Lower Manhattan Development Corporation Data Review

-August 4, 2004-

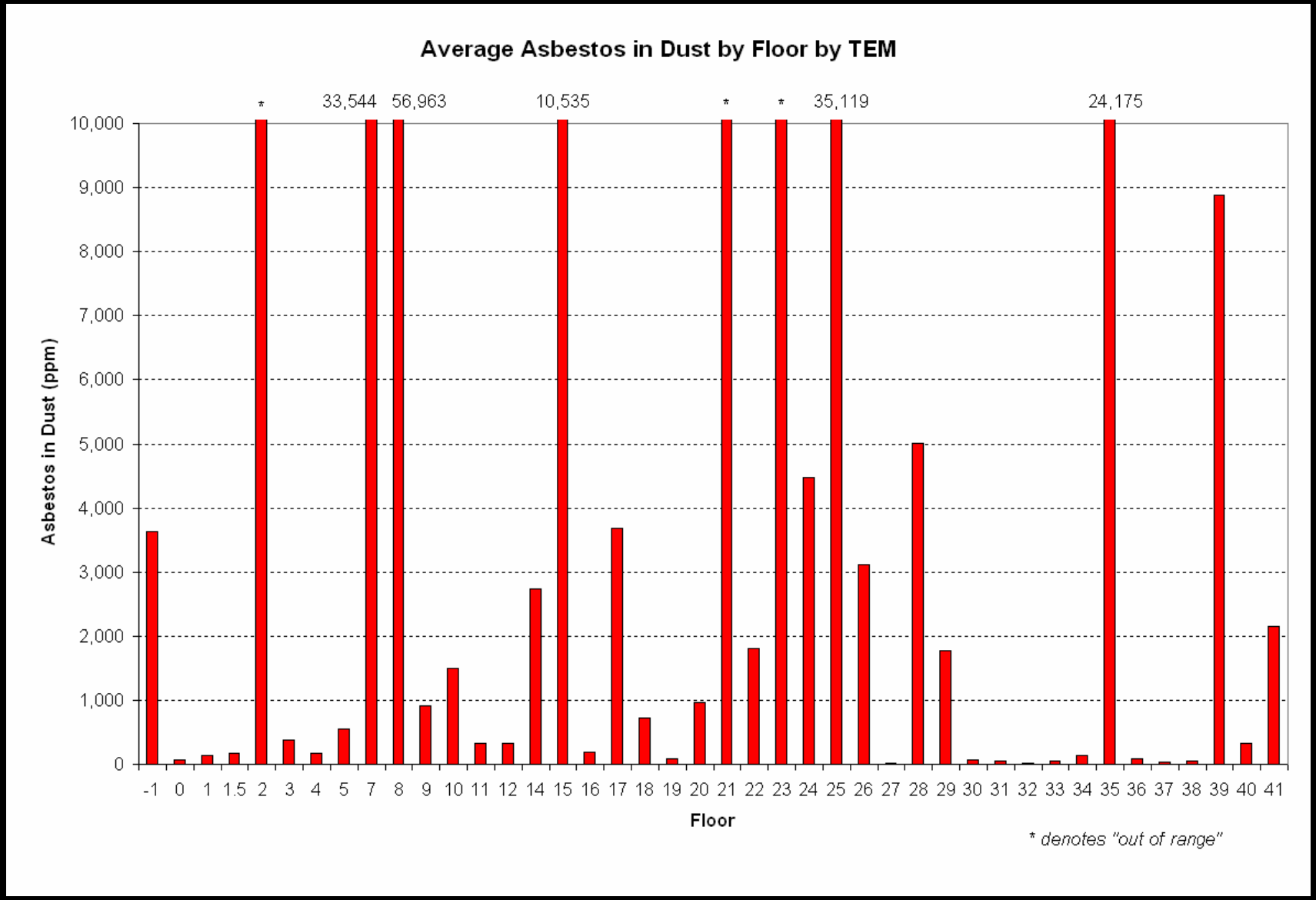
Outline

- Our data and others' data show asbestos >1% in dust
- Review analytical methods
- LMDC asbestos <1% in dust?
- NESHAP Applies
- Demolition will cause visible emissions of dust
- Disturbance of dust creates elevated airborne concentrations
- Dust contamination is pervasive (hidden reservoirs)
- Other contaminants

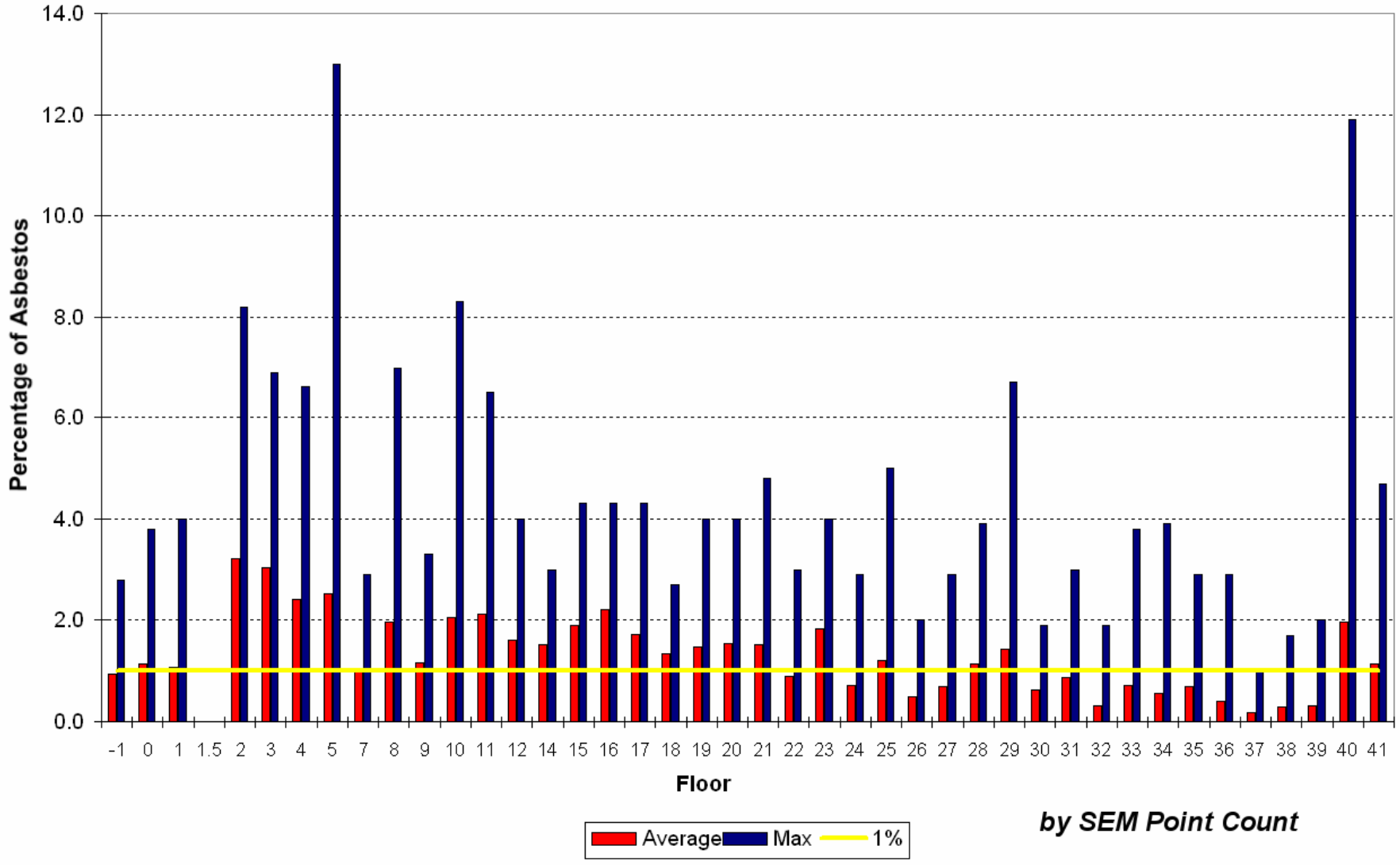
Our data and others' data show asbestos concentrations >1% in dust

Asbestos Content in Dust

	Source	Method		
		PLM	SEM Point Count	TEM
130 Liberty	Ambient Group	0.8 - 10%		
	RJLee Group	ND - 1.25%	1.0 - 13 %	0.001 - >10%
	The Bank's Insurers Young labs	> 1%		
	Chatfield and Kominsky (Oct 2001)	0.67 - 1.05%		
Other Buildings Affected by WTC Event	Lioy, et al (July 2002)	0.8 - 3.0%		Confirmed
	EPA Office of Inspector General	25% exceeded 1%		
	Other Buildings	0.5 - 4%	0.0 – 6.7%	


Average Asbestos in Dust by Floor by TEM
*
33,544
56,963
10,535
*
*
35,119
24,175
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Asbestos in Dust (ppm)
-1 0 1 1.5 2 3 4 5 7 8 9 10 11 12 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41
Floor
* denotes "out of range"

Average and Maximum Percentages of Asbestos by Floor



by SEM Point Count

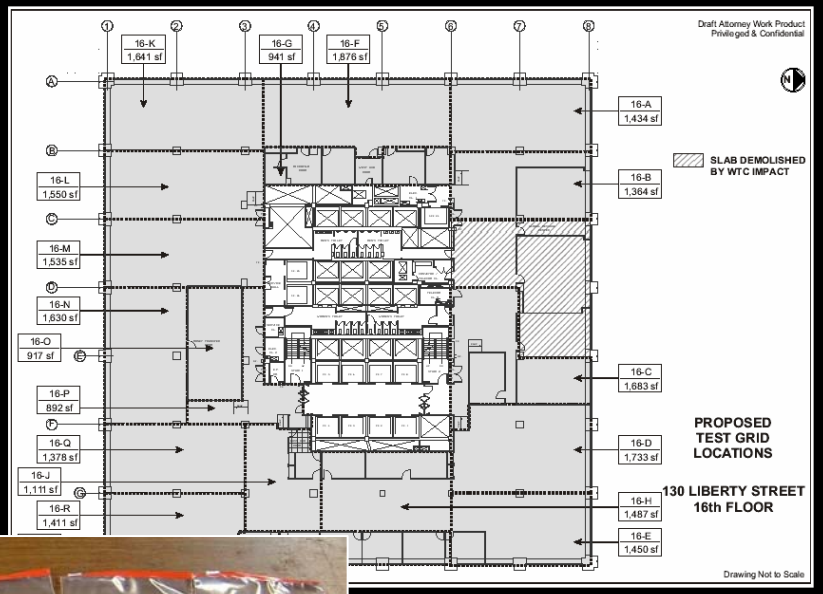
TP-01 Below Ceiling asbestos concentrations using SEM Point Count (Select Floors)

Floor	Average	Max	Count
2	3.21	8.2	15
3	3.05	6.9	15
4	2.40	6.6	30
5	2.53	13.0	33
8	1.96	7.0	19
10	2.06	8.3	11
11	2.12	6.5	19
29	1.43	6.7	15
40	1.96	11.9	19

Sampling & Analysis Methods

Sampling Program

Field Technician using a PDA



Grid Map

Sampling Kit

Sample Collection Methods

Wipe

Air

Bulk

Lift

Media

Microvac

Laboratory Sample Analysis

- Polarized Light Microscopy (PLM)
  - Asbestos
- Scanning Electron Microscopy (SEM)
  - Constituent Characterization, Asbestos
- Transmission Electron Microscopy (TEM)
  - Asbestos

Laboratory Sample Analysis

- Gas Chromatography (GC)
  - PCBs (GC/ECD)
  - PNAs (GC/MS)
  - Dioxins (GC/HRMS)
- Inductively Coupled Plasma Spectroscopy (ICP)
  - Heavy Metals
- Gravimetric & X-Ray Diffraction (XRD)
  - Dust Concentrations
  - Crystalline Silica

Laboratory Sample Analysis

PLM

TEM

SEM

ICP

GC

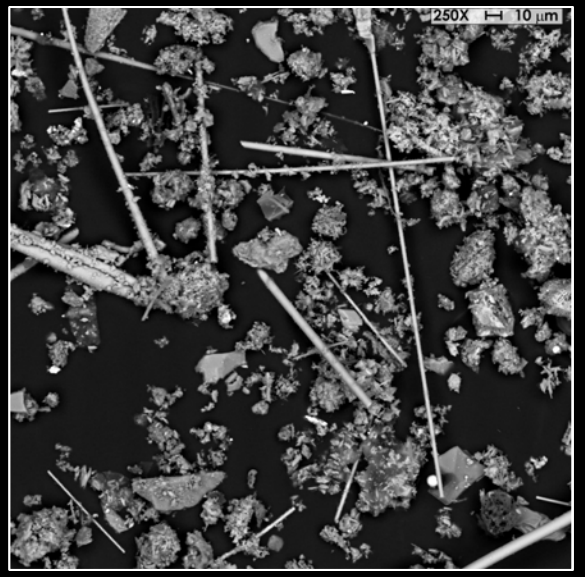
Analysis Methods

- Asbestos Microvac
  - ASTM D5755-95, ASTM D5756-95
- Asbestos Wipe
  - ASTM 6480-99
- Asbestos Bulk
  - NYS ELAP 198.1, EPA/600/R-93/116 or NYS ELAP 198.4
- PNAs Bulk or Wipe
  - EPA SW 846 8270C
- PCBs Bulk or Wipe
  - EPA SW 846 8082, EPA 1668
- Dioxins Bulk or Wipe
  - EPA SW 846 8290
- Heavy Metals Bulk or Wipe
  - EPA ASTM E-1792, NIOSH 7300
- Mercury Bulk or Wipe
  - EPA SW 846 7471
- Crystalline Silica
  - NIOSH 7500
- WTC Markers Bulk or Wipe

WTC Signature

- Characteristics
  - Unique Distribution of Ultra Fine Particles
  - Blend of Building Constituents
  - Combustion Products
- Components
  - Always Present (indoor samples)
    - *Gypsum, Mineral Wool*
  - Commonly Present
    - *Cement Dust, Asbestos, Fiberglass, Toxic Chemicals, Metals*
  - Sometimes Present
    - *Soot, Heat Affected Particles, Vapor Deposited Metals*

WTC Dust Signature: Particulate

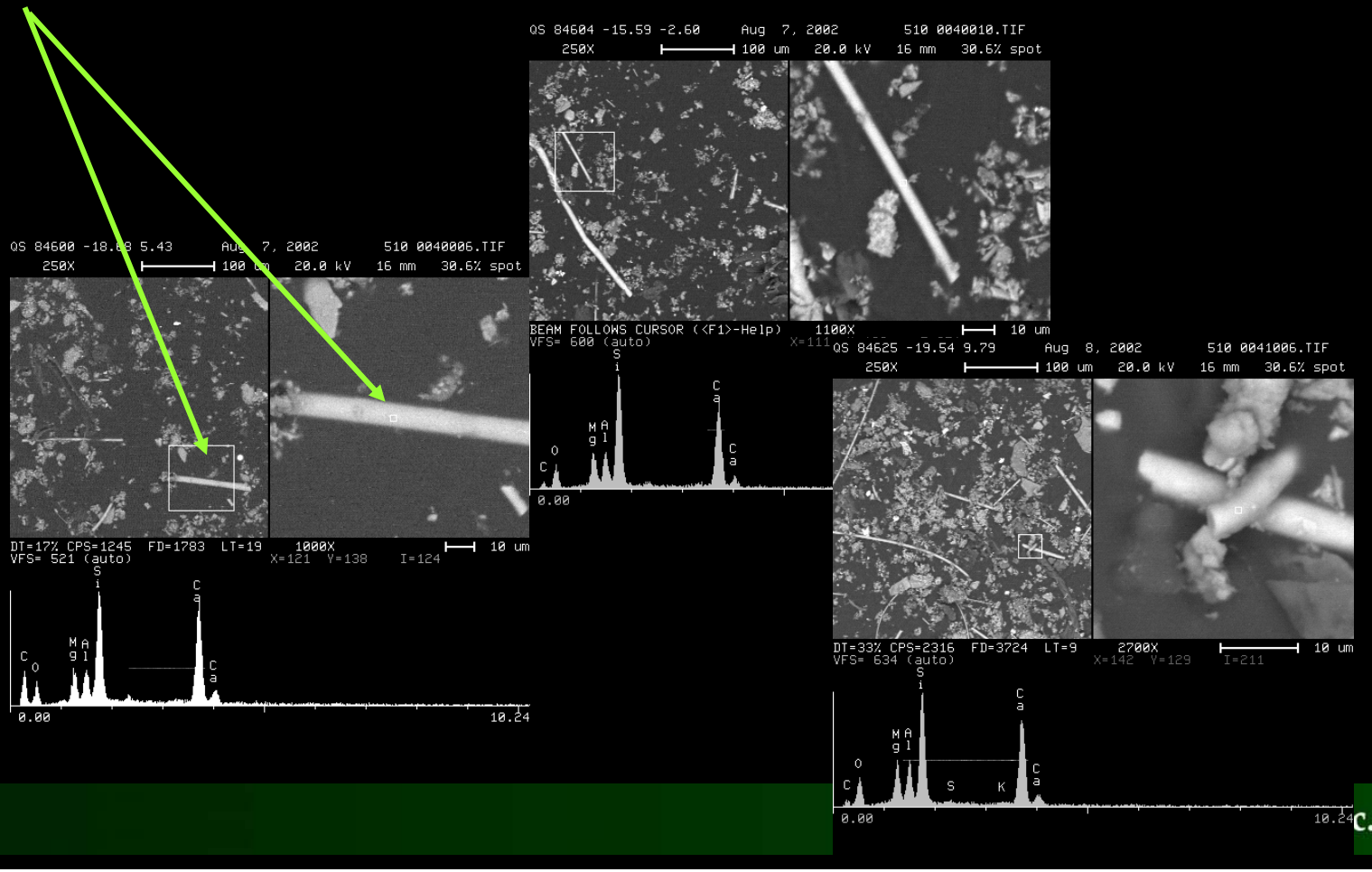


WTC Dust Markers:

- Chrysotile asbestos
- Mineral wool
- Glass fibers
- Pulverized gypsum
- Vermiculite
- Particles exposed to high heat (spherical, vesicular)
  - Carbonaceous
  - Metallic
  - Alumino-silicates
- Lead

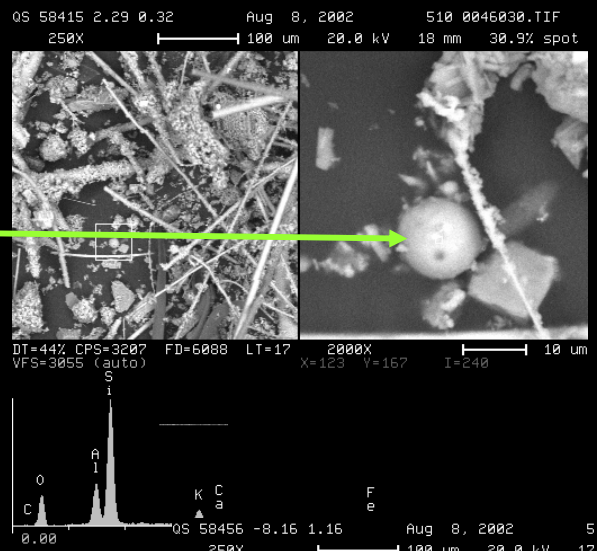
WTC Dust

Mineral Wool Present as Short Fibers

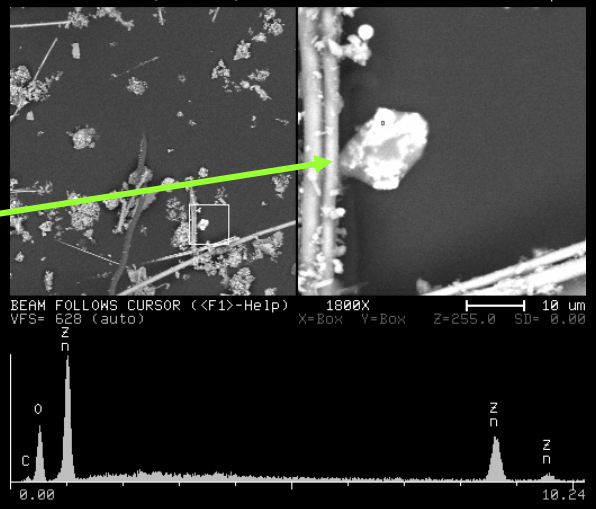


WTC Dust

High Temperature Silicate

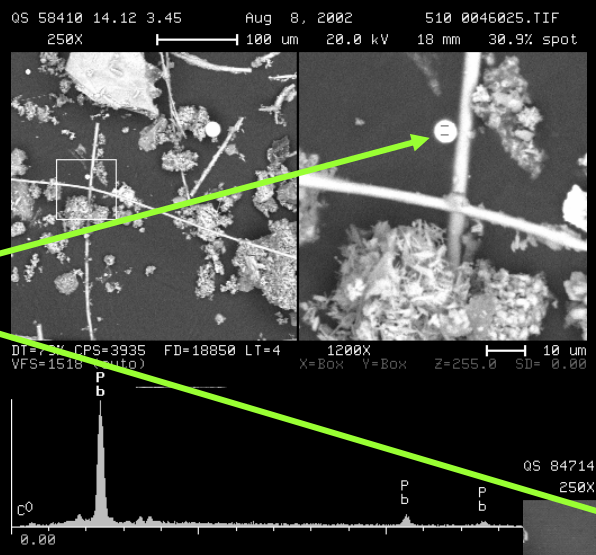


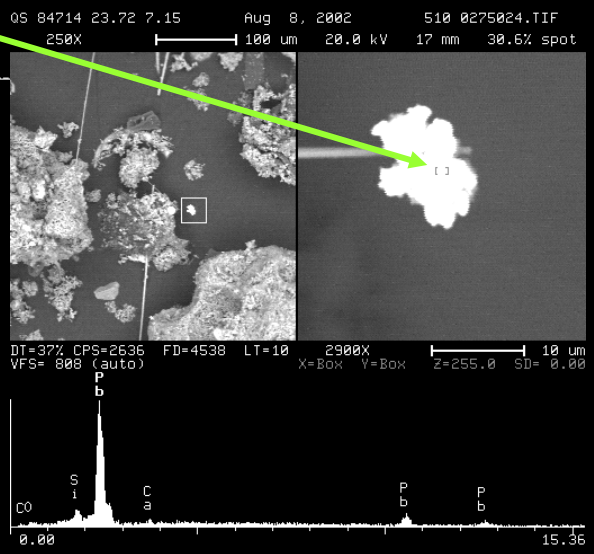
Zinc-Rich



WTC Dust

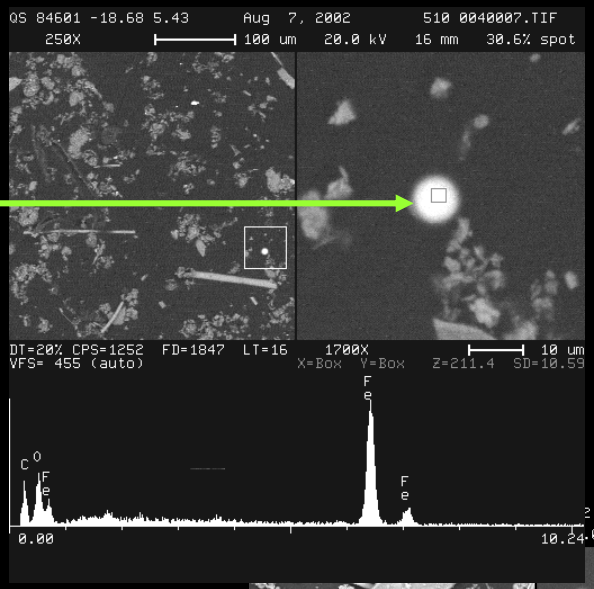
Heavy Metals,
Commonly Lead



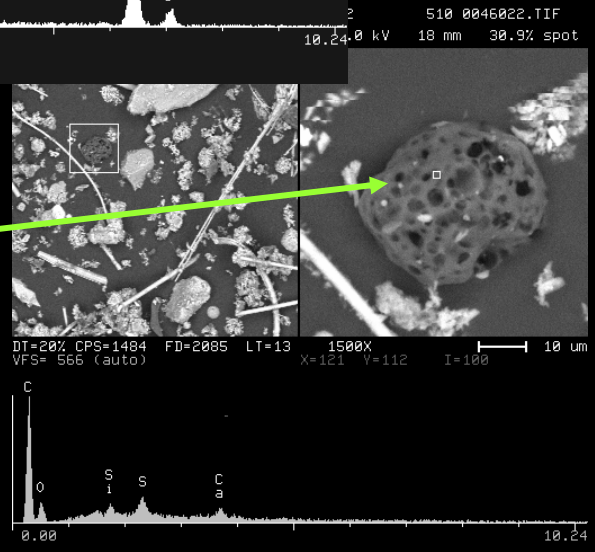


WTC Dust

Iron Sphere

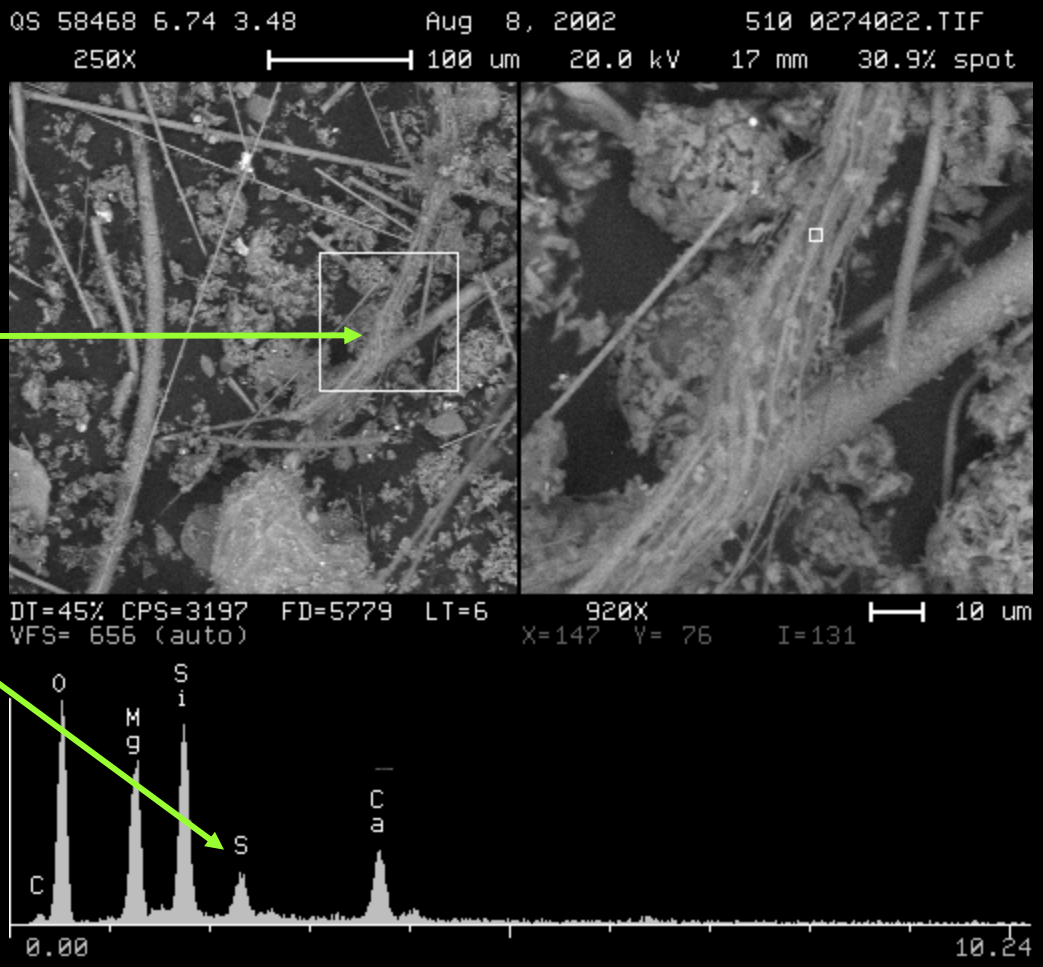


Vesicular Carbonaceous Particle



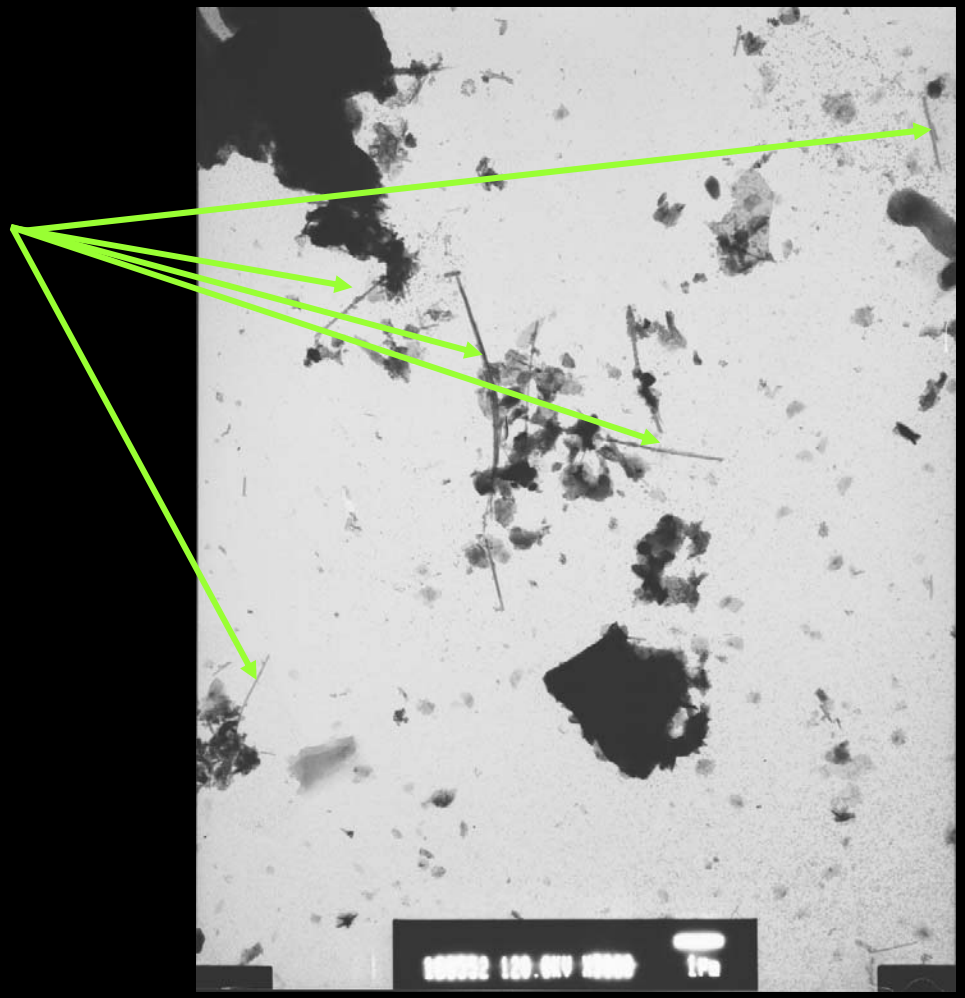
WTC Dust

Chrysotile Asbestos, Commonly Coated with Gypsum

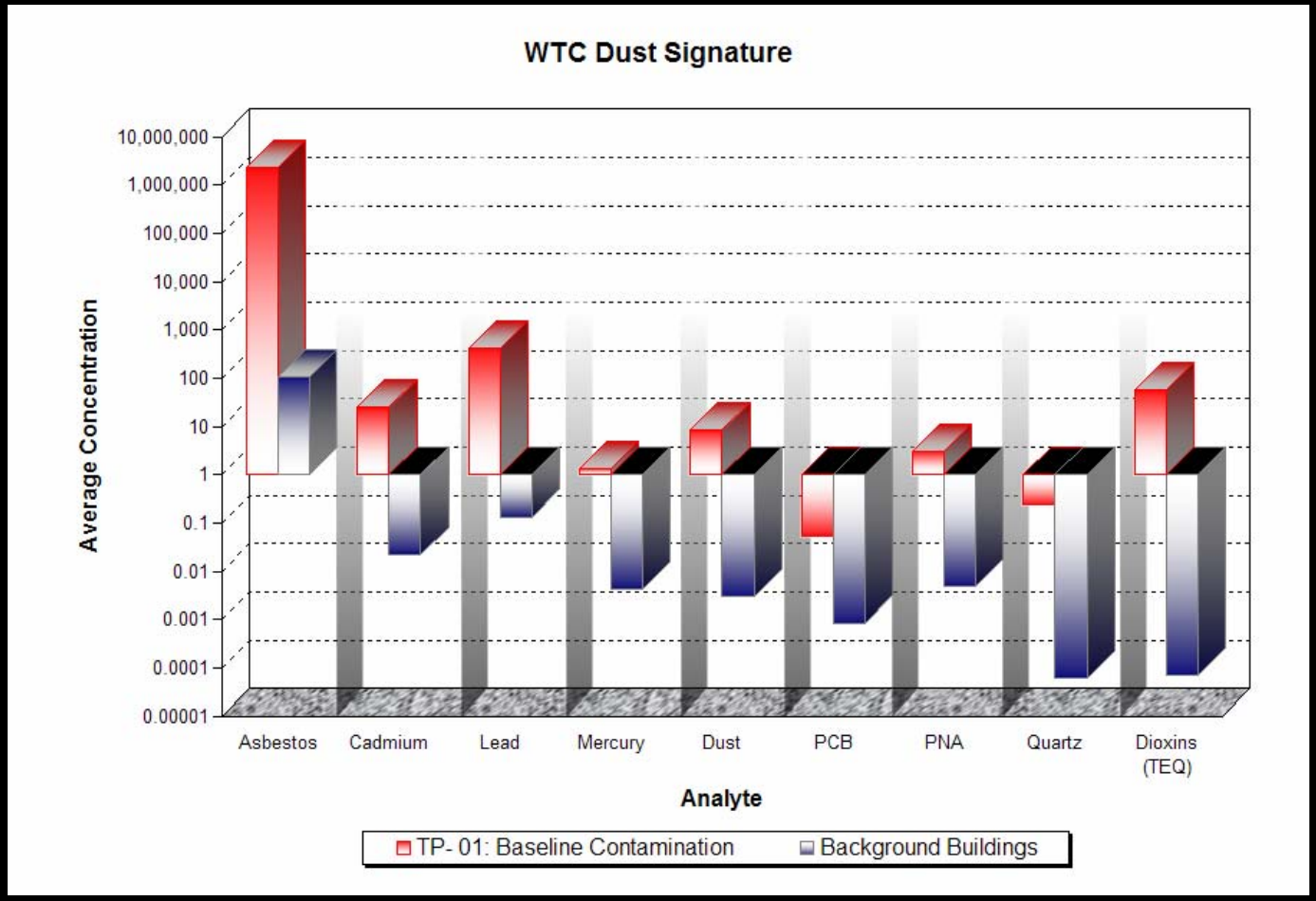


WTC Dust

Asbestos Fibers



WTC Dust Signature: Chemical



LMDC asbestos concentrations <1% in dust?

LMDC and RJLG
Bulk Sample Results

LMDC Summary of Inspection Results for Asbestos

SUMMARY OF INSPECTION RESULTS FOR ASBESTOS FOR TASK 2 (ASBESTOS BUILDING INSPECTIONAND MATERIAL SURVEY) AT 130 LIBERTY STREET, NEW YORK, NY

ACM THAT MAY BE AFFECTED MATERIAL	LMDC RESULTS	APPROXIMATE QUANTITY TO BE REMOVED		RJLG RESULTS
		Square Feet	Linear Feet	
12" x 12" Floor Tiles & Associated Mastic	Confirmed ACM	123780		**Some Positive Some Negative**
Sealant over Weather Stripping at Metal Column Parts	Confirmed ACM		45,500	**Exterior Results Negative for Asbestos**
Caulking between Column Metal Covers	Confirmed ACM		45,500	**Exterior Results Negative for Asbestos**

Curtain Wall: Interior & Exterior

Curtain Wall Interior Caulking/Sealant Samples

Sample	Location	Test	Asbestos Wt.%
Galvanizing Compound (Black Window Caulking)	In the channel in which the windows fit	PLM	4.3% to 5.8%
Black Column Sealant	Applied to the interior of extruded aluminum panels and fasteners that attach the curtain wall pieces to the angle iron supports	PLM and TEM	No asbestos was detected
Grey/Tan Column Sealant	Seals the curtain wall pieces together in the lengthwise, vertical direction	PLM and TEM	1.2% to 8.9%

Source: Curtain wall report LMDC.0726.1330.jc.doc, 1.A.

Curtain Wall Exterior

Characterization of the Exterior Bulk Caulking

Sample Number	Weight Percentage	Floor
5226171	No Asbestos Detected	7
5226176	No Asbestos Detected	22
5226183	No Asbestos Detected	28
5226195	No Asbestos Detected	30
5225366	No Asbestos Detected	36
5226191	No Asbestos Detected	38
5225344	No Asbestos Detected	Street Level
5225347	No Asbestos Detected	Street Level
5225350	No Asbestos Detected	Street Level
5225356	No Asbestos Detected	Street Level
5225359	No Asbestos Detected	Street Level

Source: Curtain wall report LMDC.0726.1330.jc.doc, II.A.1.

Curtain Wall Exterior
Surface Lift Results - Exterior Window Caulking

R-102 Sample #	WTC Dust	Chrysotile %	Floor	Location
5225343	Positive	Non-detect	Street Level	Northwest
5225346	Possible	Non-detect	Street Level	South
5225349	Positive	0.97%	Street Level	East
5225352	Positive	4.00%	Street Level	South
5225355	Positive	2.91%	Street Level	Northeast
5225362	Possible	Non-detect	Street Level	Southwest
5225365	Positive	3.81%	36	North
5226182	Positive	0.97%	28	North
5226186	Positive	1.94%	34	North
5226190	Positive	2.88%	38	North
5226194	Positive	Non-detect	30	North

Source: Curtain wall report LMDC.0726.1330.jc.doc, II.A.2.

Curtain Wall Exterior
Surface of Exterior Bulk Sample Caulking

R-102 Sample #	WTC Dust	Chrysotile %	Floor	Location
5225344	Positive	1%	Street Level	Northwest
5225347	Positive	1.96%	Street Level	South
5225350	Positive	0.98%	Street Level	East
5225353	Positive	1%	Street Level	South
5225356	Positive	1%	Street Level	Northeast
5225366	Positive	0.99%	36	North
5226171	Positive	Non-detect	7	North
5226176	Positive	Non-detect	22	Northwest
5226180	Positive	0.99%	22	Northwest
5226181	Positive	Non-detect	7	Northeast
5226191	Positive	Non-detect	38	North
5225359	Positive	1%	Street Level	Southwest
5226170	Positive	0.98%	7	Northwest
5226175	Possible	Non-detect	22	Northwest
5226183	Positive	Non-detect	28	North
5226187	Positive	Non-detect	34	North
5226195	Positive	Non-detect	30	North

Source: Curtain wall report LMDC.0726.1330.jc.doc, II.A.3.

Curtain Wall Exterior
Asbestos Wipe Results - Exterior Caulking

R-102 Sample #	Asbestos Concentration (S/cm²)	Floor	Location
5225342	7496619	Street Level	Northwest
5225345	779674	Street Level	South
5225348	1790096	Street Level	East
5225351	6462040	Street Level	South
5225354	3266171	Street Level	Northeast
5225357	3292628	Street Level	Southwest

Source: Curtain wall report LMDC.0726.1330.jc.doc, II.A.4.

Curtain Wall Exterior
Lead Wipe Results - Exterior Caulking

R-102 Sample #	Lead Concentration (ug/ft^2)	Floor	Location
5226172	437	7	Northwest
5226174	63.7	22	North
5225368	387	28	North
5226193	259	30	North
5226185	255	34	North
5225364	386	36	North
5226189	268	38	North
5225805	1080	Street Level	Southwest
5225806	265	Street Level	South
5225807	495	Street Level	East
5225808	150	Street Level	East
5225809	133	Street Level	East
5225810	286	Street Level	South

Source: Curtain wall report LMDC.0726.1330.jc.doc, II.A.5.

NESHAP Applies

- Dust is visually homogeneous
- Dust is finely pulverized and friable
- Source of dust is ACM (Singer, 1992)

Demolition will cause visible emissions of dust

Video Clip

Disturbance of dust creates elevated airborne concentrations

WTC Dust is more hazardous than other dust

Asbestos Fibers in Dust are Unique

- Airborne asbestos fibers in the Building are longer and thinner than airborne asbestos fibers collected in other buildings nationwide not impacted by the WTC Event.
- These longer and thinner fiber characteristics are generally accepted as resulting in higher human health toxicity.

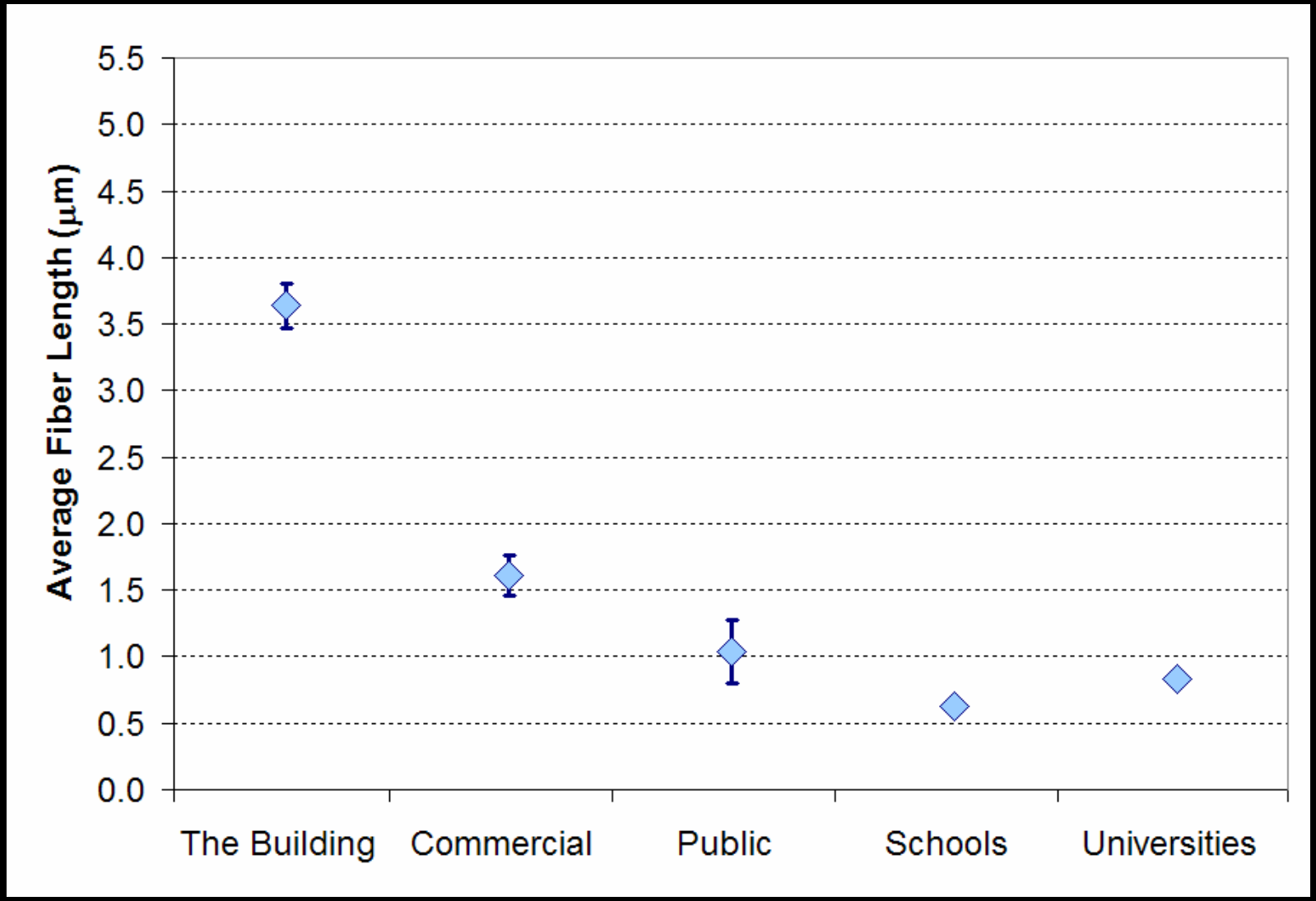
Source: S5 Report: Key Findings

Percentage of Long, Thin Fibers in surface samples collected from the Building and NY Buildings

Length:	≥5 µm	≥5 µm	≥10 µm	≥10 µm
Width:	<0.5 µm	<0.15 µm	<0.5 µm	<0.15 µm
130 Liberty	3.8%	2.9%	0.8%	0.6%
NY Buildings	1.1%	1.1%	0%	0%

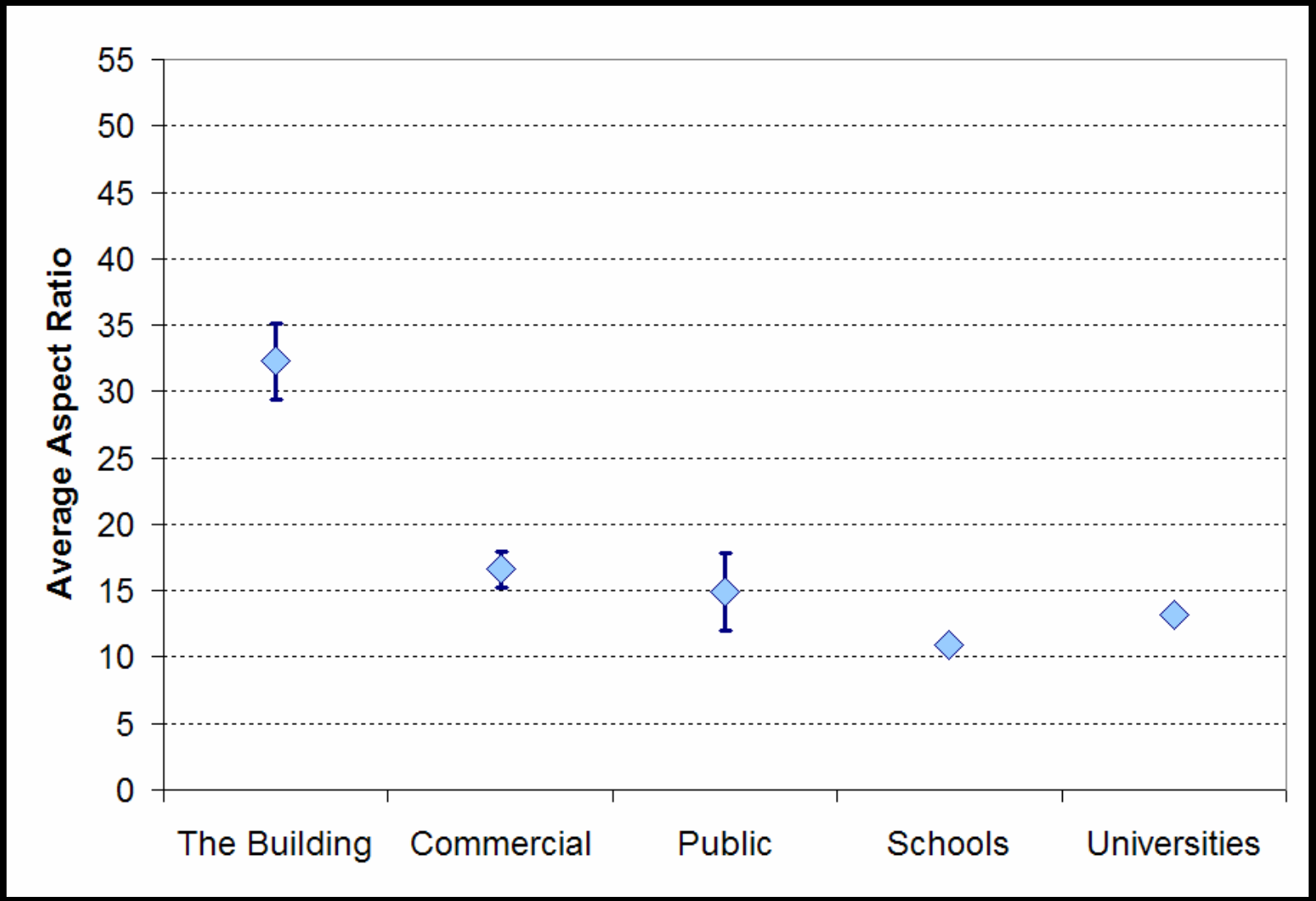
Source: WTC Dust Signature Expert Report, May 2004, Table 3

Asbestos Fiber Length in the Building Compared to Other Buildings



Source: S5 Report, Fig 1

Asbestos Aspect Ratios in the Building Compared to Other Buildings



Resuspension Characteristics of WTC Dust Under Controlled Conditions

- WTC Dust is easily aerosolized when compared to ordinary surface dust.
- Aerosolized WTC Dust contains significant amounts of respirable (breathable) asbestos and lead.
- A respirable asbestos concentration (0.87 f/cm^3) near the OSHA 30-minute excursion limit of 1.0 fiber/cm^3 resulted when surface dust in the Building was disturbed using low-velocity air pulses.

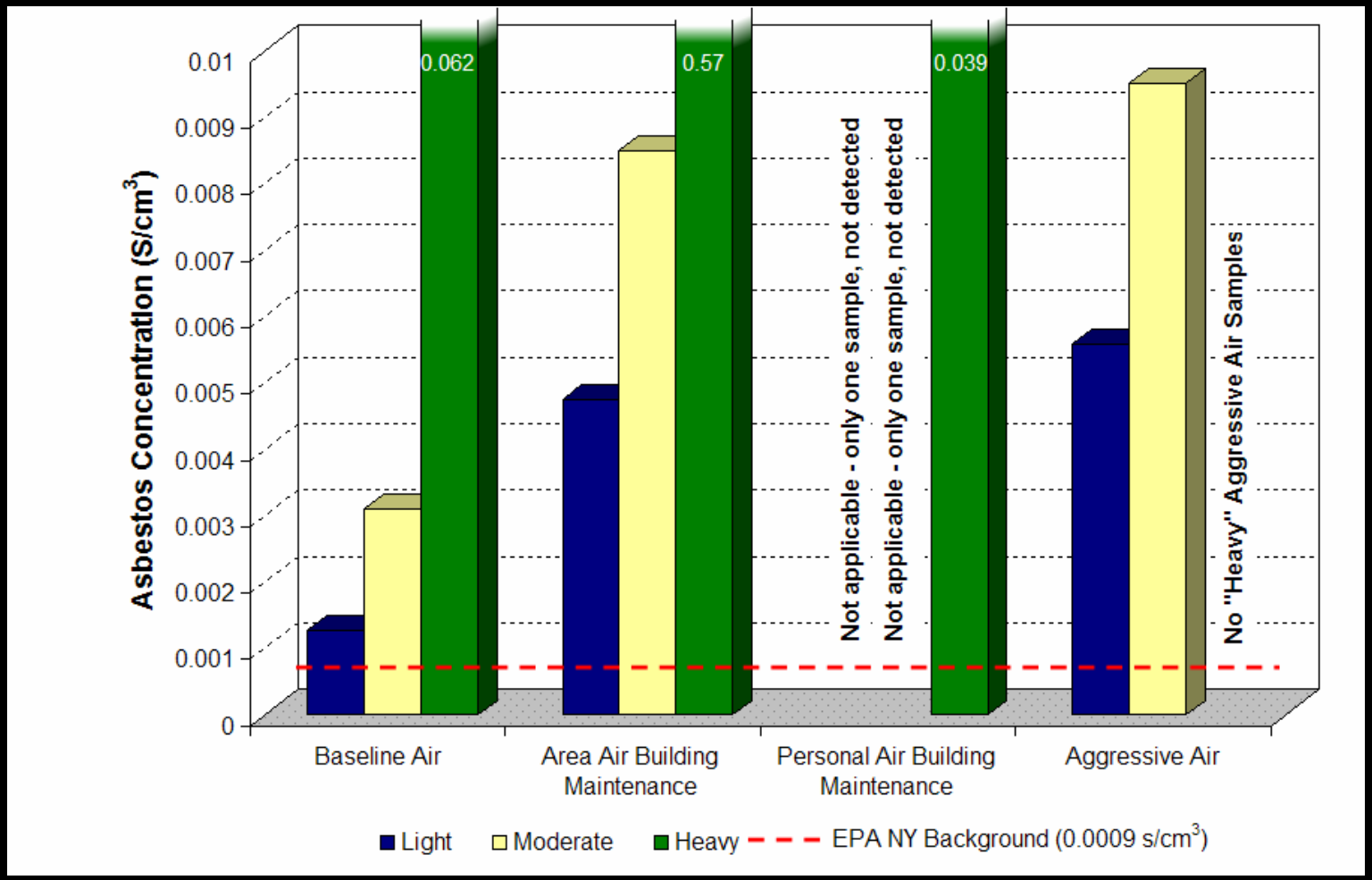
Source: S3 Report: Key Findings

The Dust is Easily Resuspended & Remains in the Air for Long Periods

- Aggressive air disturbance resuspends respirable (breathable) WTC Dust and WTC Hazardous Substances
- Resuspended asbestos fibers or bundles with widths of <0.05 µm were observed in area air samples taken from each test location. Data from Chatfield indicate that fibers of this size can remain in suspension up to eight weeks
- Normal air disturbance caused by minimal activities during sampling resuspends respirable WTC Dust and WTC Hazardous Substances

Source: S2 Report: Key Findings

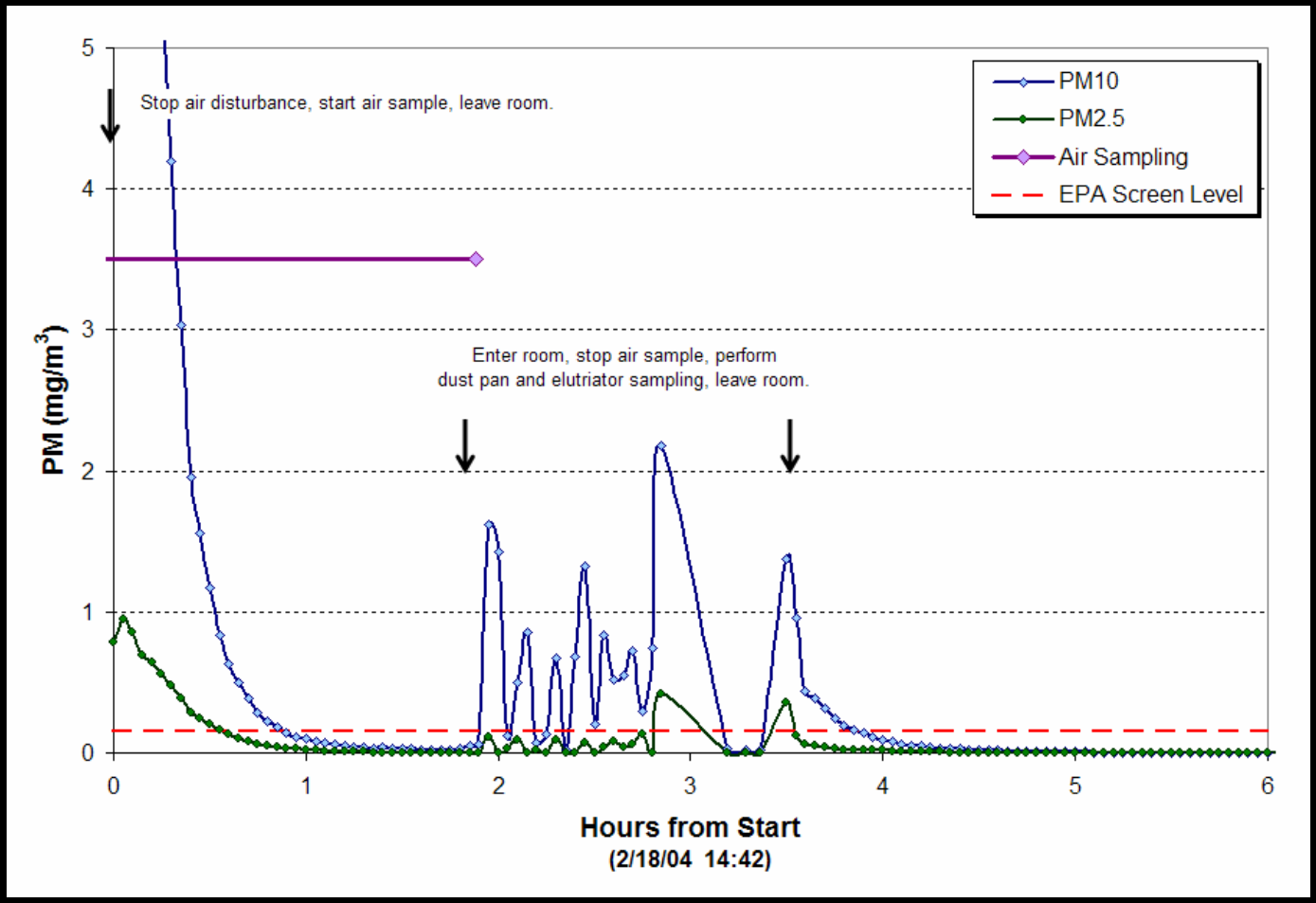
Resuspended Airborne Asbestos Concentration in 3 Unremediated Offices



Source: S2: Figure 2

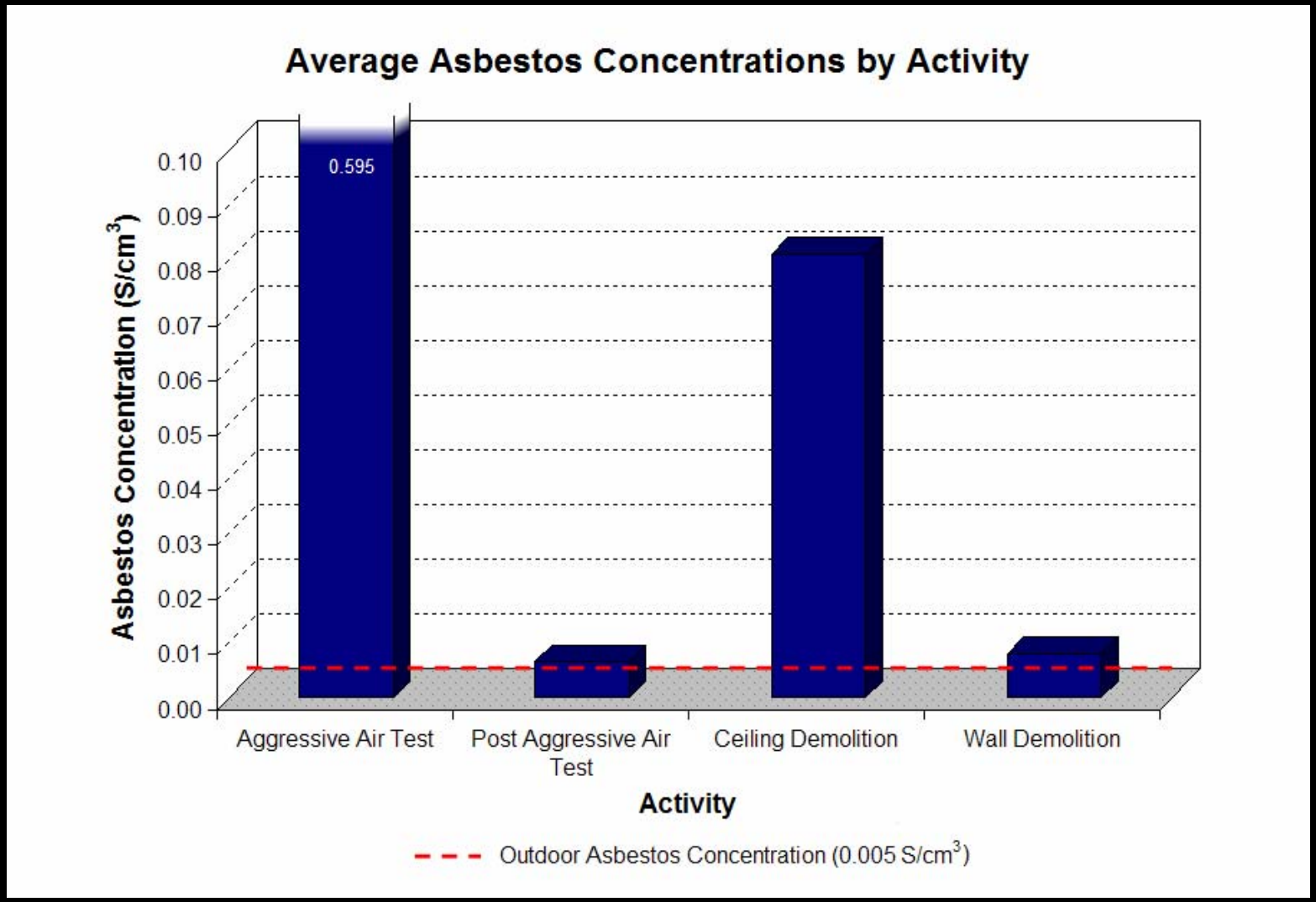
MetOne Instrument Particle Mass Data For 3rd Floor Test

Expanded vertical scale and hours 0-6 only.



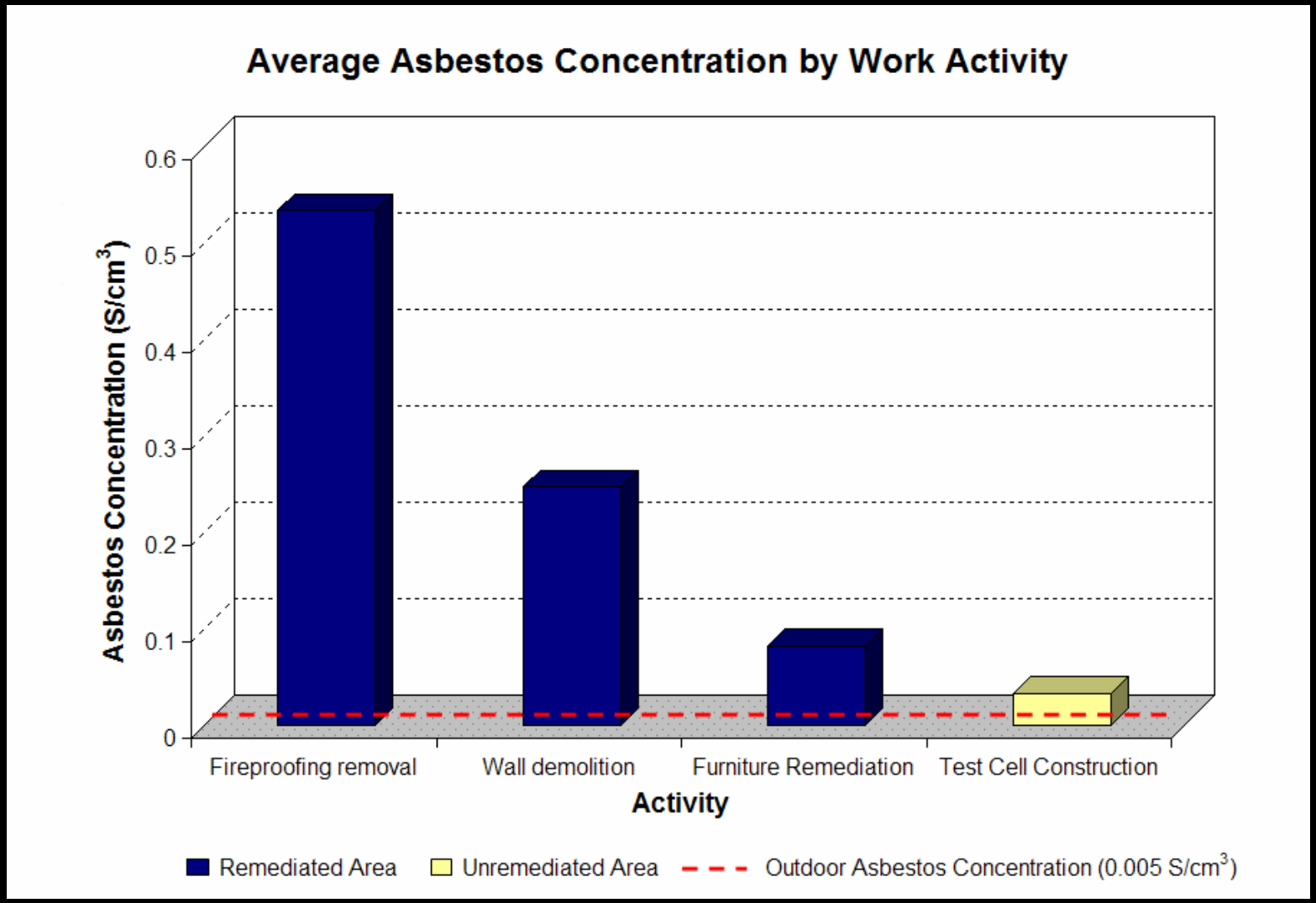
Source: S4 Report: Figure 2

Cascade Impactor Study



Source: S1 Report, Fig 2

Cascade Impactor Study



Source: S1, Fig 3

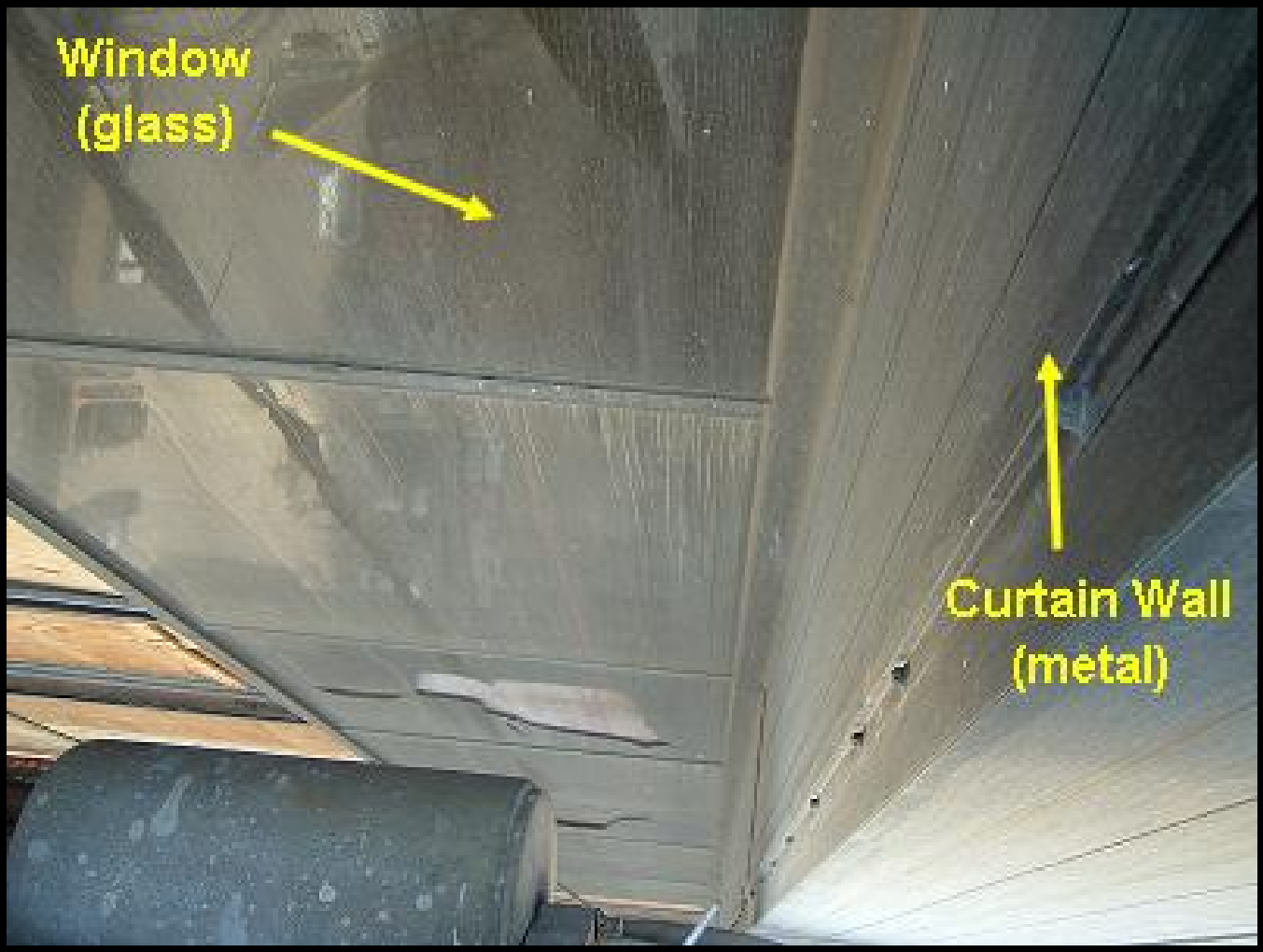
Surface & Airborne Concentrations

- The propensity of WTC Dust to aerosolize is 10 to 10,000+ times greater than that of ordinary office building surface dust.
- Aerosolized WTC Dust contains significant quantities of respirable (breathable) asbestos and lead particles as well as other WTC Hazardous Substances.

Source: S2 Report: Key Findings

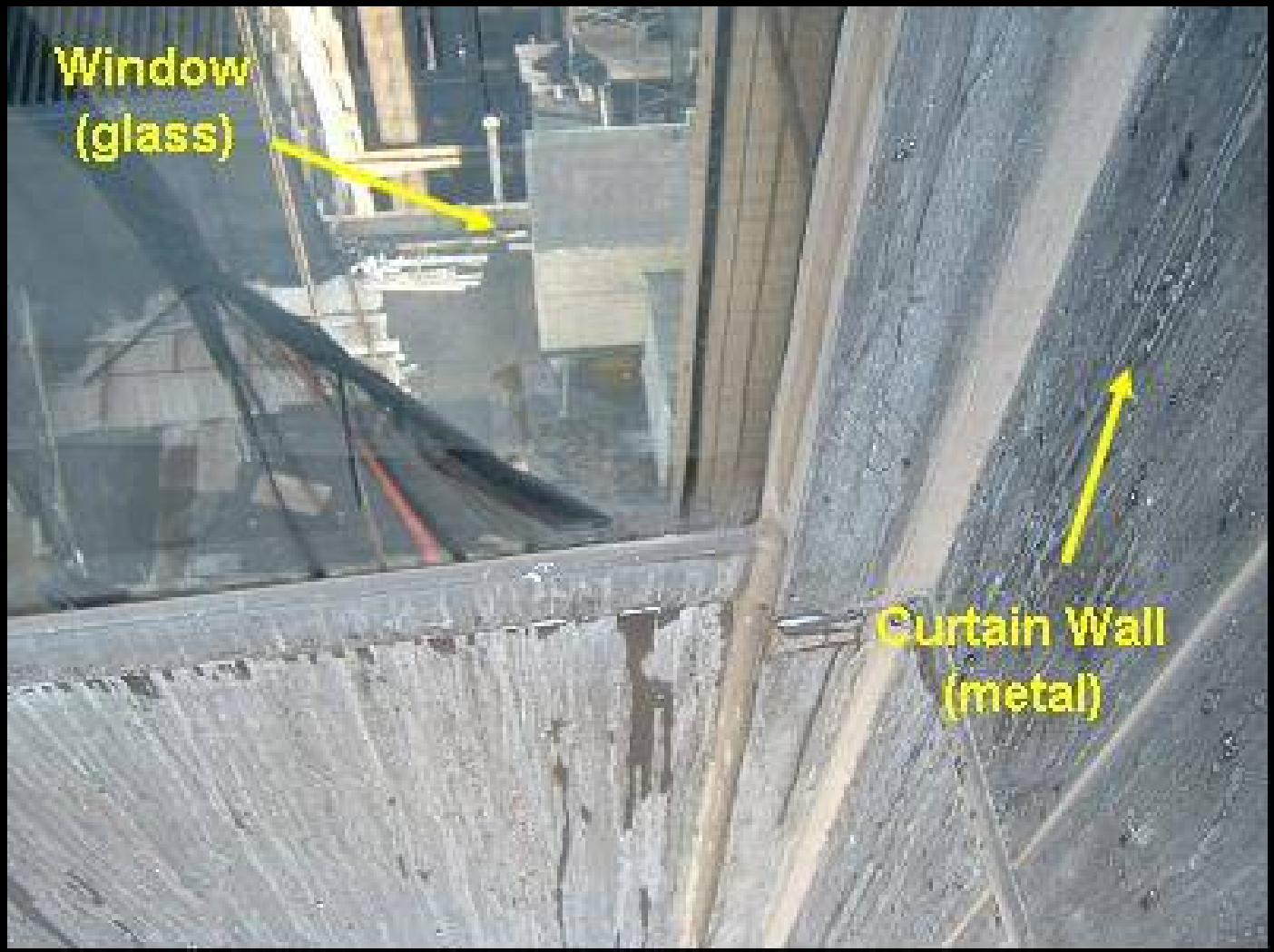
Dust contamination is pervasive (hidden reservoirs)

Heavily Contaminated and Damaged Portion of Exterior Curtain Wall



Source: R7: Exterior Façade Testing (Figure 1)

Surface Contamination on the Exterior Curtain Wall



Source: R7: Exterior Façade Testing (Figure 2)

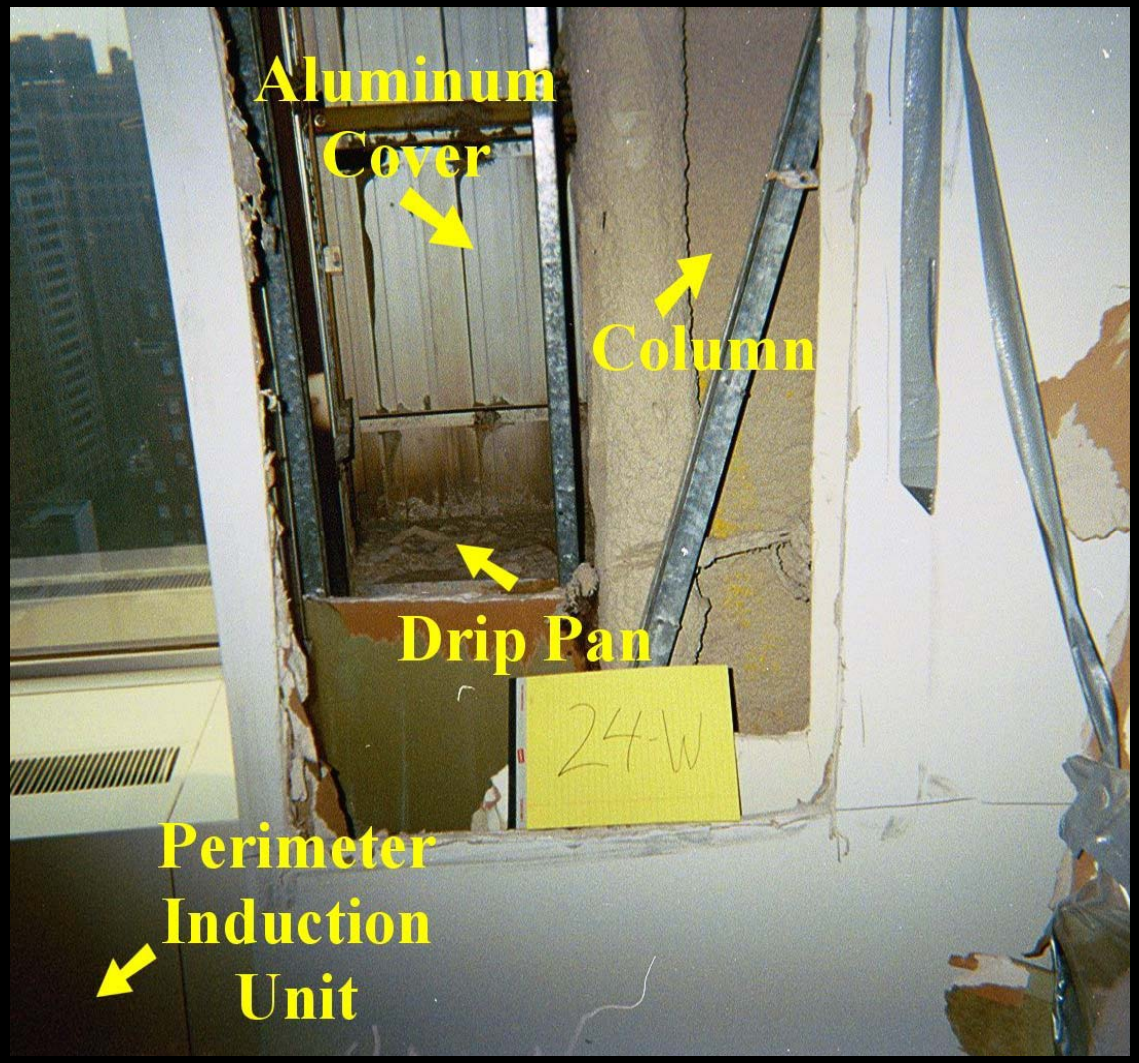
Typical above-ceiling ductwork interior sampling

Source: Supplement to CR01: Figure 22

Ductwork Interior Sampling Surface And Used Template Area

Source: Supplement to CR01: Figure 23

Drywall Removed To Expose Interior Of The Curtain Wall



Source: CR07: Figure 3

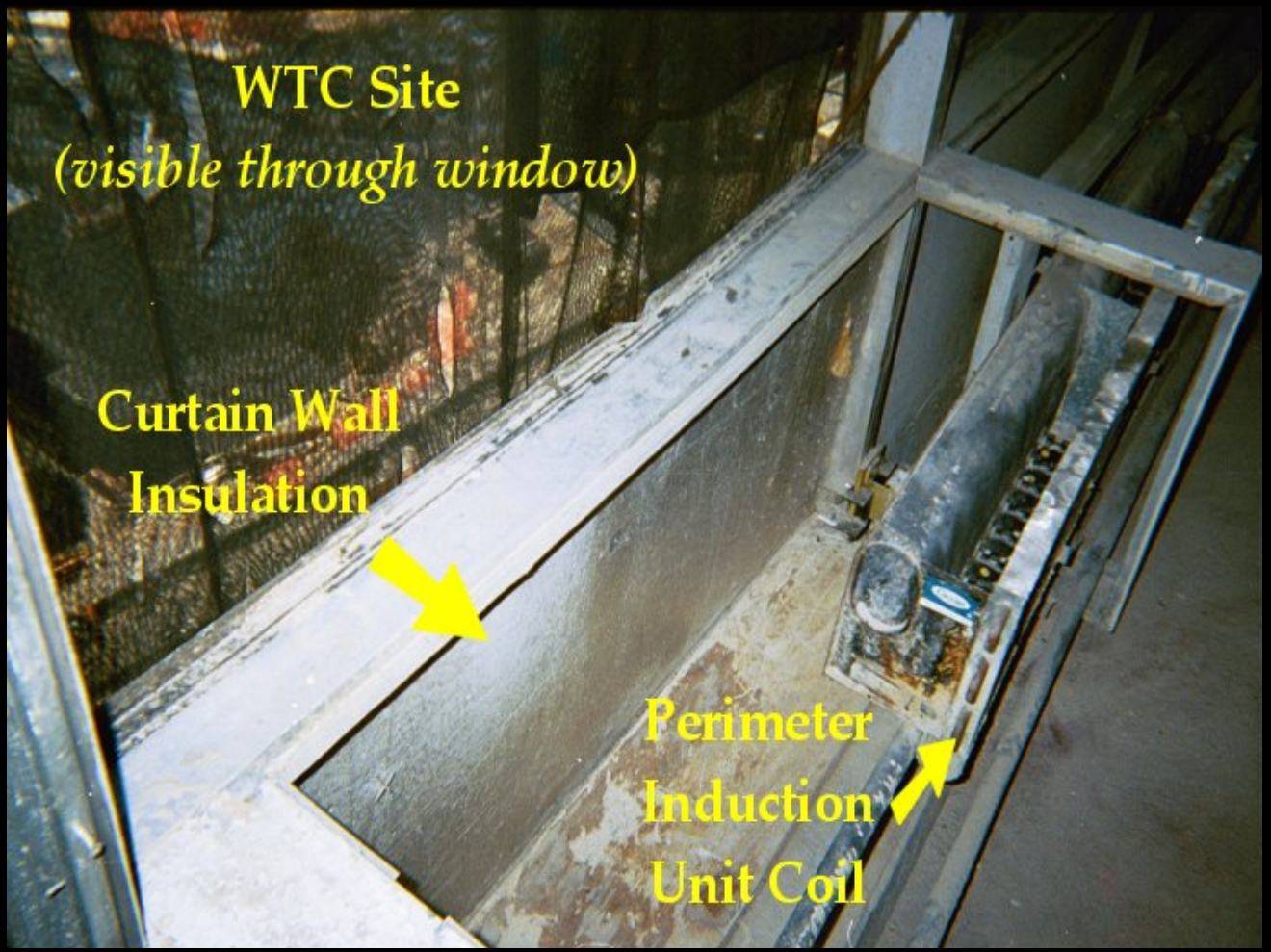
Exposing A Curtain Wall

Source: CR07: Figures 27, 28, 29

Exposing A Curtain Wall

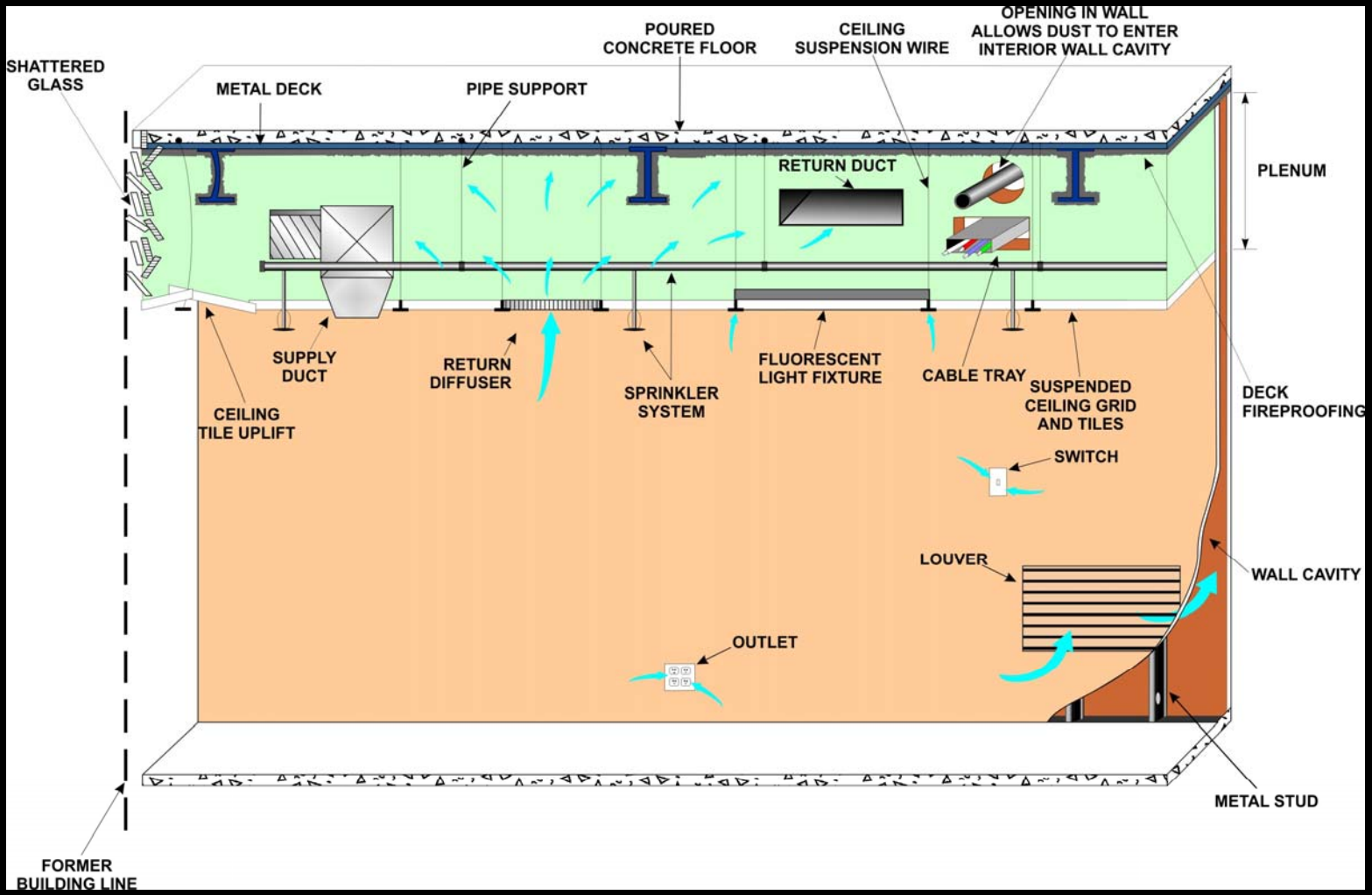
Source: CR07: Figures 30, 31, 32

Curtain Wall Insulation With Perimeter Induction Unit Cover Removed



Source: CR08: Figure 3

Ceiling And Wall Cavity Cross-section Of Typical Floor

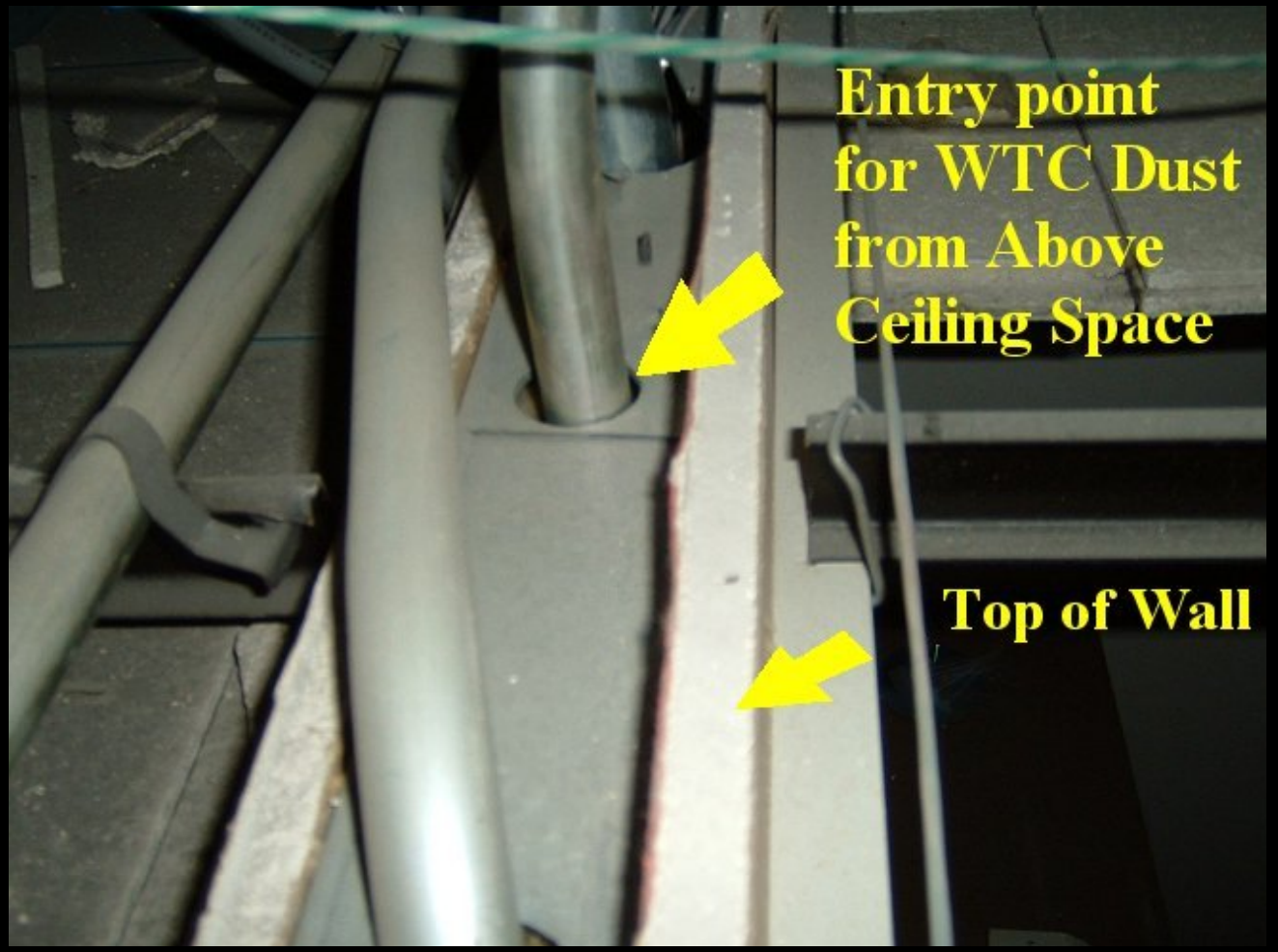


Source: CR06: Figure 1

Type 4 Interior Above-ceiling Wall Cavity Showing Wall Cavity Without Sound Attenuation Insulation

Source: CR06: Figure 2

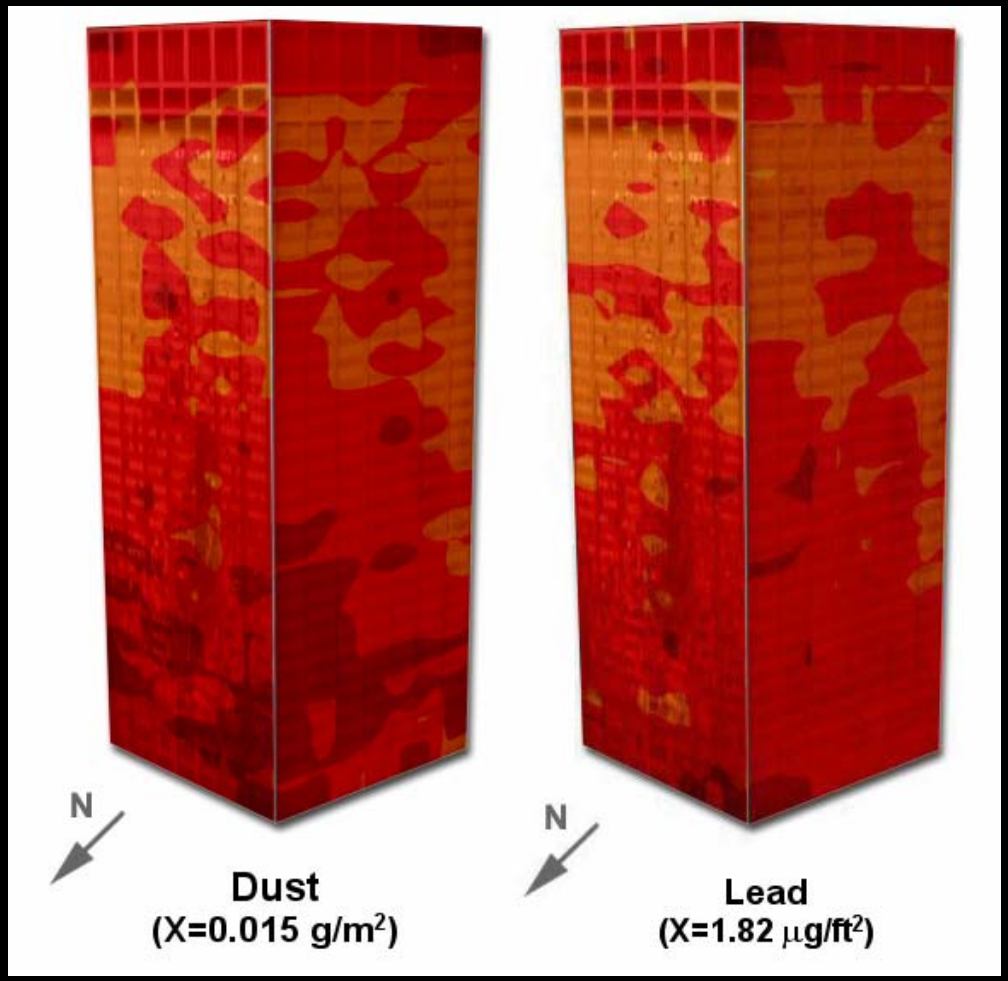
Type 4 Interiors With Conduits Penetrating The Top Plate Of The Wall

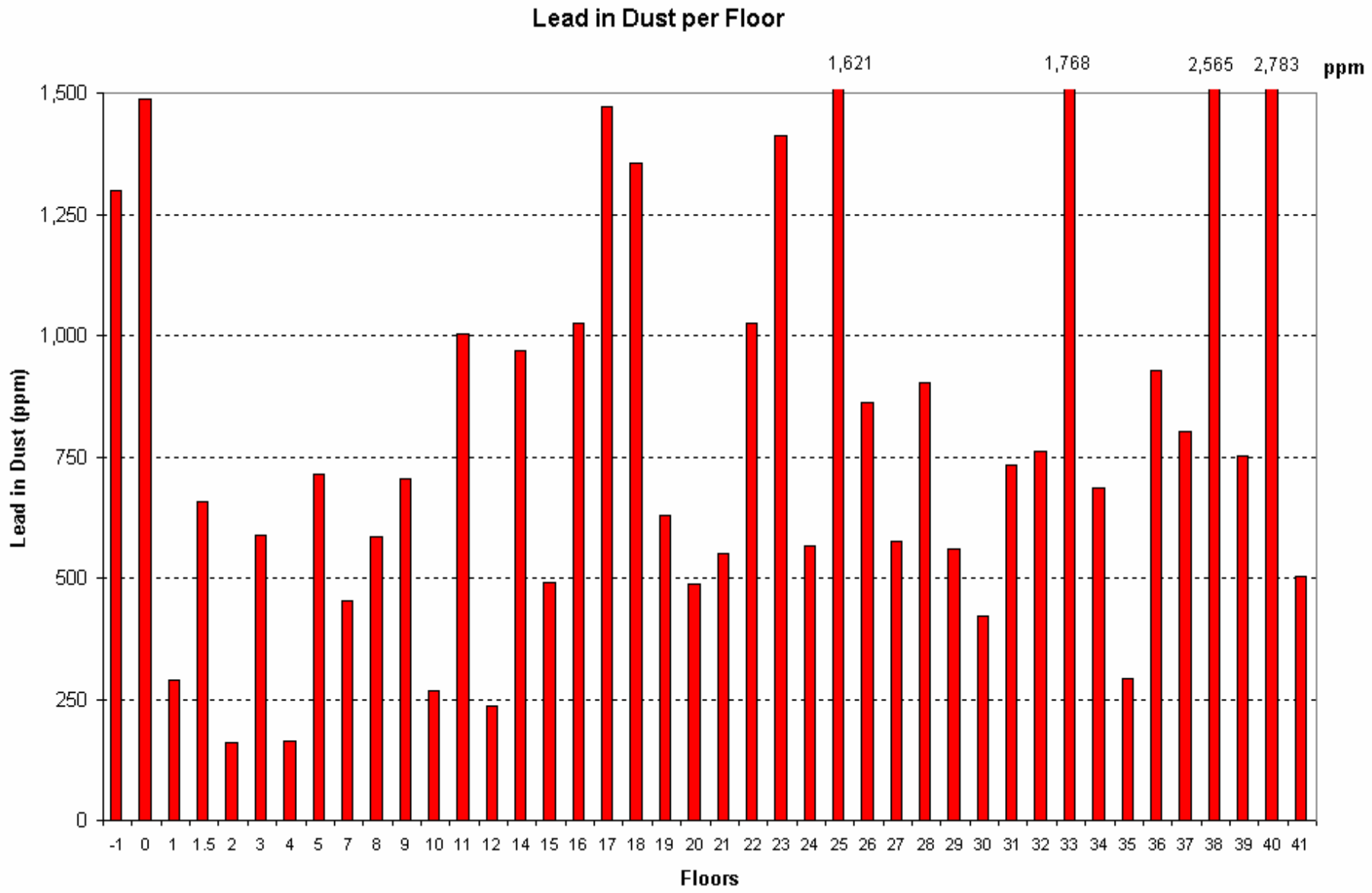


Source: CR06: Figure 3

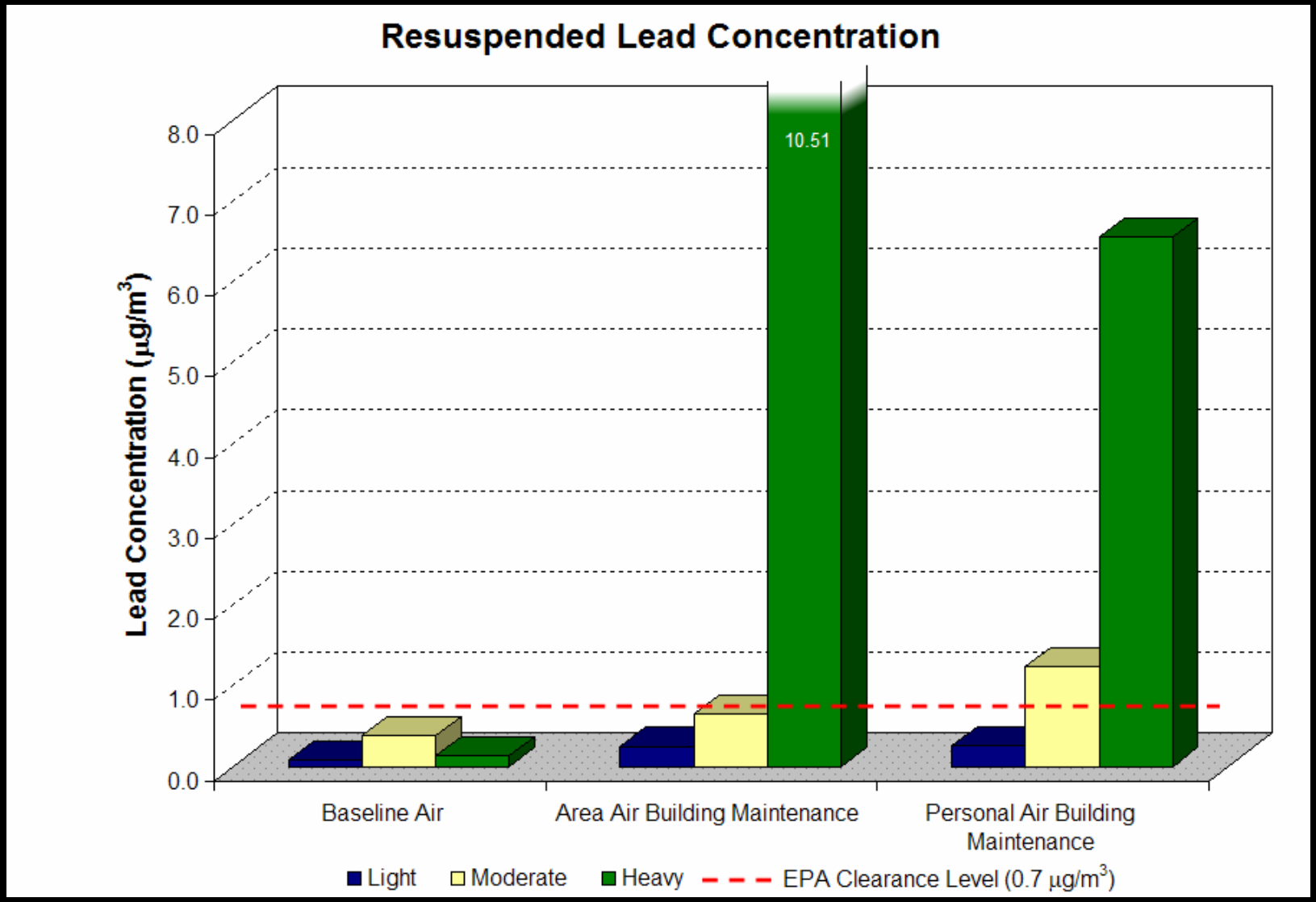
Other contaminants require containment

Lead Concentrations





RJ Lee*Group*, Inc.



Source: S2 Report, Fig 3

Characteristics of WTC Dust Increase Likelihood For Toxic Effects

Lead from WTC Dust is more easily absorbed by the body:

- Chemical and physical forms of environmental lead influence the amount of lead absorbed into the body **(bioavailability)**
- The greater the bioavailability - the more readily it is absorbed into the body following exposure (e.g., ingestion)
- *In vitro* testing of samples was conducted to determine the bioavailability of lead from WTC Dust contaminating the Building

Source: Risk Assessment and Public Health Implications of WTC Dust Contamination of the Deutsche Bank 130 Liberty Street Property, May 12, 2004

Bioavailability of Lead

Sample 1	89%
Sample 2	86%
Sample 3	97%
Sample Average	*91%*
EPA – Relative Bioavailability (for Soil and Dust)	60%

The lead in WTC Dust from the Building is at least 50% more bioavailable than is assumed by the EPA regarding human exposure to lead in soil and dust.

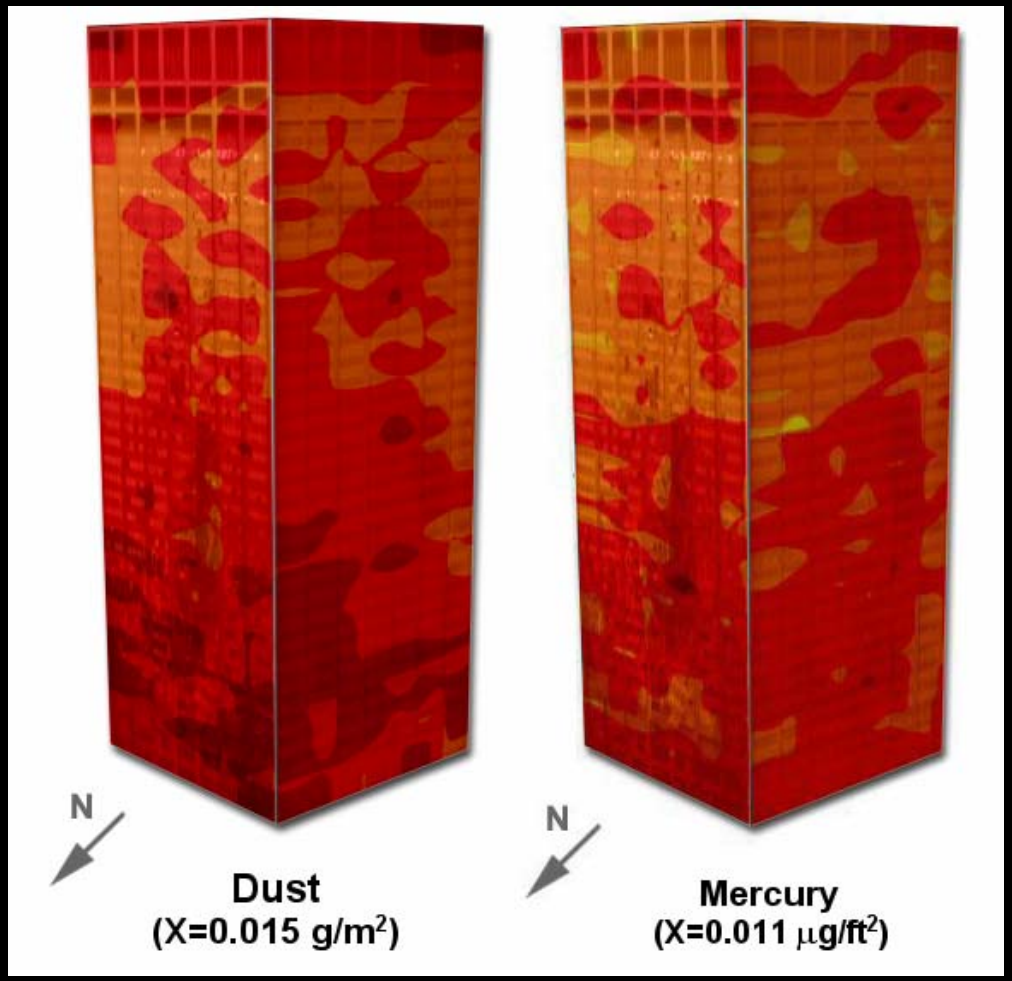
Source: Risk Assessment and Public Health Implications of WTC Dust Contamination of the Deutsche Bank 130 Liberty Street Property, May 12, 2004

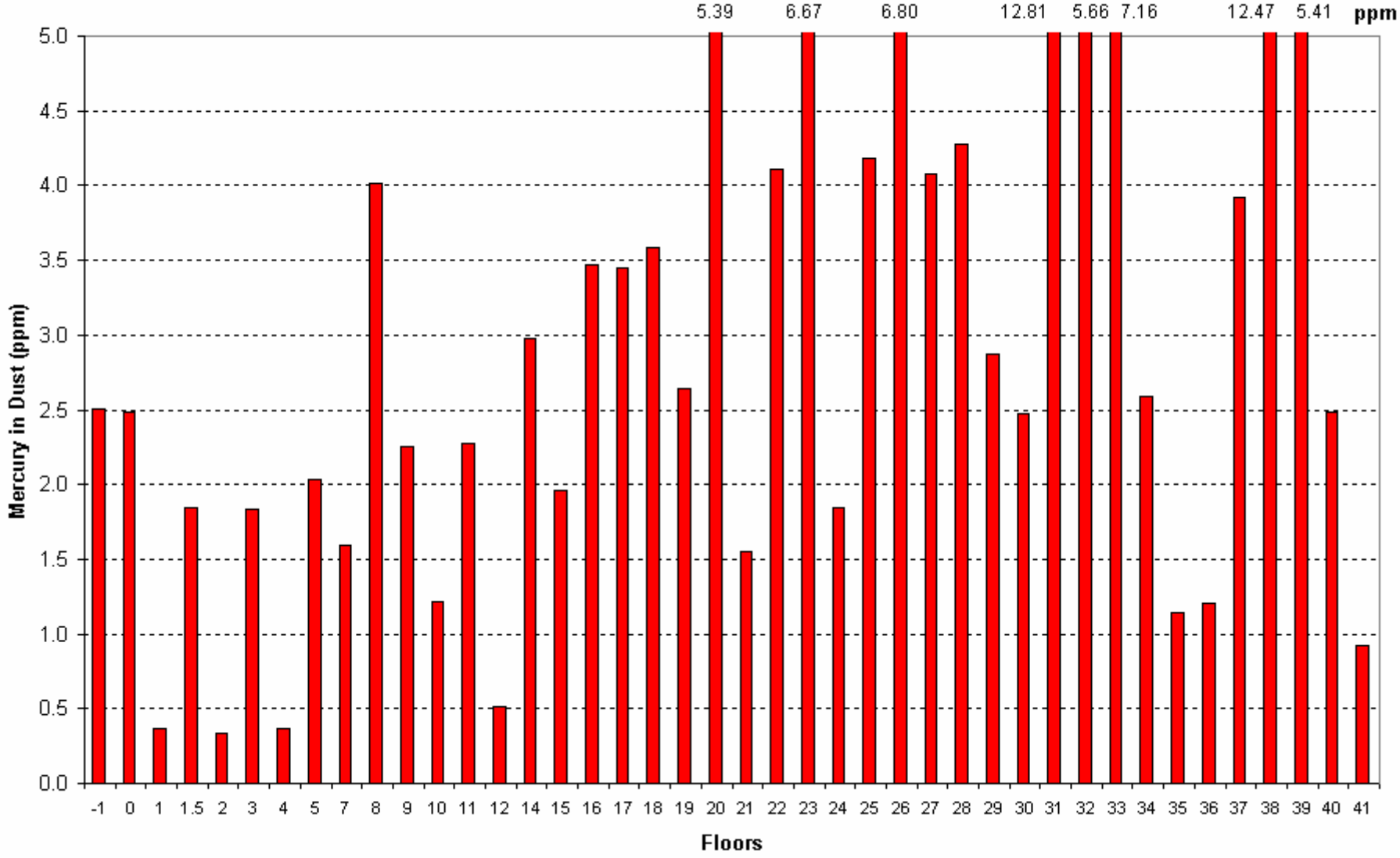
Size distribution (diameter in μm) of lead occurrences in the Building

Total Count	Median Diameter	Frequency Type	Percent Frequency Within Specified Size Range									
			0-1	1-2	2-5	5-10	10-15	15-25	25-35	35-45	45-55	>55
448	4.0	In-class	6.3	29.2	23.0	24.6	7.8	5.4	2.0	0.2	0.2	1.3
		Cumulative	6.3	35.5	58.5	83.0	90.8	96.2	98.2	98.4	98.7	100

Source: WTC Dust Signature Expert Report, May 2004, Table 4

Mercury Concentrations





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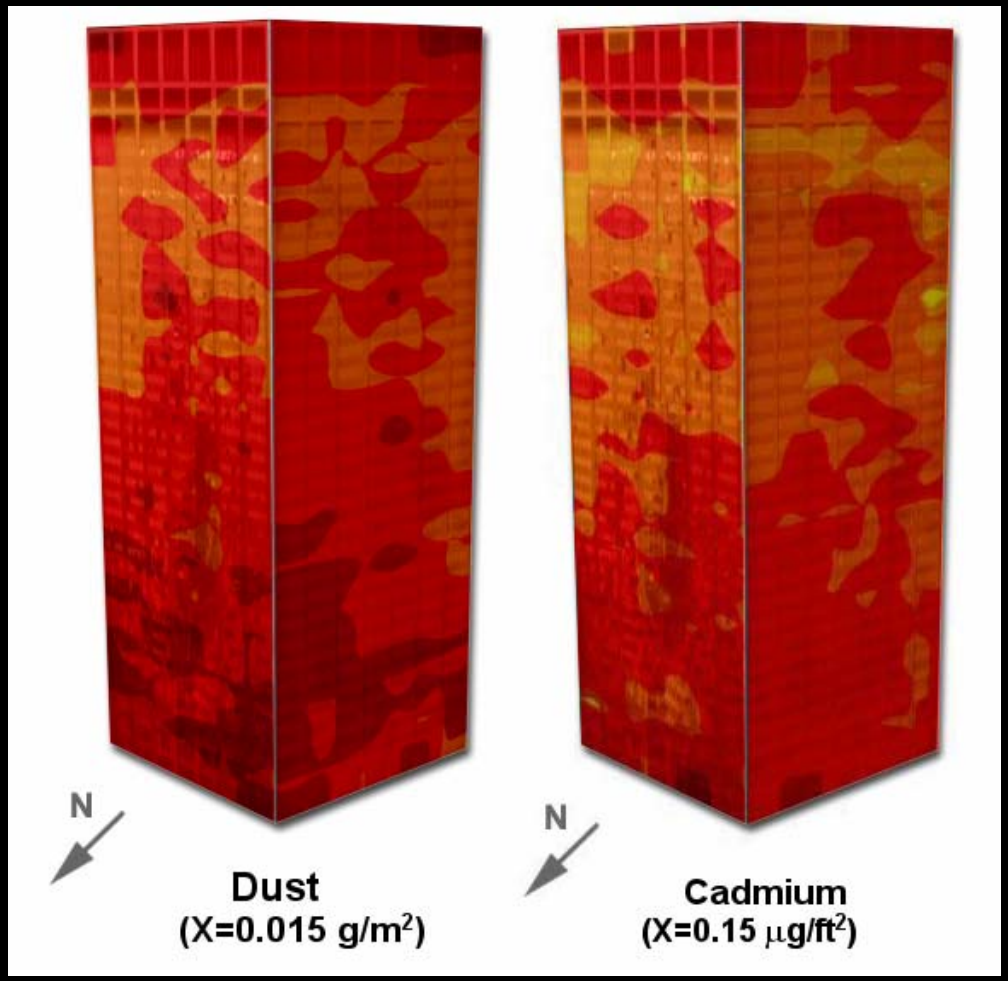
Average Mercury Levels During Drilling of Steel Beams Compared to Corresponding Non-drilling Averages

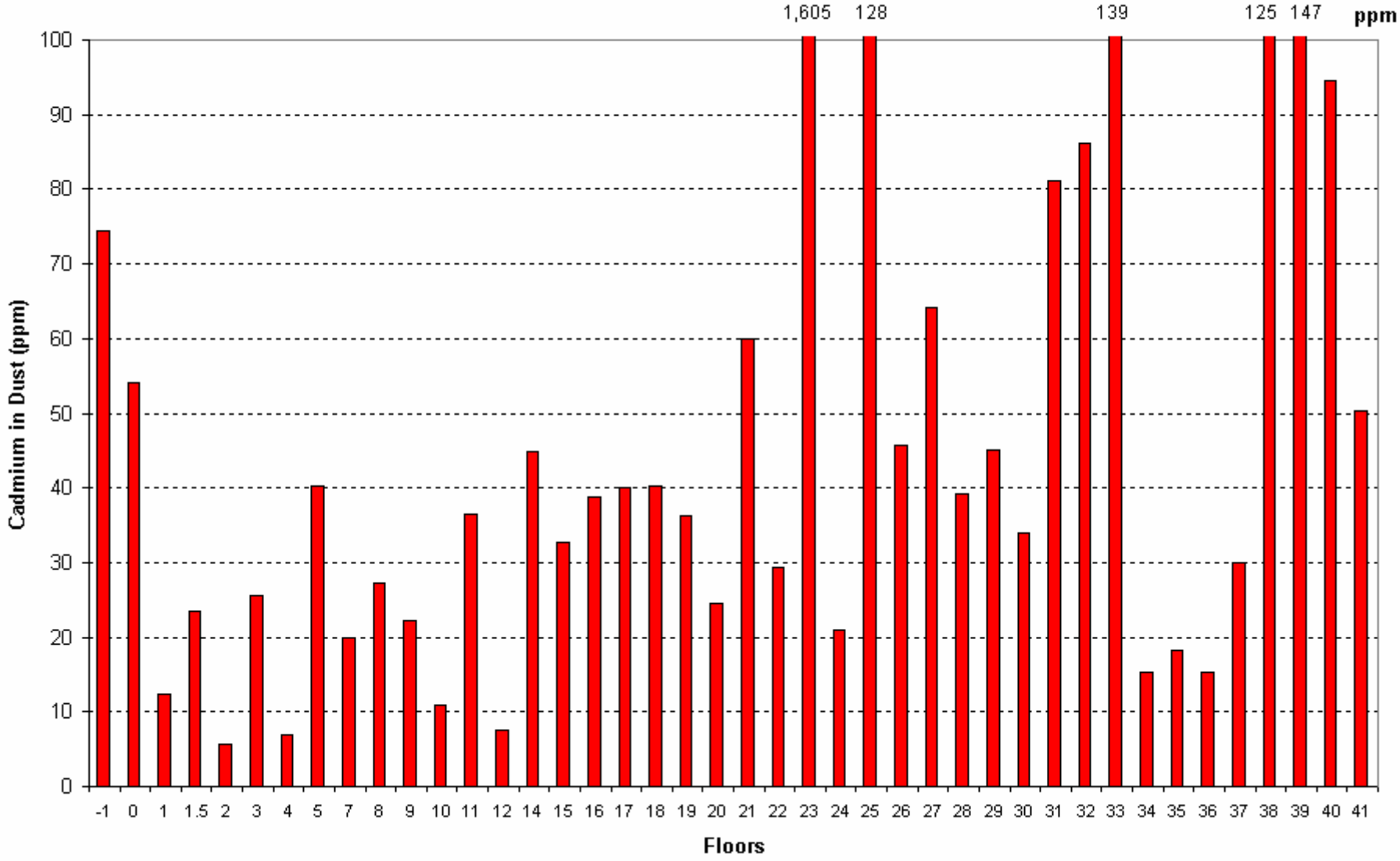
Date	Floor	Average Mercury concentration (ng/m³)	
		Drilling	Non drilling[1]
11/22/2003	34	204	11
11/24/2003	34	177	12
11/24/2003	29	275	13
12/03/2003	19	107	17

[1]Measurements were performed in the vicinity of the drill bit and the workers/samplers.

Source: H2 Report: Table 3

Cadmium Concentrations





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Mercury Regulation Levels

Table 1. Agency risk and threshold for toxicity levels.

Agency	Level
OSHA's Permissible Exposure Limit (PEL)[46] ceiling for mercury vapor	100,000 ng/m^3 (0.1 mg/m^3)
NIOSH Recommended Exposure Limit (REL)[31]	50,000 ng/m^3 (0.05 mg/m^3)
American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV)[32] for elemental mercury	25,000 ng/m^3 (0.025 mg/m^3)
Environmental Protection Agency (EPA) Integrated Risk Information System (IRIS) has an Inhalation Reference Concentration (RfC)[33]	300 ng/m^3
ATSDR Minimum Risk Level (MRL)[34]	200 ng/m^3
California's Recommended Exposure Limit (REL)[35,36]	90 ng/m^3

The OSHA PEL is a ceiling limit. The NIOSH REL and ACGIH TLV limits are time-weighted averages (TWA). The EPA RfC, ATSDR MRL and CA REL are based on assumed continuous (i.e., 24/7, 365 days per year) exposure.