the health effects of silica in all its WTC-related documents, concealing the fact that it is a federally recognized human carcinogen, and that it causes chronic conditions similar to those being reported as "WTC cough."

Sincerely,

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cc: Board of Directors, 114 Liberty St. Condominiums

References

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[1] Jenkins, C. (July 4, 2003) Comments on the EPA Office of Inspector General's 1/27/03 interim report titled: "EPA's Response to the World Trade Center Towers Collapse" A DOCUMENTARY BASIS FOR LITIGATION, prepared by Cate Jenkins, Ph.D., Environmental Scientist, Waste Identification Branch, Hazardous Waste Identification, Office of Solid Waste Office of Solid Waste and Emergency Response, EPA. Available from author at Jenkins.cate@epa.gov or posted at the following web addresses:

http://www.nyenvirolaw.org/PDF/Jenkins-7-4-03-documentary-d2.pdf
http://nycosh.org/Jenkins-7-4-03-documentary-d.pdf

[2] US EPA (May, 2003) Interim Final WTC Residential Confirmation Residential Confirmation Cleaning Study Cleaning Study, Volume 1, U.S Environmental Protection Agency, Region 2 U.S Environmental Protection Agency, Region 2 New York City Response and Recovery New York City Response and Recovery Operations. http://epa.gov/wtc/interim_wtc_residental_study2.pdf .

[3] Jenkins, C. (December 19, 2001) Wipe sampling for asbestos in Lower Manhattan. Projection of airborne levels from settled WTC dusts. Estimation of increased cancer risks based on various WTC dust exposure scenarios. Memorandum from Cate Jenkins, Ph.D., Waste Identification Branch, Hazardous Waste Identification Division, to Affected Parties and Responsible Officials. www.nyenvirolaw.org/nyeljp-jenkins.htm -- or -- www.911digitalarchive.org/collections/reports

[4] US EPA (undated) World Trade Center Indoor Dust Cleaning Program
Cleaning Contract Scope of Work, http://www.epa.gov/wtc/factsheets/cleaning_sow.pdf

[5] EPA (May, 2003) Final WTC Residential Confirmation Residential Confirmation Cleaning Study Cleaning Study, *op. cit.*

[6] US EPA (undated) World Trade Center Indoor Dust Cleaning Program
Cleaning Contract Scope of Work, http://www.epa.gov/wtc/factsheets/cleaning_sow.pdf

[7] NY Times (August 9, 2003) Insurers Block Plans to Raze Deutsche Bank

[8] MICHAEL SLACKMAN, NY Times (August 12, 2003) Bank Sues to Force Insurers to Declare Tower 9/11 Loss.

[9] US EPA (August 21, 2003) Evaluation Report. EPA's Response to the World Trade Center Collapse: Challenges, Successes, and Areas for Improvement Report No. 2003-P-00012. See pp. 3 and 24. www.epa.gov/oig/ereading_room/WTC_report_20030821.pdf

[10] Jenkins, C. (July 4, 2003) Comments on the EPA Office of Inspector General's 1/27/03 interim report titled: "EPA's Response to the World Trade Center Towers Collapse" A DOCUMENTARY BASIS FOR LITIGATION, *op. cit*.

[11] US EPA (August 21, 2003) Evaluation Report. EPA's Response to the World Trade Center Collapse: Challenges, Successes, and Areas for Improvement Report No. 2003-P-00012. www.epa.gov/oig/ereading_room/WTC_report_20030821.pdf

See IG report, Appendix K, page 93, Table K-1.

The first error in this table is the claim that the results are for TEM analyses converted to PCM equivalents. This is untrue. Both direct PCM light microscope tests of the air were performed as well as TEM electron microscope tests

on 9/13/01. The TEM test results are given on page 96 of Appendix K of the IG report. The results given in Table K-1 are not related to TEM testing, and are perhaps instead direct PCM tests, not TEM tests converted to PCM equivalents.

The second, and most important error, is the incorrect data in Table K-1 showing that some air levels at 290 Broadway on 9/13/01 were above safety levels. The levels from Table K-1 were as follows:

Table K-1 of IG report, p. 93. Incorrectly labeled by IG as being TEM analyses converted to PCM equivalents		Date: 9/13/01
Units of fibers per cubic centimeter (f/cc) PCM equivalents from TEM analysis	Sample location	Sample ID
0.0042	290 Broadway (8th floor)	27490
less than 0.0043	290 Broadway (Lobby)	27491
less than 0.0041	290 Broadway (22nd floor N.)	27492
0.004	290 Broadway (22nd floor S.)	27493
0.013	290 Broadway (LL-1)	27494
0.0044	290 Broadway (LL-2)	27495

These values in the IG table are completely fictitious and false. I have the actual laboratory sheets from SciLabs as well as the report for all the sampling at 290 Broadway and field logs from the industrial hygiene firm Stratus Corp., who performed the analyses and took samples on behalf of the GSA. NY Enviro Law, S&B (formerly of Stratus), and SciLabs also have copies of the same data and can quickly confirm its authenticity.

The actual direct PCM analyses which should have been given in Table K-1 of the IG report showed no asbestos detected whatsoever for 11 out of 12 samples at 290 Broadway. The detection limit for these direct PCM analyses were all 0.001 f/cc, which means that the levels were all below 0.001 f/cc. For one sample, there was 0.001 f/cc, which does not exceed the NYC guidelines.

The actual TEM analyses for 3 air samples taken on 9/13/01 at 290 Broadway also showed no asbestos detected, with a detection limit of 0.0039 s/cc. Note that TEM air analyses will always show larger concentrations of asbestos fibers than PCM (or PCM equivalent) measurements, since TEM includes not only the larger asbestos fibers, but also those which are smaller and believed by EPA to have no carcinogenic risk.

EPA Region 2 has a history of falsifying claims about the test methods as well as the results for its building at 290 Broadway. A letter dated 2/22/02 from Administrator Whitman to Congressman Nadler claims that no TEM testing of dust was ever performed at 290 Broadway, claiming that only PLM testing was performed, which is false. This was an attempt by Region 2 to obfuscate the fact that more sophisticated testing was available for the Region 2 building than offered to the general public in Manhattan after the WTC. This falsification by Region 2 which was incorporated into Whitman's 2/22/02 letter (excerpted in my 3/11/02 memorandum) is given below. Note that Region 2 was giving yet another false value for the air measurements than is given in Table K-1 of the IG report, but this time the level was only as high as 0.0133 f/cc

> EPA did not set a more stringent standard of cleanup for these federal buildings, and the lobby cleanup was consistent with the New York City Department of Health advisory. … As outlined in the enclosure, EPA collected seven air samples at 26 Federal Plaza and six air samples at 290 Broadway, and found results below levels of concern.
> …
> 290 Broadway: Six air samples were collected at the 290 Broadway (8th, 22th, LL-1, LL-2 and Lobby). The asbestos concentrations ranged from non-detect to 0.0133 fibers/cc (LL-1).
> …
> Methodology.
> Air samples were analyzed by TEM EPA 40CFR763 AHERA.
> Dust samples were analyzed by PLM – EPA-600 R-93/116.

See Section L of my 7/4/03 report which discusses the fact that EPA Region 2 refused free TEM testing resources for dust for the rest of Manhattan from Region 8 on 9/12/01, telling them: "We don't want you fucking cowboys here. The best thing they could do is reassign you to Alaska."

It is very important for EPA Region 2 to cover up what happened at their own building after the WTC. Everybody knows that they evacuated even though they were claiming at the same time that this distance was far from Ground Zero and unaffected, telling the public there was no hazard nearer Ground Zero.

This is one of the most shameful, cowardly responses by EPA to 9/11. It is obvious that Region 2 is trying to avoid an adverse finding by the EPA IG about its sampling and abatement activities at 290 Broadway, even to the extent of falsifying the air monitoring data for its own building. If they can convince the IG that the air levels showed hazardous asbestos levels, then they can justify the unusual evacuation and abatement at 290 Broadway. In actuality, the only data indicating a hazard was settled dust levels. Section N of my 7/4/03 report to the EPA IG brought charges of bias and preferential treatment by EPA Region 2 on its own behalf in this regard.

[12] US EPA (August 21, 2003) Evaluation Report. EPA's Response to the World Trade Center Collapse: Challenges, Successes, and Areas for Improvement Report No. 2003-P-00012. See p. 114. www.epa.gov/oig/ereading_room/WTC_report_20030821.pdf

[13] US EPA (undated) World Trade Center Indoor Dust Cleaning Program Monitoring Contract Scope of Work. http://www.epa.gov/wtc/factsheets/monitoring_sow.pdf

[14] For the detection limits achieved for silica at 110 Liberty St., see Table 11.2, results for Unit 5A-Test 3B, and results for Unit 4A-Test 2A in EPA's pilot cleaning study:

EPA (May, 2003) Final WTC Residential Confirmation Residential Confirmation Cleaning Study Cleaning Study, *op. cit.*

[15] EPA has a history of claiming typographical errors whenever data it presents proves to be damning. See Section S, of my 7/4/03 report "Comments on the EPA Office of Inspector General's 1/27/03 interim report …" (*op. cit.).* For polychlorinated biphenyls (PCB's), EPA had in its possession for over 1 year a report showing extremely high levels of PCB's in dusts in lower Manhattan after the WTC collapse. The report specifically noted the high levels, drawing attention to the fact. EPA did not release the information to the public or act upon it in any way. Then, in the fall of 2002, when EPA included the report as a reference to its draft Constituents of Potential Concern document, the public did notice and become alarmed. EPA immediately claimed the data was a typographical error, but has never provided any chain of custody documentation to prove that this was in fact just a typographical error.

In another instance described in my 7/4/03 report, the cleanup at IPN Plaza in NYC showed continual overloading of air asbestos samples. EPA's Barry Breen first told the residents that nothing could be done about the situation, that it was probably only cigarette smoke causing the overloading, and that EPA had done its best and would not re-clean as required by the contractual statement of work. At this point, the press and other professionals (including myself) were contacted. Then, EPA conveniently came up with a new excuse. They claimed that they were looking at the wrong set of data, and that the sample was not overloaded at all, but instead passed the asbestos criterion.

[16] EPA (May, 2003) Final WTC Residential Confirmation Residential Confirmation Cleaning Study Cleaning Study, *op. cit.*. See pp. 9-10.

[17] This is the result of multiplying 50 $\mu g/m^3$ by 40 hrs./wk. and then dividing by 168 hours total in a week: (50) x (40/168) = 12

[18] US EPA (April, 2003) WORLD TRADE CENTER BACKGROUND STUDY REPORT INTERIM FINAL. Prepared for: United States Federal Emergency Management Agency IAG No.: EMW-2002-IA-0127. Prepared by EPA Region 2, New York City Response and Recovery Operations, Approved by: Kathleen C. Callahan, Assistant Regional Administrator, New York City Response and Recovery Operations. http://epa.gov/wtc/bg_report_section1.pdf .

[19] The EPA background study, *op. cit*., EPA (April, 2003), did not provide the actual values for the 11 samples where it did detect α-quartz. Table 6-4 of this report only indicates that for one sample, the value was 259 $\mu g/m^3$, and that for the 34 out of 46 samples where quartz was not detected, EPA assumed that the value was ½ the detection limit, which would be 2 $\mu g/m^3$. EPA provided the mean concentration for all these values, however. This enabled a back-calculation of the mean of the samples without the outlier.

Note that EPA stated in its background study that eliminating the high outlier of 259 $\mu g/m^3$ was appropriate, and provided an Upper Confidence Limit for α-quartz at 7.8 $\mu g/m^3$ in Table 8-1 that did not use the high outlier.

[20] USEPA, ORD, NCEA (October, 2002) draft Exposure and Human Health Evaluation of Airborne Pollution from the World Trade Center Disaster, EPA Publication No. NCEA - W - 1395 EPA/600/P-2/002A, External Review Draft, http://oaspub.epa.gov/eims/eimscomm.getfile?p_download_id=36387 .

[21] Jenkins, C. (July 4, 2003) Comments on the EPA Office of Inspector General's 1/27/03 interim report titled: "EPA's Response to the World Trade Center Towers Collapse" A DOCUMENTARY BASIS FOR LITIGATION, *op. cit*.

[22] US EPA, et al. (May, 2003) World Trade Center Indoor Environment Assessment: Selecting Contaminants of Potential Concern and Setting Health-Based Benchmarks, Prepared by the Contaminants of Potential Concern (COPC) Committee of the World Trade Center Indoor Air Task Force Working Group. See p. 15, http://www.tera.org/peer/WTC/COPC%20-%20Benchmark%20Report%20with%20appendices.pdf

[23] US EPA (October, 2002) DRAFT: Exposure and Human Health Evaluation of Airborne Pollution from the World Trade Center Disaster National Center for Environmental Assessment Office of Research and Development U.S. Environmental Protection Agency, http://oaspub.epa.gov/eims/eimscomm.getfile?p_download_id=36387

[24] EPA (May, 2003) Final WTC Residential Confirmation Residential Confirmation Cleaning Study Cleaning Study, *op. cit.* See p. 15

[25] NIOSH. NIOSH Carcinogen List. See NIOSH website at http://www.cdc.gov/niosh/npotocca.html

[26] NIOSH (May 20, 2002) NIOSH UPDATE. NIOSH REPORT ON RESPIRABLE CRYSTALLINE SILICA REVIEWS HEALTH EFFECTS DATA, DISCUSSES RESEARCH NEEDS http://www.cdc.gov/niosh/crysilup.html

[27] NIOSH (1974) Criteria Documents Criteria for a Recommended Standard: Occupational Exposure to Crystalline Silica, DHHS (NIOSH) Publication No. 75-120, http://www.cdc.gov/niosh/75-120.html

[28] NIOSH (2002) HAZARD REVIEW Health Effects of Occupational Exposure to Respirable Crystalline Silica http://www.cdc.gov/niosh/02-129I.html

[29] NTP (2002) 10th Report on Carcinogens, http://ehp.niehs.nih.gov/roc/toc10.html .

[30] The conclusions and opinions are those of the author and do not necessarily reflect those of the U.S. Environmental Protection Agency.