

TASK ORDER 0001

SPECIAL INVESTIGATIVE AUDIT #14 (SIA#14)

**Environmental Data Trend Report
World Trade Center Disaster (DRAFT)**

prepared by:

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ENVIRONMENTAL DATA TREND REPORT WORLD TRADE CENTER DISASTER (DRAFT)

INTRODUCTION

Under Technical Direction (TD) 36, the IT Corporation Quality Assurance Technical Support (IT QATS) Program has been tasked by the US Environmental Protection Agency (USEPA) to evaluate environmental data collected in the aftermath of the World Trade Center (WTC) disaster (see Attachment 1). IT QATS was instructed to access environmental data compiled in the New York City (NYC) Response Monitoring Data Retrieval database, and evaluate those data for trends by analyte, location, and collection dates. The purpose of this document is to report and illustrate any apparent trends for select analytes of concern to EPA. This draft report contains the evaluation results for only a few parameters. Addendums will be provided when other analyte assessments are completed.

This work was performed by IT QATS under Task Order 0001 of USEPA Contract 68-W-01-010.

BACKGROUND

The terrorist attacks on the World Trade Center on September 11, 2001 completely destroyed the twin towers and several surrounding buildings. The initial collapse of the buildings released a dust cloud that hovered over the area and penetrated into broken windows of buildings in the surrounding area. The dust cloud was comprised primarily of materials inherent to the construction of the collapsed buildings. The concern was that some of those materials, including asbestos, airborne metals in dust, and particulate matter, have the potential to cause health problems to workers and residents if they are present in sufficiently high concentrations. In addition to materials in the dust cloud, organic and inorganic compounds from air conditioners, broken gas lines, fuel, and other sources may have been or continue to be released from the smoldering rubble pile into the air and ground water.

Since the attack, the USEPA and other federal, state, and local agencies have each day been collecting environmental monitoring data from the WTC destruction zone and surrounding area. Samples from a variety of media, including air, dust, water, river sediments, and drinking water have been taken and analyzed for the presence of contaminants that may pose a health risk to those working or living in the surrounding vicinity. (see http://www.epa.gov/epahome/wtc/data_summary.htm). EPA is using a variety of benchmarks and standards to assess the safety of workers and residents (see <http://www.epa.gov/epahome/wtc/activities.htm>). As of October 23, 2001, thousands of samples from various locations in lower Manhattan and the Staten Island Landfill have been taken and analyzed for asbestos, volatile organic compounds (VOCs), inorganic elements, particulates, and other parameters. Links to sample collection site maps (see Attachment 2) for several of these parameters are as follows:

Fixed Air Monitoring Station Map <http://www.epa.gov/epahome/wtc/monstations.htm>
Asbestos Monitoring Site Map <http://www.epa.gov/enviro/nyc/asbestos/>
Bulk Dust Monitoring Site Map <http://www.epa.gov/enviro/nyc/bulkdust/>
PM 2.5 Monitoring Site Map <http://www.epa.gov/enviro/nyc/pm25/>

The data from these analyses have been entered into the NYC Monitoring Data Retrieval database as they have become available.

TECHNICAL APPROACH

Database Description

The NYC Monitoring Retrieval Database (the database) is a secure archive containing search fields for agencies responsible for select sampling and analysis efforts, including the New York City Department of Environmental Protection (NYCDEP), New York State Department of Environmental Conservation (NYSDEC), New Jersey Department of Environmental Protection (NJDEP), New York State Department of Health (NYSDOH), and the EPA. The database contains search fields by media types, including air, indoor air, bulk dust, wipe-bulk dust, drinking water, water, sediment, and sludge.

The database contains four hundred thirty six (433) analytes including asbestos, VOCs (i.e., trichlorofluoromethane, benzene, trichloroethene, vinyl chloride, chloroform, etc.), hydrogen halides (i.e., hydrogen bromide, hydrogen chloride, and hydrogen fluoride), methyltertiarybutylether (MTBE), chlorinated dibenzodioxins/furans, semivolatile organic compounds (SVOCs), pesticides (i.e., DDT, endrin, methoxychlor), polychlorinated biphenyls (PCBs) and PCB congeners, inorganic metals (i.e., arsenic, barium, lead, iron, cadmium, mercury, zinc, etc.), alkanes/alkenes (i.e., pentane, hexane, hexene), classical chemistry parameters (i.e., color, pH, conductivity, free chlorine, hardness,), particulate content in air (i.e., PM 2.5, PM 10), and radioactive parameters (i.e., gross alpha, gross beta).

The database contains seventy five (75) fields per sample, including twenty six (26) station information fields, twenty four (24) sample information fields, and twenty five (25) result information fields. The station information fields contain information about the location where the sample was taken, such as the station type, station ID, geographic area, address, latitude, longitude, elevation, cross streets, etc. The sample information fields include sample ID, sample volume, sampling start and end dates and times, media, collection method, etc. The result information fields include the sample ID, laboratory analyzing the sample, analyte, analysis date, analytical result, result units, method detection limit (MDL), etc.

Significant information has been entered into the database for select parameters. For example, as of October 26, 2001, the database contains 13,299 rows of information for asbestos. Each row represents one sample taken for analysis. Of the available station, sample, and result information fields, 38 have been more or less consistently completed for asbestos in air. Therefore, over 505,000 pieces of information (13,299 X 38) have been entered into the database for just this one parameter. A similar amount of information has been collected for particulate matter in air with diameters smaller than 2.5 microns (PM 2.5). A complete listing of analytes in the database is

provided in Attachment 3.

Data Analysis Approach

IT QATS uses the following technical approach in assessing data trends:

- For each parameter of interest, the NYC Response - Predefined HTML Output is examined and Microsoft .cvs spreadsheet files are created as needed.
- All sample information fields are clicked on, therefore allowing all available data to be downloaded into the spreadsheet files.
- The data in each spreadsheet are evaluated and sorted to allow evaluation of potential trends.
- Microsoft Excel® allows sorting 3 columns by priority. The data are first sorted by positive “hits”, analyte concentration from high to low, and location.
- The positive hit data are sorted by sample collection date and concentration.
- If sufficient data points from one site exist over time, data are sorted by date, concentration, and location.
- Graphs are created and printed to illustrate trends or lack thereof.
- For select analytes, statistical correlations are calculated between analytes, locations, and dates.

Summaries of each parameter are prepared indicating the characteristics (i.e., the numbers of samples taken, general result concentration range, etc.), discussion of trends, and conclusions. If there are inconsistencies that may result in quality concerns, these are discussed. Graphs illustrating trends are referenced and provided. When weather conditions appear to have been a factor in some of the trending data for air samples, this is also discussed. A listing of the weather conditions for New York City for each day since September 11, 2001 is also provided in Attachment 4.

Following the individual parameter assessments, statistical evaluation of select multiple parameters is performed by location to determine potential correlation.

RESULTS

Benzene

Characteristics (benzene):

- C A total of 110 samples were collected for benzene between 9/22/01 and 10/23/01.
- C These include 14 drinking water and 96 air, fixed air, and bulk dust samples.
- C The 14 drinking water samples were taken on September 15, 2001 and analyzed for benzene on GC/MS by Region 2 EPA. The station ID for the water samples was identified but the location was not described. Although the data fields did not indicate whether the positive results were detected, all results were 1 ug/l “reporting limit”, and assumed to be non-detected.
- C The air samples were collected from September 22 to October 21. Nearly all were identified as being analyzed by GC/MS in the Region 2 Trace Atmospheric Gas Analyzer (TAGA) mobile laboratory.
- C Most samples were taken from WTC South Tower, WTC North Tower, or Sample Locations 2 and 3 at Rubble (work zone).
- C Benzene was detected in 57 of the 96 air samples, ranging from 5 ppb to 86,000 ppb.
- C The highest concentration of benzene was 86,000 ppb in a sample taken from the site “North Tower Middle” on October 5, 2001. Note that the location descriptions and sample collection dates for three samples from North Tower Middle were initially in the database, but were later removed. However, the concentrations (86,000, 39,000, and 38,000 ppb, respectively) and sample IDs (10470-B, 10465, and 10470-A, respectively), remain in the database.
- C The detection limits for the samples reported as “not detected” ranged from 20 ppb to 50 ppb.
- C Quality Control. One (1) blank sample was analyzed with the air samples. Although the sample volume taken for the air samples was variable, ranging from 20 ml to 250 ml, there is no indication the data are faulty.

Data Trends (benzene):

- C Benzene was non-detected in all 14 drinking water samples.
- C Concentration versus location analysis of the benzene in air samples reveals the highest concentrations are at the WTC locations (North and South Towers and Work Zones) (see Figure 1).
- C Concentration versus date trend analysis reveals that concentrations from the WTC site locations do not appear to be decreasing with time (see Figure 2). A high concentration of benzene (24,000 ppb) was observed on October 23, 2001 at the WTC North Tower Center.

Conclusions (benzene):

Benzene concentrations remain elevated at the WTC locations. This may indicate that the rubble pile, which is still burning, is emitting benzene from the combustion of office or other materials present in the mass. The Occupational Safety & Health Administration (OSHA) Regulation for Benzene Permissible Exposure Limits (PEL) Time Weighted Average (TWA) is 1 ppm (1000 ppb) as an 8-hour time-weighted average. The Short Term Exposure Limit (STEL) is

no more than 5 ppm over a 15 minute period (OSHA Standard 29-CFR, Benzene-1910.1028) A recent air sample from the WTC site showed levels of 24,000 ppb benzene.
(Standard 29-CFR) 1910.1028

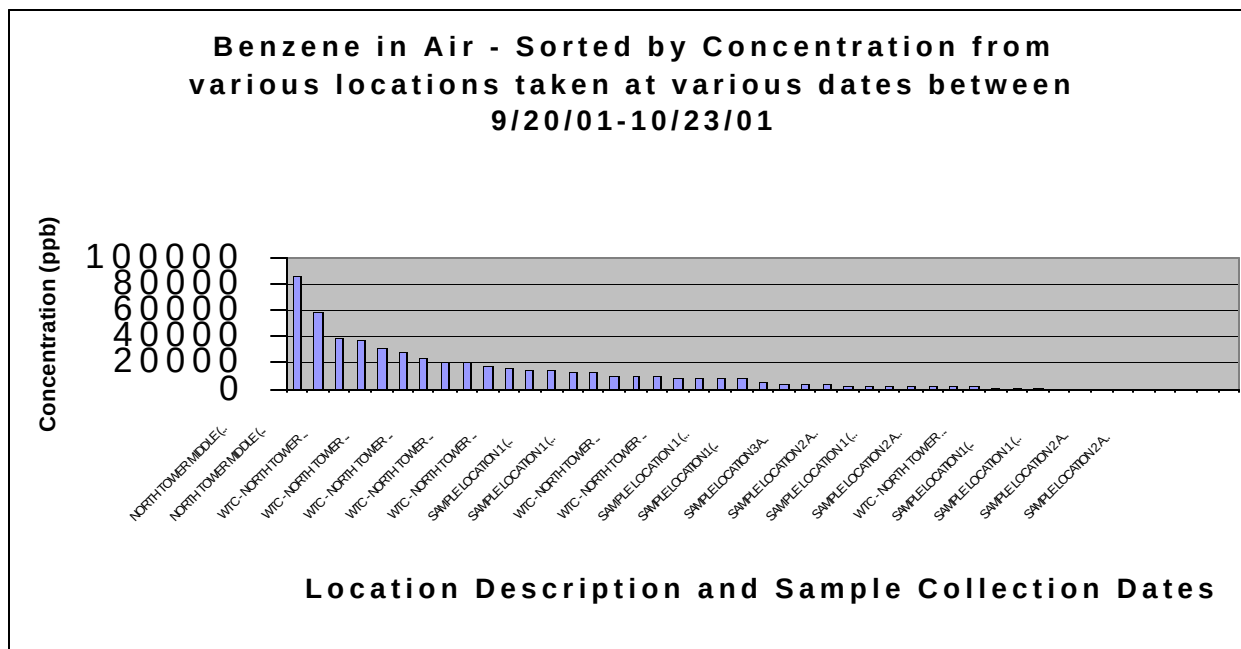


Figure 1. Benzene in Air, All Locations, Sorted by Concentration

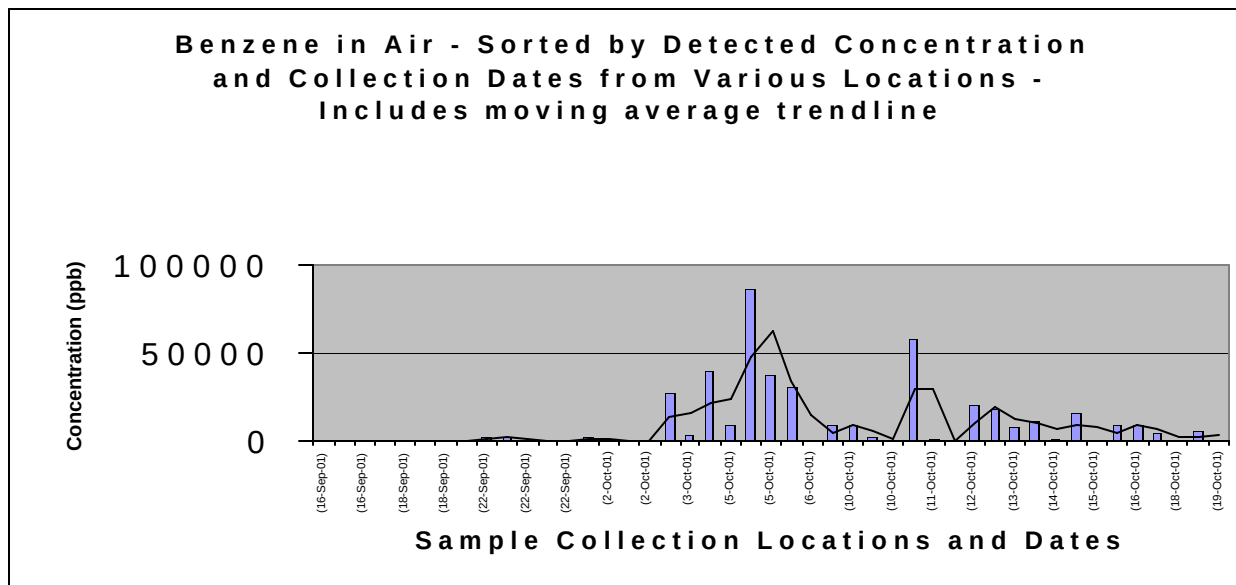


Figure 2. Benzene in Air, Sorted by Date

Dichlorodifluoromethane

Characteristics (dichlorodifluoromethane):

- C A total of 85 air, fixed air, and bulk dust samples were collected for dichlorodifluoromethane between September 22 and October 23, 2001.
- C Nearly all samples were indicated as taken at "0" elevation or ground level, and were indicated as being analyzed by GC/MS in the TAGA mobile laboratory.
- C Dichlorodifluoromethane was detected in 13 of the 85 samples at concentrations ranging from 8.1 to 240 ppb.
- C The highest concentration was 240 ppb, from a sample taken from the WTC South Tower on October 16, 2001.
- C The detection limit for those samples reported as "Not Detected" ranged from 20 ppb to 1000 ppb.
- C The sample volume for the air samples was variable, ranging from 0.1 ml to 250 ml. Use of samples of low volume (i.e., 1 ml), caused the detection limits to increase accordingly (i.e., 1000 ml). Although the sample volumes used were variable, there is no indication the data are faulty as a result.
- C QC. One (1) blank sample was analyzed.

Data trends (dichlorodifluoromethane):

- C Concentration versus location trend analysis reveals the highest dichlorodifluoromethane concentrations are at the WTC locations (towers and work zones).
- C Concentration versus date trend analysis reveals no correlation. The highest observed concentration of dichlorodifluoromethane (240 ppb) was observed from a sample taken on October 16, 2001 at the WTC South Tower (Location 1).

Conclusions (dichlorodifluoromethane):

Dichlorodifluoromethane concentrations remain elevated at the WTC locations. This may indicate the compound, which may have been present in the air conditioning system of the collapsed buildings, is being released as the rubble pile burns.

Trichlorofluoromethane

Characteristics (trichlorofluoromethane):

- C A total of 90 samples were collected for trichlorofluoromethane, including 14 drinking water samples, and 76 air/fixed air/bulk dust samples.
- C The 14 drinking water samples were taken on September 15, 2001 and analyzed by GC/MS for trichlorofluoromethane. The sampling location was not identified. Although the data fields did not indicate whether the positive results were detected, all results were 2 ug/l "reporting limit", and assumed to be non-detect.
- C The air samples were collected from September 22 to October 21 by both USEPA and NYDEP. All air samples were taken at "0" elevation or ground level. Nearly all were identified as being analyzed by GC/MS in the TAGA mobile laboratory.
- C 49 of the 76 air/fixed air/bulk dust samples were taken at the WTC South Tower, North Tower, or rubble (work zone).
- C Trichlorofluoromethane was detected in 18 samples at concentrations ranging from 9.4 ppb to 310 ppb.
- C The highest concentration was 310 ppb, from a sample taken from the WTC South Tower

on October 22, 2001.

- C The detection limit for those samples reported as “Not Detected” ranged from 20 ppb to 50 ppb.
- C QC. One (1) blank sample was analyzed. Although the sample volume taken for the air samples was variable, ranging from 20 ml to 250 ml, there is no indication the data are faulty.

Data trends (trichlorofluoromethane):

- C Trichlorofluoromethane was non-detected in all 14 drinking water samples.
- C Concentration versus location trend analysis reveals the highest trichlorofluoromethane concentrations are at the WTC locations (towers and work zones) (see Attachment 5-TCF(1)).
- C Concentration versus date trend analysis reveals no correlation. The highest observed concentration of trichlorofluoromethane (310 ppb) was observed from a sample taken on October 22, 2001 (see Attachment 5-TCF(2)).

Conclusions (trichlorofluoromethane):

Trichlorofluoromethane concentrations remain elevated at the WTC locations. This may indicate the compound, which may have been present in the air conditioning system of the collapsed buildings, is being released as the rubble pile burns.

Asbestos

Characteristics (asbestos):

- C As of 10/26/01, 13299 samples had been analyzed from several general locations. These include approximately 26 from Brooklyn and Jersey City, 3504 from the Freshkills Landfill in Staten Island, 5468 from Lower Manhattan, and 595 from New Jersey.
- Select data from the analysis of approximately 1400 samples by Phase Contrast Microscopy (PCM) collected between September 18, 2001 to October 18, 2001 have been evaluated from various sampling locations within these general zones.
- The data evaluated were reported in Fibers per millimeter squared (f/mm²) or Structures per millimeter squared (S/mm²).
- The sample data evaluated were collected from 17 sites from Lower Manhattan, 16 Sites from the Freshkills Landfill; and 4 sites from New Jersey.
- Each site evaluated contains data from 2 to over 50 analyses.
- The vast majority of analyses were reported as non-detects for asbestos.
- Nine (9) PCM concentrations exceeded 70 f/mm², with the highest value reported at 100 f/mm² at Location D, Albany and Greenwich (see Figure 4).

Data trends (asbestos):

- C Concentration versus location trend analysis shows that in general higher concentrations of asbestos are observed in sampling sites from Lower Manhattan than from the Landfill and other locations. However, from the analyses evaluated, only about 1% (9 of 755) of PCM results from the Lower Manhattan sites exceeded 70 f/mm². The highest concentration was observed at Location D, Albany and Greenwich (see Figure 4).
- C Concentration versus date trend analysis reveals no correlation over time. However,

several sites indicated high PCM concentrations on October 10, 2001, which is illustrated from a sample taken from Location F, Vesey St. and West St. on that date (See Figure 3).

Conclusions

- The evaluation of the PCM data revealed that nine (9) samples from five (5) Lower Manhattan sites exceed the Asbestos Hazardous Emergency Response Act (AHERA) standard of 70 f/mm² which defines when it safe for children to reenter buildings after asbestos remediation activities.
- Inconsistencies in the how the data were collected, analyzed, and documented make it difficult to evaluate the data for trends. For example,
 - Five different methods are indicated in the database: Polarized Light Microscopy (PLM); Infrared (IR); Transmission Electron Microscopy (TEM) (AHERA); TEM NIOSH 7402; and Phase Contrast Microscopy (PCM) NIOSH 7400.
 - The results are reported in different units, depending upon the method applied: percent (%); fibers per millimeter squared (f/mm²), fibers per cubic centimeter (f/cc); structures per mm² (s/mm²); structures smaller than 5 microns (S<5u); structures greater than 5 microns (S>5u); AF/NAF; Adjusted TEM f/cc; and some results were reported with no assigned units.
 - Some fields are inconsistently completed. For example, the DETECTED/NOT-DETECTED column was inconsistently completed, and the method detection limit (MDL) column was usually not completed.
- The data collected from other analyses and methods has yet to be evaluated. Note that the results evaluated were for PCM analysis only, and do not include TEM and other results.

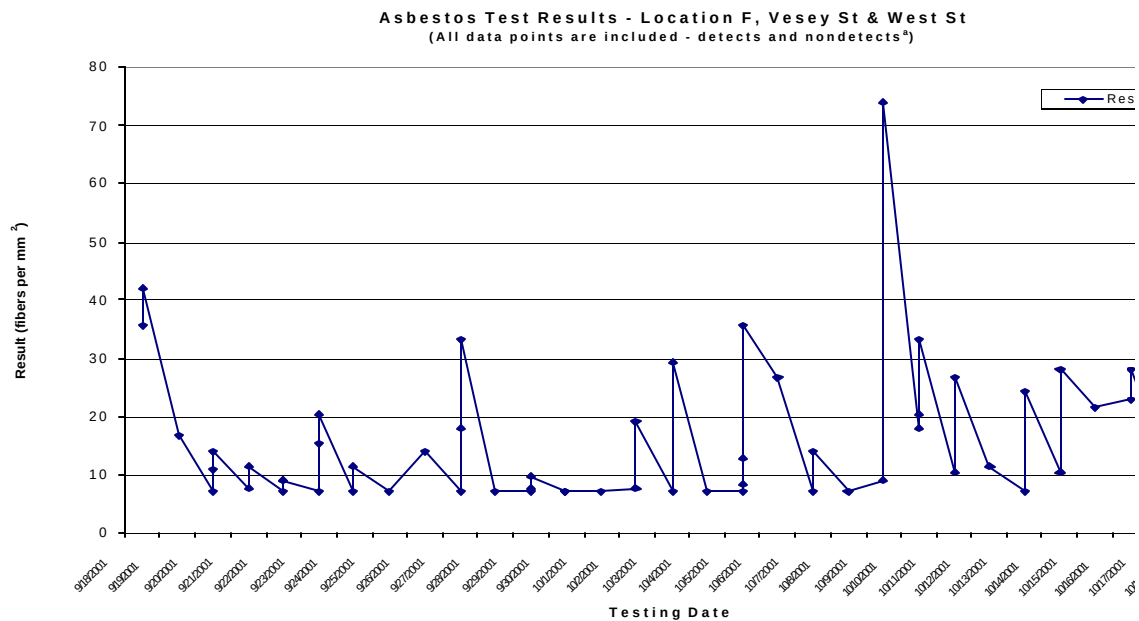


Figure 3. Asbestos at Location F

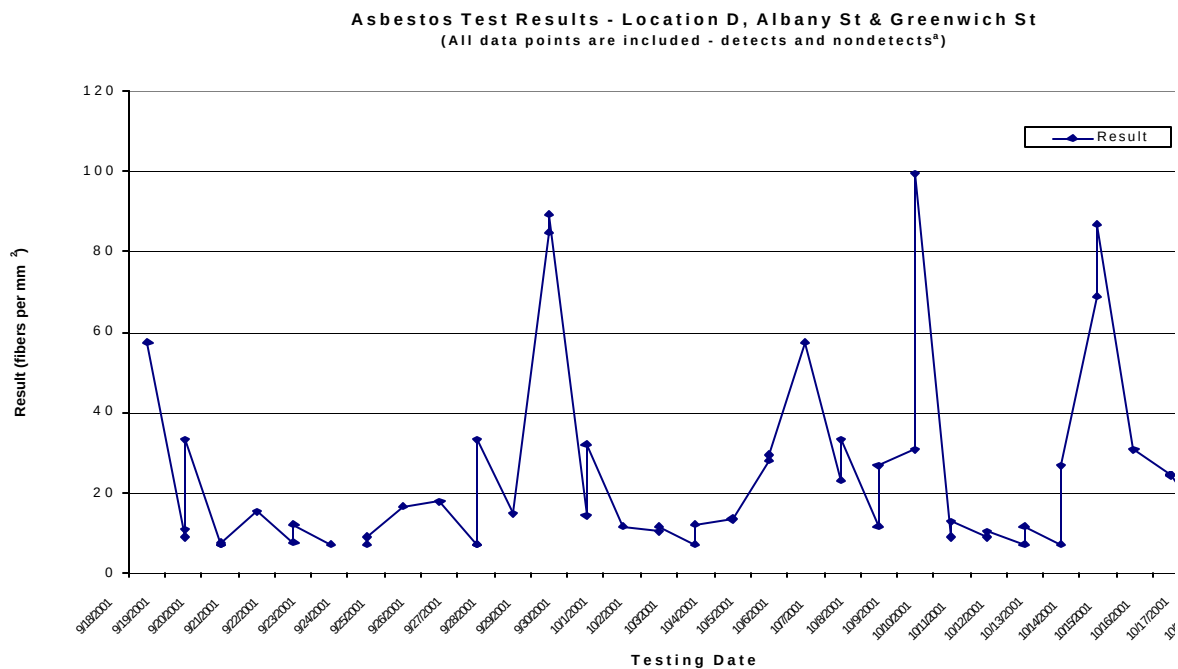


Figure 4. Asbestos at Location D

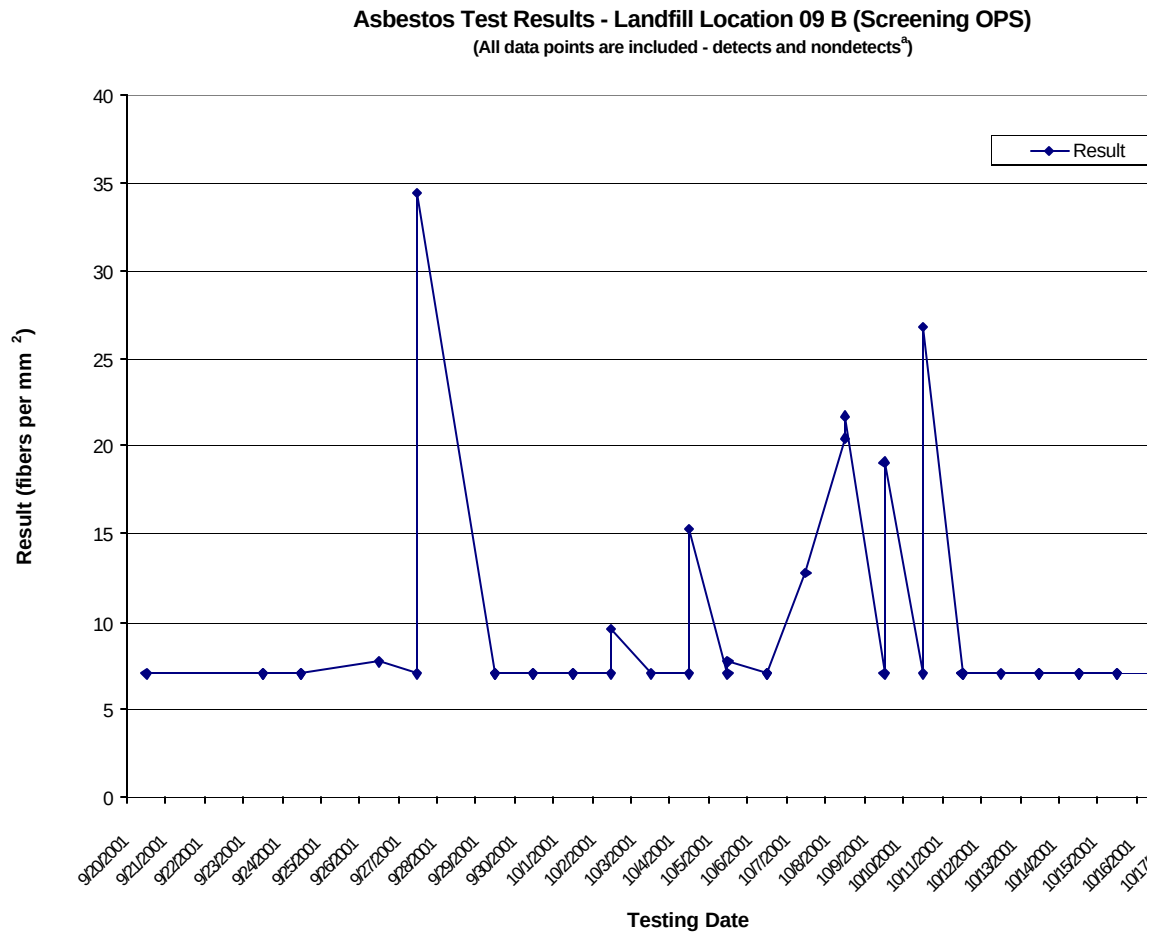


Figure 5. Asbestos at Landfill Location 09 B

Sulfur dioxide and Isocyano-methane

Only one sampling/analysis event is available for each of these two compounds, both from September 22.

- Sulfur dioxide was found at the Liberty St & West St location at 4.2 ppbv.
- Isocyano-methane was detected at 220 ppbv at the WTC-Building 5 SW site.

Other Target Compounds and Correlations

The results and correlations between select representatives from several target compound classes, including chlorinated dioxins and furans (CDD/CDF), polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), metals, and volatile organics (VOCs) are described in the following sections. Comparisons and correlations are described for the following:

- CDD/CDF in four (4) bulk dust samples from Battery Pk & 2nd Pl on Sept 16
- Aroclors 1254 and 1260 in bulk dust samples from seven (7) locations
- Total PCBs in air from Church St & Dey St. and WTC-Building 5 SW
- Benzo(a) pyrene, dibenzofuran, and benzo(a)anthracene in bulk dust samples at four (4) locations
- Lead and Chromium in air samples from three (3) locations
- Benzene/toluene vs. trichlorofluoromethane/dichlorodifluoromethane
- Uncorrelated lead and total PCBs in air

Correlation coefficients were calculated for many of the data sets. In general, correlation coefficient values near 1.0 indicate highly similar patterns in the data and are suggestive of similar sources of the compounds. Lower correlation coefficients indicate less similar trends and different sources. In examining the data, however, the correlations between compounds from different classes are difficult to describe because sample results for different compound classes are from different locations and were taken on different dates. For example, from the data examined to date, the correlation between benzene and lead from the Austin Tobin Plaza Rubble Work Area, where there is a large number of benzene results, is not possible since lead results from this sampling site are not available. Results from nearby sampling sites may reveal correlations between different target compound types but exhaustive statistical evaluations between sampling sites and compound classes is beyond the scope of this preliminary work.

Chlorinated Dioxin/Furan (CDD/CDF) in Bulk Dust

The results from four (4) CDD/CDF bulk dust samples taken on September 16 at the Battery Pk & 2nd Pl sampling site are summarized in Table 1 and Figure 3. From these results, the pattern in CDD/CDF congeners and congener class concentrations in the different samples are highly correlated suggesting a single source. The correlation coefficient calculated between samples AO6353 and AO6351 is 0.9726. In each of the four samples, CDD concentrations generally increase with the level of chlorination. In three of the four samples, OCDD is approximately ten times (10x) the concentration of total TCDD. The reverse is true of CDF concentrations where the concentration decreases with the level of chlorination. In all four samples, the concentration of OCDF is approximately one-tenth (1/10) the concentration of total TCDF. The highest reported concentration of 2378-TCDD, the most toxic CDD/CDF, was 325 pg/g (ppt).

**Table 1. CDD/CDF in Bulk Dust
Battery Pk and 2nd Pl; Sept 16
Units: pg/g (ppt)**

CDD/CDF	Sample ID AO6354	Sample ID AO6353	Sample ID AO6355	Sample ID AO6351
2378-TCDD	1.44	2.68	3.41	5.18
Total TCDD	102	109	167	325
Total PeCDD	64.2	66.7	135	189
Total HxCDD	72.4	79.2	156	224
Total HpCDD	125	360	445	696
OCDD	299	1890	2630	3170
2378-TCDF	10.7	20.6	23.9	43.8
Total TCDF	656	910	1170	2190
Total PeCDF	392	451	693	1110
Total HxCDF	233	241	373	579
Total HpCDF	136	154	232	356
OCDF	81.5	113	168	238

Battery PK & 2nd PI CDD/CDF Profiles

Bulk Dust Samples

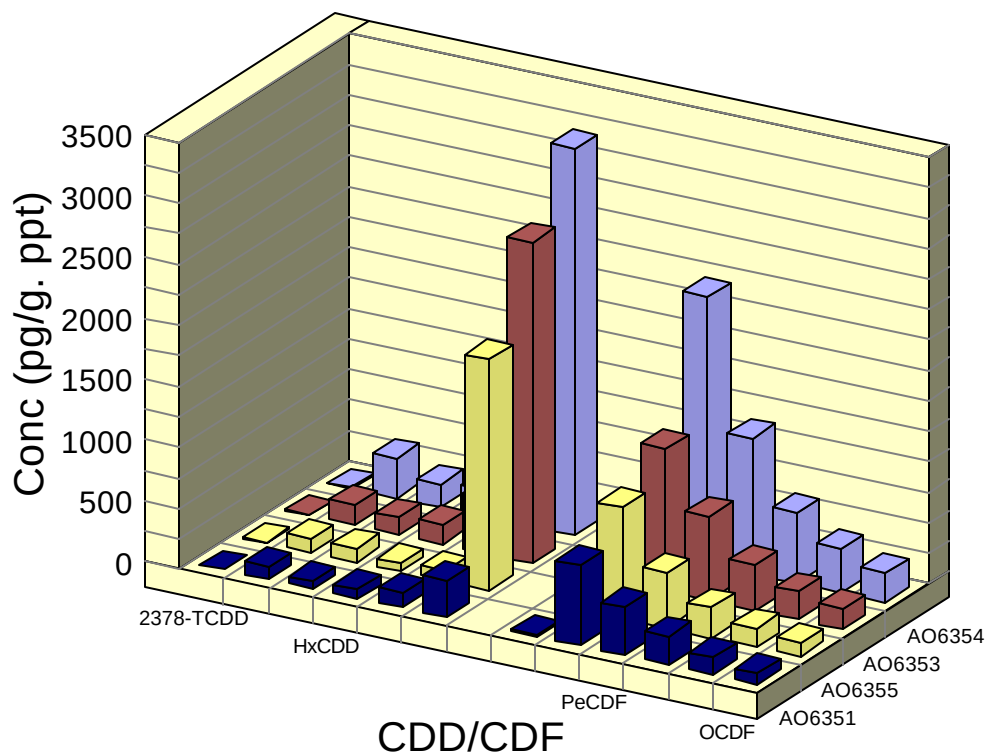


Figure 6. CDD/CDF in Bulk Dust from Battery St & 2nd PI

Polychlorinated Biphenyls (PCBs) in Bulk Dust and Air Samples

Aroclor 1254 and Aroclor 1260 results from the WTC database reveal high levels of Aroclor 1260 in several bulk dust samples from several sampling sites. Three (3) of the seven (7) samples listed in Table 2 were found to contain Aroclor 1260 at levels greater than 1000 mg/Kg (ppm). Aroclor 1254 results were generally lower or not detected. No PCB congener or Total PCB results for bulk dust samples have yet been found. PCB congener results for September 20 water samples were found but have not been evaluated.

**Table 2. Aroclor 1260 and Aroclor 1254 Results
Sept. 16 Bulk Dust Samples
Units: mg/Kg (ppm)**

Location	Aroclor 1254	Aroclor 1260
110 Greenwich Street	< 0.740	< 0.740
22 Cortlandt	0.550	1.20
600 Gateway Plaza	0.170	1.50
Albany St & West St (WTC)	not detected	1400
Battery Pk & 2nd Pl	not detected	1600
North End & Park Pl	not detected	1100
Park Place & West Broadway	not detected	159

Total PCBs in Air samples were reported for several locations on several sampling dates, as listed Table 3 and illustrated in Figure 4. At Location B - Church St & Dey St and the WTC - Building 5 SW site, the maximum concentrations were detected on October 2, 2001. Comparison of the results from these two (2) sites reveal a correlation coefficient of 0.8993.

Table 3. Total PCBs in Air
Units: ng/m3

Location	Date	Concentration
Location A - Barclay St & West Broadway	23-Sept	< 3.44
	27-Sept	38.7
	2-Oct	8.3
	4-Oct	77.2
	8-Oct	< 1.77
Location B - Church St & Dey St	16-Sept	6.98
	23-Sept	4.14
	27-Sept	4.99
	2-Oct	17.9
	4-Oct	13.3
	8-Oct	4.54
Location C - Broadway & Liberty St.	23-Sept	< 3.18
	27-Sept	< 1.81
	2-Oct	8.16
	4-Oct	<1.8
	8-Oct	15.7
WTC-Building 5 SW	23-Sept	55.9
	2-Oct	153
	4-Oct	58.6
	8-Oct	18.1

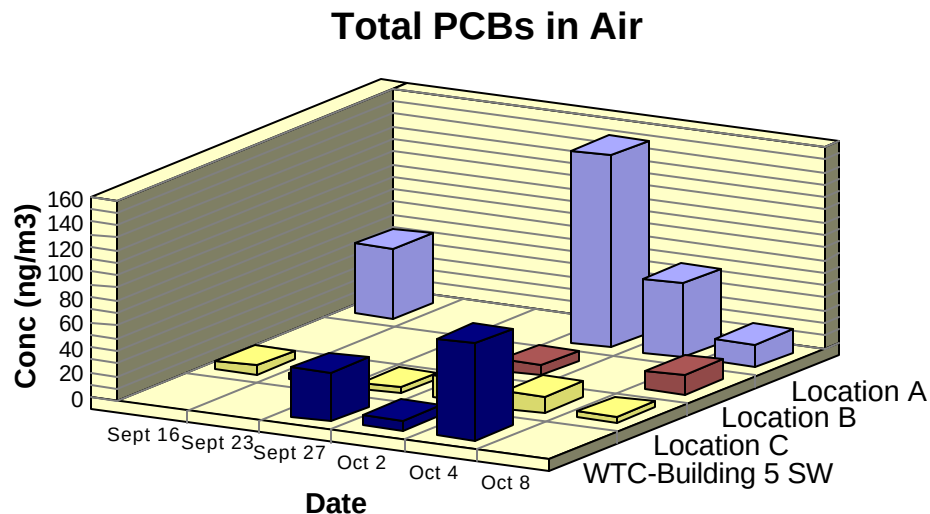


Figure 7. Total PCBs in Air at Four (4) locations

Polyaromatic Hydrocarbons (PAHs) and Dibenzofuran

Three (3) representative compounds, benzo(a)pyrene (BaP), dibenzofuran (DBF), and benzo(a)anthracene, were detected in bulk dust samples in a consistent trend over at least four (4) sites, as described in Table 4 below. At each site, the ratio of benzo(a)anthracene and benzo(a)pyrene to dibenzofuran was approximately four (4) to one (1), which like the CDD/CDF profile, suggests a common source. The correlation coefficient calculated for BaP and DBF in these samples was 0.9995. Results for benzo(e)pyrene, another toxic PAH, were not available for these samples.

**Table 4. Benzo(a)pyrene, Dibenzofuran and Benzo(a)anthracene
Bulk Dust; Units: ug/Kg (ppb)**

Site	Date	Benzo(a)pyrene	Dibenzofuran	Benzo(a)anthracene
22 Cortland	10-Oct	76000	18000	71000
600 Gateway Plaza	10-Oct	8500	1800	7300
Albany St & West St (WTC)	16-Sept	6200	1500	5800
Battery Pk & 2 nd Pl	16-Sept	7900	1300	7200

Lead and Chromium

The lead and chromium in air concentrations at three locations is presented below in Table 5. Lead was detected in all of the samples with a maximum of 5.4 ug/m³. Chromium was not detected in ten (10) of the eighteen (18) samples. Lead and chromium results from the Location A - Barclay & West Broadway site are correlated at 0.8403.

Table 5. Lead and Chromium in Air
Units: ug/m3

Location	Date	Lead	Chromium
Location A - Barclay St & West Broadway	23-Sept	4.3	< 0.12
	27-Sept	2.8	0.32
	4-Oct	1.4	< 0.12
	8-Oct	0.55	< 0.12
	11-Oct	0.49	0.16
	15-Oct	0.13	0.23
Location B - Church St & Dey St	23-Sept	1.7	< 0.12
	27-Sept	0.69	0.3
	4-Oct	0.26	< 0.12
	8-Oct	0.32	< 0.12
	11-Oct	0.23	0.27
	15-Oct	0.28	< 0.13
WTC-Building 5 SW	23-Sept	5.4	< 0.12
	2-Oct	1.1	Detected
	4-Oct	0.42	< 0.12
	8-Oct	0.73	< 0.12
	11-Oct	0.48	0.24
	15-Oct	1.1	0.38

The maximum concentration of lead in bulk dust samples was 370 mg/Kg (ppm) in a sample from the Park Place & West Broadway location on September 16. A high value of 1500 ug/L (ppb) for a water sample from September 14 was also reported. No location is listed for the water samples.

Volatile Organic Compounds (VOCs)

The concentrations of benzene and toluene in air appear to maximize at the WTC North Tower Center. The highest concentrations of benzene and toluene reported were 58,000 ppb and 23,000 ppb, respectively, on October 11. The concentrations for these two (2) compounds and two (2) freons are listed below in Table 6. Benzene and toluene are highly correlated (0.9538 correlation coefficient), but benzene does not correlate with the freons (0.2538 correlation coefficient), suggesting different sources.

Table 6. VOCs in Air at WTC North Tower Center
Units: ppb

Date	Benzene	Toluene	Trichlorofluoromethane (Freon 11)	Dichlorodifluoromethane (Freon 12)
3-Oct	< 20 28000	< 20 13000	< 20 120	< 20
6-Oct	31000	14000	230	< 20
11-Oct	58000	23000	< 20	98
12-Oct	21000	9600	54	< 20
13-Oct	18000	11000	< 50	< 50
14-Oct	1800	900	< 20	< 20
15-Oct	16000	10000	49	27
16-Oct	9200	6200	< 50	< 50
18-Oct	4500	470	< 20	< 20
19-Oct	720	290	< 20	< 20
20-Oct	15000	7400	< 40	< 40
21-Oct	2700	570	< 40	< 40
22-Oct	8700 13000 15000	2300 3700 4800	< 50 < 1000	< 50 < 1000
23-Oct	20000 24000	7000 7500	< 20 88	

VOCs in Air at WTC North Tower Center

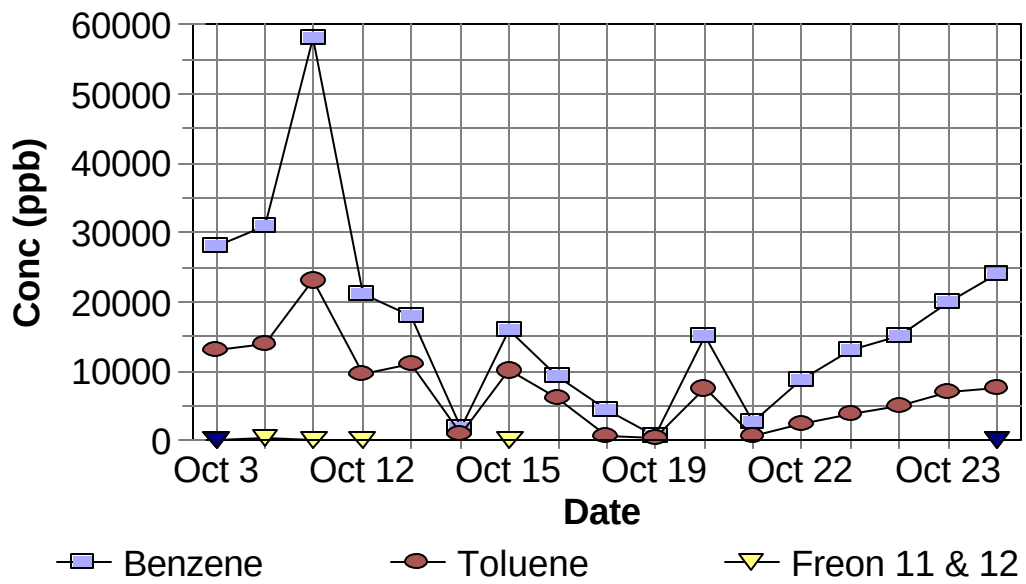


Figure 8. VOCs in Air at WTC North Tower Center

Lead and Total PCBs in Air

Based on the results for lead and total PCBs in air from the WTC-Building 5 site, these two compounds appear independent and uncorrelated (-0.095 correlation coefficient).

Table 7. Lead and Total PCBs in Air

Location	Date	Lead (ug/m3)	Total PCBs (ng/m3)
Location A - Barclay St & West Broadway	23- Sept	4.3	< 3.44
	27- Sept	2.8	38.7
	2-Oct	na	8.3
	4-Oct	1.4	77.2
	8-Oct	0.55	< 1.77
	11-Oct	0.49	na
	15-Oct	0.13	na
Location B - Church St & Dey St	16- Sept	na	6.98
	23- Sept	1.7	4.14
	27- Sept	0.69	4.99
	4-Oct	0.26	17.9
	8-Oct	0.32	13.3
	11-Oct	0.23	4.54
	15-Oct	0.28	na
WTC - Building 5 SW	23- Sept	5.4	55.9
	2-Oct	1.1	153
	4-Oct	0.42	58.6
	8-Oct	0.73	18.1
	11-Oct	0.48	na
	15-Oct	1.1	na

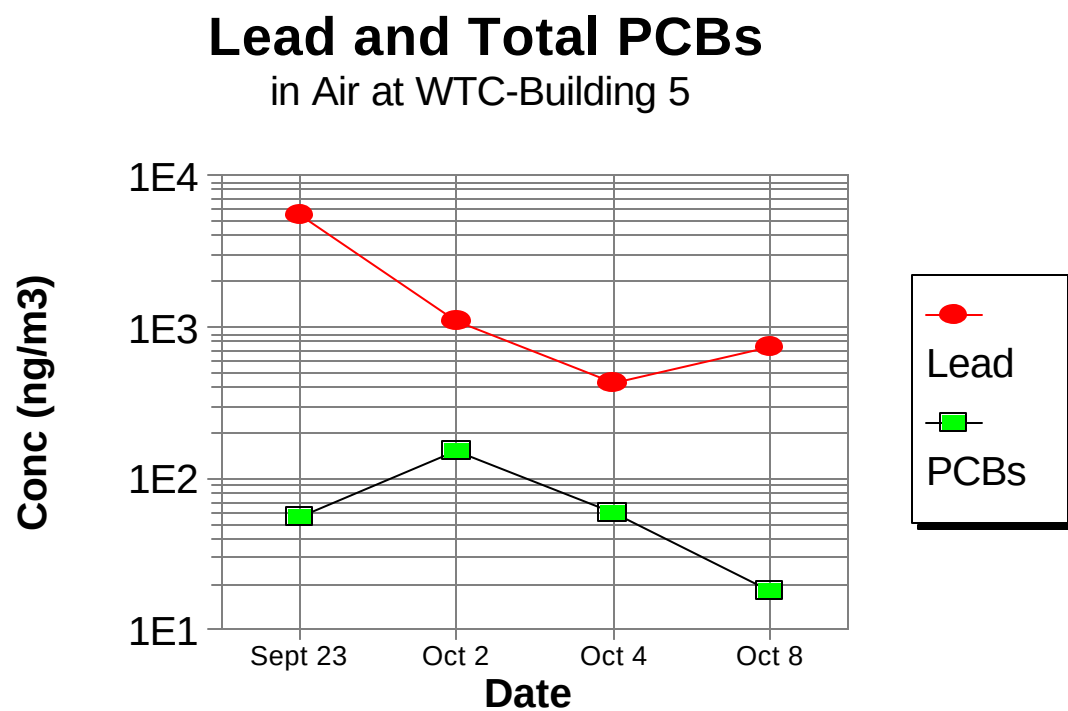


Figure 9. Lead and Total PCBs in Air at WTC Building 5; log y scale

CONCLUSIONS AND RECOMMENDATIONS

Examination of the NYC Response Monitoring database and the results discussed here suggest several important conclusions:

- The large number of target analytes require prioritization. Only a few analytes have been thoroughly evaluated and the review is ongoing. It will also be helpful to prioritize the sites, matrices, dates, etc.
- Background data from New York City, or data prior to September 11, would be useful in establishing the impact of the WTC event.
- Several very high concentrations of many toxic compounds were detected in the bulk dust samples, including CDD/CDF, PCBs, PAHs, and metals.
- VOCs, lead, and total PCBs in air have all decreased from their maximum values.
- Low correlations between compounds from different classes suggest many different sources of contamination.
- The most recent results from the WTC North Tower Center site indicate an increase in benzene and toluene over the Oct 20 to Oct 23 period, the most recent sample results available in the database at the time of this report.
- Only PCM data have been evaluated for asbestos thus far. The TEM (AHERA) and other results have yet to be reviewed.
- We recommend continued monitoring and review of the results to establish long-term trends.

ATTACHMENT 4
New York City Weather September 11 - October 23

Date	Mean Temperature (F)	Wind Speed (mph)	Conditions
11-Sep-01	73.5	8.77	Partly Cloudy
12-Sep-01	70.5	10.59	Partly Cloudy
13-Sep-01	74.8	9.74	Partly Cloudy
14-Sep-01	60.3	9.29	Rain and then Partly Cloudy
15-Sep-01	62.3	7.98	Mostly Clear
16-Sep-01	63.1	5.44	Partly Cloudy
17-Sep-01	70.8	7.41	Partly Cloudy
18-Sep-01	70.3	5.09	Partly Cloudy
19-Sep-01	70.2	8.54	Partly Cloudy
20-Sep-01	69.7	12.70	Rain
21-Sep-01	72.9	6.33	Partly Cloudy
22-Sep-01	72.1	6.41	Partly Cloudy
23-Sep-01	77.0	6.90	Partly Cloudy
24-Sep-01	72.3	10.22	Light Rain
25-Sep-01	67.4	11.97	Partly Cloudy
26-Sep-01	56.3	10.67	Partly Cloudy
27-Sep-01	60.9	9.29	Partly Cloudy
28-Sep-01	57.9	7.37	Partly Cloudy and then Rain
29-Sep-01	NA	NA	NA
30-Sep-01	53.7	15.80	Rain
1-Oct-01	55.1	11.36	Rain
2-Oct-01	61.0	4.22	Partly Cloudy
3-Oct-01	71.3	7.60	Partly Cloudy
4-Oct-01	75.3	10.28	Partly Cloudy
5-Oct-01	70.7	9.06	Clear
6-Oct-01	65.4	18.36	Partly Cloudy and then Rain
7-Oct-01	52.3	18.33	Partly Cloudy
8-Oct-01	46.6	12.66	Clear
9-Oct-01	54.3	7.37	Partly Cloudy
10-Oct-01	60.7	9.13	Partly Cloudy
11-Oct-01	65.9	8.34	Partly Cloudy
12-Oct-01	62.2	6.21	Clear
13-Oct-01	NA	NA	NA
14-Oct-01	NA	NA	NA
15-Oct-01	64.0	8.52	Clear
16-Oct-01	62.4	11.62	Partly Cloudy and then Rain
17-Oct-01	51.4	11.28	Partly Cloudy and then Rain
18-Oct-01	51.4	12.81	Partly Cloudy
19-Oct-01	54.8	9.11	Partly Cloudy
20-Oct-01	63.3	7.57	Partly Cloudy
21-Oct-01	64.2	10.24	Partly Cloudy
22-Oct-01	NA	NA	NA
23-Oct-01	60.5	8.63	Partly Cloudy

NA - Not available

