

**Damage Assessment  
130 Liberty Street Property**

**Report Date: December 2003**

**Determination of Appropriate Levels for Surfaces  
in the Building**

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## ***Determination of Appropriate Levels for Surfaces in the Building***

### **1.0 Summary**

As discussed in several reports prepared by RJ Lee Group, Inc., the World Trade Center destruction commencing on September 11, 2001 (“WTC Event”) physically destroyed significant portions of the interior and exterior of the building located at 130 Liberty Street, New York, NY (the “Building”). A gash was created in the north side of the Building; over 1,500 windows were broken; the plaza in front of the Building was crushed which exposed Level A and Level B Basement areas; and the Building was exposed to the elements as well as being filled with a combination of soot, dust, dirt, debris, and contaminants. For a period of time following the WTC Event, the Building owner, Deutsche Bank Trust Company Americas (the “Bank”), was precluded by the City of New York from entering the Building. After the Bank gained access to the Building, the Bank retained the services of engineering firms to assess the physical damage. Additionally, an environmental firm was retained to conduct limited sampling for asbestos, heavy metals, and biological contaminants. The results of this sampling have been reported in a number of contaminant reports prepared by RJ Lee Group.

In January 2003, the Center for Toxicology and Environmental Health, L.L.C. (CTEH) was retained by the law firm of Pitney Hardin Kipp & Szuch LLP, on behalf of the Bank, to evaluate the significance of the data collected by RJ Lee Group and other environmental consultants. This work has been performed under the supervision of Phillip Goad, Ph.D., Partner and Senior Toxicologist with CTEH.

### **1.1 Investigation**

As part of the process of investigating the feasibility of returning the Building to its condition prior to the WTC Event, an evaluation of the potential worst-case surface concentrations of WTC Hazardous Substances in the Building prior to the WTC Event was performed. The purpose of this investigation was to establish applicable comparison criteria representing an upper bound of the potential levels of WTC Hazardous Substances existing in the Building before the WTC Event. These levels are hereinafter referred to as “Appropriate Levels.” Two separate Appropriate Levels have been established in this analysis. First, an arithmetic mean value has been selected as the “Average Appropriate Level.” If post-remediation sampling of a specific area reveals that the arithmetic mean concentration of a WTC Hazardous Substance in that area exceeds the Average Appropriate Level, the remediation effort will be considered unsuccessful for that contaminant.

Second, the 95%-95% Upper Tolerance Limit has been selected as the "Maximum Appropriate Level".<sup>1</sup> This represents a "not-to-exceed" standard for post-remedial clearance testing. If any single post-remedial sample reveals a WTC Hazardous Substance surface concentration in excess of the Maximum Appropriate Level, the remediation effort will be judged unsuccessful for that contaminant for the area tested.

These levels are referred to herein as "Appropriate Levels" since, as described below, they have been developed solely for use in evaluation of various remedial (i.e., decontamination) methods for the Building. The levels are not intended to represent the pre-WTC Event presence of WTC Hazardous Substances in the Building or even "background" levels in Class A office buildings not impacted by the WTC Event, which would likely be lower than the relevant Appropriate Levels. (See RJ Lee Group report titled, "Contamination Report Pursuant to Testing Protocol Background Levels in Buildings – Summary Report" which confirms this assumption.)

Three approaches were utilized to evaluate Appropriate Levels for WTC Hazardous Substances. The first approach was to statistically evaluate data from analysis of surface wipe samples obtained from Class A office buildings not impacted by the WTC Event using methods similar to those used to obtain samples from the Building. These buildings are referred to as "Background Buildings." The results of this testing are reported in the RJ Lee report titled, "Contamination Report Pursuant to Testing Protocol Background Levels in Buildings." The second approach consisted of a statistical evaluation of the data from surface wipe samples obtained in the tenant space (i.e., below the finished ceiling) of the post-WTC Event Building as reported in "Contamination Report Pursuant to Testing Protocol TP-01 Interior Spaces." The third approach involved a comprehensive review of published studies of surface concentrations of the WTC Hazardous Substances measured in public and commercial office buildings in the United States.

The statistical analyses of the data discussed in this report were performed by Dr. Robert Gibbons, Professor of Biostatistics and Director of the Center for Health Statistics at the University of Illinois at Chicago. A copy of Dr. Gibbon's reports are attached.

## 1.2 Findings

Based on the information obtained from these data sources, Average Appropriate Levels and Maximum Appropriate Levels were determined and are presented in **Table 1**.

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<sup>1</sup> The 95%-95% UTL represents with 95% confidence the concentration that is **higher** than 95% of the samples within the designated "cold spot" areas.

**Table 1. Average Appropriate Levels and Maximum Appropriate Levels**

WTC Hazardous Substances	Average Appropriate Level	Maximum Appropriate Level
Asbestos (s/cm <sup>2</sup> )	156	801
Beryllium (µg/ft <sup>2</sup> )	0.036	0.34
Cadmium (µg/ft <sup>2</sup> )	0.15	0.94
Lead (µg/ft <sup>2</sup> )	1.82	9.46
Mercury (µg/ft <sup>2</sup> )	0.011	0.067
PCBs (µg/100 cm <sup>2</sup> )	0.001	0.01
PCDD/PCDF TEQ (pg/100 cm <sup>2</sup> )	0.25	1.83
PNAs (µg/100 cm <sup>2</sup> )	0.035	0.29

The Maximum Appropriate Levels selected are “upper bound” estimates of potential pre-WTC Event levels in the Building, and serve as absolute maximum allowable concentrations to evaluate the efficacy of selected remedial alternatives. Post-remediation surface testing should demonstrate that no single sample concentration exceeds the Maximum Appropriate Level for that WTC Hazardous Substance. Post-remediation testing should also demonstrate that the arithmetic mean concentration of WTC Hazardous Substances is at or below the Average Appropriate Levels of WTC Hazardous Substances established in this report.

Although the extensive testing performed in the Building revealed a characteristic “WTC Dust” with a recognizable “chemical fingerprint” of numerous WTC Hazardous Substances, the WTC Hazardous Substances selected for arithmetic average and maximum Appropriate Levels evaluation were limited to asbestos, polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), expressed as 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) Equivalents (TEQ), total polynuclear aromatic hydrocarbons (PNAs), total polychlorinated biphenyls (PCBs) - reported as Aroclors, cadmium, lead, mercury and beryllium. The total PCB concentrations represent a summation of the Aroclors identified in the samples and PNA concentrations represent the sum of the individual analytes that were above the method detection limits. The total dioxins/furans TEQ values were calculated for each sample using toxicity equivalent factors (TEFs) based on the conclusions of the World Health Organization (WHO) meeting in Stockholm, Sweden, 15-18 June 1997 (Van den Berg et al., 1998) for individual analytes that were above the estimated detection limits. These contaminants were selected due to their relative abundance and potential human health risk from chronic exposure.

## 2.0 Data Sources

No data are available regarding surface concentrations of WTC Hazardous Substances in the Building before the WTC Event. To estimate surface concentrations of WTC Hazardous Substances that potentially may have existed in the Building prior to the WTC Event, three sources of data were considered:

- Surface concentrations of WTC Hazardous Substances measured in Background Buildings not impacted by the WTC Event (See RJ Lee Group report titled, *"Contamination Report Pursuant to Testing Protocol Background Levels in Buildings."*)
- Surface concentrations of WTC Hazardous Substances measured in the post-WTC Event Building pursuant to protocol TP-01 (Interior Spaces) (See RJ Lee Group report titled, *"Contamination Report Pursuant to Testing Protocol TP-01 Interior Spaces."*)
- Published data on surface concentrations of WTC Hazardous Substances measured in public and commercial office buildings throughout the United States.

No single source of information provided all of the necessary data to determine Appropriate Levels for the Building. Published data on surface concentrations of WTC Hazardous Substances from comparable commercial buildings is limited. The data obtained from post-WTC Event surface sampling is from the Building itself, but the pervasive nature of the WTC Dust deposition limits the utility of these data for pre-WTC Event evaluation, allowing at best, an upper bound estimate of WTC Hazardous Substances surface levels potentially present prior to the WTC Event. Ideally, the most appropriate indicator of levels that were most probable to have existed in the Building prior to the WTC Event would be data obtained from samples from well-maintained commercial office buildings that are of similar construction, occupied by a similar type of tenants, and that are also located in lower Manhattan, but which have not been impacted by the WTC Event. Unfortunately, the availability of such buildings are limited. Accordingly, a "weight-of-evidence" approach was used in this evaluation, utilizing rigorous statistical analyses and professional judgment to determine the Appropriate Levels for the Building.

The first source of data used in this evaluation is the surface concentrations of the WTC Hazardous Substances measured on frequently cleaned surfaces (e.g., desks, tables, credenzas) from occupied spaces in other Class A office buildings not impacted by the WTC Event (i.e., Background Buildings). The results of sampling of frequently cleaned surfaces from Background Buildings should confirm the data selected for representation of pre-WTC Event conditions of the Building.

The second source of data used in the evaluation was the results of sampling performed inside the Building following the WTC Event. Although the WTC Dust has pervasively contaminated the Building, it was hypothesized that certain locations could be used to establish both a **lower bound** of existing contamination and a theoretical **upper bound** of contamination that existed prior to the WTC Event. The approach used in this analysis (i.e., use of upper tolerance limits) is consistent with that prescribed by the United States Environmental Protection Agency (USEPA) in certain of its environmental regulatory programs.

The third source of data used in the evaluation was published surface concentrations of WTC Hazardous Substances that were measured in commercial and public office buildings in urban locations throughout the United States.

Inherent in the weight-of-evidence approach to the selection of Average Appropriate Levels and Maximum Appropriate Levels, is the assumption that prior to the WTC Event, the Building's surfaces were well maintained in accordance with standard practices for Class A office buildings in New York. This assumption was demonstrated to be correct. The Building had a documented history of being maintained to the highest standards in the industry. The Building was awarded the Building Operators and Management Association of New York (BOMA/NY) 1996-1997 Pinnacle Award for Corporate Facilities over 500,000 square feet. The Building was then nominated for the BOMA Mid-Atlantic Conference 1996-1997 Operating Office Building of the Year Award in the category of Corporate Facilities over 500,000 square feet. Entries for the Office Building of the Year Award are judged on 15 separate categories covering virtually every aspect of the building operation. Furthermore, in 1993, the Building launched a proactive, formal Environmental Quality Program to ensure a quality environment and reduce or eliminate sources of odors or noise. The Bank has confirmed that, prior to the WTC Event, there were no fires or explosions in the Building (other than small fires), and that the Building was used as an office building with no manufacturing or other such activities. Thus, to the extent that pre-WTC Event Building surfaces may have contained measurable contaminant levels, these levels would most probably have been equal to or lower than background concentrations present in comparable office buildings.

With respect to the evaluation of the efficacy of remedial (i.e., decontamination) methods, no remedial method should be considered "effective" if post-cleaning residual levels of WTC Hazardous Substances exceed the Appropriate Levels for any substance. Stated differently, if the Building surfaces cannot be decontaminated such that they are at least as

“clean” as the least contaminated surfaces in the post-WTC Event Building, then the Building cannot be returned to its pre-WTC Event condition.

### 3.0 Data Evaluation

#### 3.1 Background Building Sampling

Occupied spaces in eight Background Buildings were sampled from five different cities (New York, NY, Pittsburgh, PA, Philadelphia, PA, Washington DC, and Florham Park, NJ) to determine the concentrations of certain contaminants on frequently cleaned surfaces. Four samples were obtained in each of the Background Buildings, for a total of 32 samples for each analyte of interest. The locations selected included desks, table and counter tops, and in one Background Building, an induction unit cover. All of the sample locations were located in generally used office space. Each sampling location was a high contact surface with visible light dust present, with concentrations under 0.05 grams/square meter as verified through the use of gravimetric sampling and analysis methods. The surfaces selected were from office cubicles in the common areas of a given floor, and were used on a daily basis.

Wipe and total dust samples were obtained from non-porous horizontal surfaces. The samples were obtained using the same sampling procedures used to collect the samples from the Building. Laboratory analyses were performed by commercial testing laboratories that are accredited by New York's Environmental Laboratory Accreditation Program (NY ELAP). Using the results of analyses of surface samples from these locations, the arithmetic mean and maximum surface concentrations were determined, along with the upper 95% confidence limit for the upper 95<sup>th</sup> percentile (95%-95% upper tolerance limit - UTL) of the distribution. The 95%-95% UTL was estimated using methods described in Gibbons and Coleman, *Statistical Methods for Detection and Quantification of Environmental Contamination*, Wiley, 2001), and is presented in the attached report of Dr. Robert Gibbons. **Table 2** is a tabular summary of these analyses.

**Table 2. Results of Sampling in Background Buildings**

WTC Hazardous Substances	Average	Maximum	95%-95% UTL
Asbestos (s/cm <sup>2</sup> )	106	691	487
Beryllium (µg/ft <sup>2</sup> )	<0.025	<0.025	0.013
Cadmium (µg/ft <sup>2</sup> )	0.022	0.38	0.21
Lead (µg/ft <sup>2</sup> )	0.13	2.5	1.3
Mercury (µg/ft <sup>2</sup> )	0.004	0.038	0.026
PCBs (µg/100 cm <sup>2</sup> )	0.001	0.015	0.008
PCDD/PCDF TEQ (pg/100 cm <sup>2</sup> )	0.00007	0.00086	0.001
PNAs (µg/100 cm <sup>2</sup> )	0.005	0.13	0.053

### 3.2 Cold-Spot Analysis

In order to estimate an upper bound on the surface concentrations of WTC Hazardous Substances that existed prior to the WTC Event, or a lower bound on the levels that existed following the WTC Event, a k-means cluster analysis (using the statistical software program SAS) was performed on the below-ceiling TP01 data (all pre-cleaning data) by Dr. Robert Gibbons, Professor of Biostatistics and Director of the Center for Health Statistics at the University of Illinois at Chicago. This analysis performs an iterative evaluation that selects areas within the Building that are simultaneously low with respect to all WTC Hazardous Substances considered in the analysis. The analysis identified 18 locations with the lowest distribution of asbestos, PCBs, PNAs, PCDDs/PCDFs, beryllium, cadmium, lead, and mercury. This analysis revealed a negative correlation between asbestos concentrations and lead in the cold spots. That is, as asbestos levels in the cold spots decreased, lead concentrations in the same samples increased, and visa versa. Accordingly, a separate cluster analysis was performed exclusively on asbestos data, and the results from this analysis were used for establishing the asbestos "cold spots." A total of 32 locations were identified from the asbestos cold spot analysis. The locations within the Building identified in the cold spot analyses are presented in **Table 3**.

**Table 3. Locations of Building “Cold Spots”**

WTC Hazardous Substances			
Cold Spots		Asbestos Cold Spots	
Floor	Grid	Floor	Grid
7	17	5	10
7	30	20	35
8	18	21	12
20	7	23	5
25	44	23	27
26	1	25	10
27	14	26	1
27	15	26	5
27	44	26	16
28	28	26	23
29	39	26	35
32	5	26	46
33	9	27	2
33	25	28	15
35	12	28	23
35	18	29	4
36	3	29	49
39	20	30	27
-	-	31	7
-	-	31	45
-	-	32	9
-	-	32	48
-	-	33	9
-	-	35	7
-	-	35	35
-	-	35	46
-	-	36	6
-	-	36	8
-	-	36	32
-	-	36	46
-	-	38	14
-	-	39	20

It was noted that the areas identified from the cluster analysis are predominantly located in the southern two-thirds of the Building above Floor 25.

Using the results of analyses of surface samples from these locations, the average and maximum surface concentrations were determined, along with the upper 95% confidence limit for the upper 95<sup>th</sup> percentile (95%-95% upper tolerance limit - UTL) of the distribution. The 95%-95% UTL was estimated using methods described in Gibbons and Coleman, *Statistical Methods for Detection and Quantification of Environmental Contamination*, Wiley, 2001).

The 95%-95% UTL represents with 95% confidence the concentration that is **higher** than 95% of the samples within the designated “cold spot” areas. It is an upper bound estimate of the potentially worst-case pre-WTC Event levels

within the Building. In fact, of the samples in question, more than half contained at least 0.1 gm /square meter of total dust, a level indicative of a moderate dust loading, and all but three of the samples contained particle types that were indicative of those known to be associated with the WTC Event as determined using scanning electron microscopy (SEM) techniques. Thus the values derived in the cold spot analysis are from locations that are considered to be contaminated areas.

Results of the statistical analysis of the cold spot data for the selected contaminants are presented in **Table 4**.

**Table 4. Results of Cold Spot Analysis from TP-01 Data**

WTC Hazardous Substances	Units	Cold Spot Analysis		
		Average	Max	95%-95% UTL
Asbestos	s/cm <sup>2</sup>	156	1,049	801
Beryllium	µg/ft <sup>2</sup>	0.036	0.48	0.34
Cadmium	µg/ft <sup>2</sup>	0.15	1.13	0.94
Lead	µg/ft <sup>2</sup>	1.82	7.98	9.46
Mercury	µg/ft <sup>2</sup>	0.011	0.063	0.067
PCBs *	µg/100 cm <sup>2</sup>	< 0.01	< 0.01	N/A
PCDD/PCDF TEQ	pg/100 cm <sup>2</sup>	0.25	2.43	1.83
PNAs	µg/100 cm <sup>2</sup>	0.035	0.46	0.29

\* The estimated detection limit for the Cold Spot Analysis PCB results are based on a method detection limit (MDL) of 0.05 micrograms for Aroclor 1232 and a 500 cm<sup>2</sup> sampled area. Aroclor 1232 had the highest MDL of the Aroclor mixtures reported.

### 3.3 Review of Published Literature on Background Levels

A comprehensive search was performed to identify publications relating to “background” levels of the contaminants constituting WTC Hazardous Substances investigated in this study. This search was conducted for literature published over the last 38 years. Over 50 articles and publications were reviewed for levels of WTC Hazardous Substances. However, this search revealed only a limited number of studies with relevant information, i.e., information for commercial/public office buildings not impacted by identifiable chemical sources.

The amount of applicable published literature related to “typical” surface concentrations for the eight WTC Hazardous Substances that could be present in well-maintained commercial office buildings is extremely limited. Only a few publications were identified as being applicable for surface concentrations of asbestos, PCBs, and dioxins/furans. Some publications were available for lead and PNAs, but only for residential settings. No publications were identified for cadmium or beryllium, and the only published data for background values available for mercury were from samples obtained in dentists’ offices. Given the use of mercury amalgams in dental practice, data from these locations were not considered relevant to the Building evaluation. The data obtained from potentially-applicable locations are described below.

### PCDD/PCDF

Data on background surface concentrations of polychlorinated dibenzo-p-dioxins (PCDD) and dibenzofurans (PCDF), expressed as 2,3,7,8-TCDD equivalents (TEQ) were reported by the New York State Department of Health for the Utica State Office Building in Utica, New York (NYSDOH, 1989), two office buildings (John F. Kennedy Federal Building and Staltonstall State Office Building) in Boston, Massachusetts (Kominsky et al., 1987), and three office buildings in Santa Fe, New Mexico (Kominsky et al., 1988). The concentrations of 2,3,7,8-TCDD Equivalents (TEQs) were calculated using the toxicity equivalency factors (TEFs) presented by the World Health Organization (WHO) Meeting 1 in Stockholm, Sweden, 15-18 June 1997. The calculated concentration of 2,3,7,8-TCDD equivalents is an estimate of 2,3,7,8-tetrachlorodibenzo-p-dioxin equivalent toxicity of the sample mixture.

The surface concentrations of PCDDs and PCDFs measured in Boston (Kominsky et al., 1987) and Santa Fe (1988) were reported as 2,3,7,8-tetra CDD and CDF isomers, and total tetra- through octachlorinated homologs. The concentrations of 2,3,7,8-TCDD equivalents were calculated by assuming that the fraction of 2,3,7,8-substituted congeners in each homologue group was equal to the fraction of possible 2,3,7,8-substituted congeners in that group. For example, there are three 2,3,7,8-substituted hexachlorodibenzodioxin congeners out of 10 possible hexachlorodibenzodioxin congeners. The fraction of total hexachlorodibenzodioxin that is assumed to be 2,3,7,8-substituted is calculated to be 3/10<sup>th</sup> (0.30) of the total hexachlorodibenzodioxins. Using these methods, TEQ levels on high contact surfaces from the three Santa Fe Buildings averaged 0.83 pg/100 cm<sup>2</sup>, with a range of 0.19 to 2.7 pg/100 cm<sup>2</sup>. Background surface levels in the two Boston office buildings averaged 0.78 pg/100 cm<sup>2</sup>, with a range of 0.32 to 1.8 pg/100 cm<sup>2</sup>. In Utica, the average surface concentration of 2,3,7,8-TCDD equivalents was 0.61 pg/100 cm<sup>2</sup>, with a range of 0.58 to 0.64 pg/100 cm<sup>2</sup>.

**Asbestos**

Ewing and coworkers (Ewing et al., 1996) reported on the results of surface sampling in six buildings from a "large northeastern US city" with no known friable asbestos-containing surface materials. As noted by the authors, one of the 28 samples collected in this study had an "unusually high" result (270,000 s/cm<sup>2</sup>) thought possibly to be related to improperly performed removal of asbestos-containing floor tile. Excluding this sample result, the arithmetic average surface concentration for asbestos in the six buildings was 930 s/cm<sup>2</sup>. If this value is included, the average level was 5,800 s/cm<sup>2</sup>. The highest surface asbestos concentration found in any of the other five buildings was 1,400 s/cm<sup>2</sup>. The range of concentrations reported was <240 to 270,000 s/cm<sup>2</sup>.

**PCB**

Data on background levels of polychlorinated biphenyls (PCB) were reported by the New York State Department of Health (NYSDOH) (1985 Kominsky data from Cincinnati, Minnesota, and Pine Bluff, Arkansas, 1989), Kominsky and coworkers (1987a, 1987b, 1987c), Oatman and Roy (1986). Each of these studies reported PCBs as Aroclors. Results were evaluated on a total PCB Aroclor concentration basis. The total PCB Aroclor "background" values varied widely. The reported concentrations were between 0.005 to 1.8 µg/100 cm<sup>2</sup>, with an average of 0.2 µg/100 cm<sup>2</sup>.

## 4.0 Appropriate Levels

Based on a weight-of-evidence evaluation of the data sources discussed above, the following Appropriate Levels were selected for each of the specific WTC Hazardous Substances considered in this evaluation. A tabular summary of the three sources of information for derivation of Average and Maximum Appropriate Levels is presented in **Table 5**.

Table 5. Summary of Data Sources for Building Appropriate Level Analysis

WTC Hazardous Substances	Units	Literature Values		Cold Spot Analysis			Background Building Samples		
		Average	Max	Average	Max	95%-95% UTL	Average	Max	95%-95% UTL
Asbestos <sup>1</sup>	s/cm <sup>2</sup>	930	NR <sup>1</sup>	156 <sup>3</sup>	1049	801 <sup>3</sup>	106	691	487
Beryllium	µg/ft <sup>2</sup>	na <sup>2</sup>	na <sup>2</sup>	0.036 <sup>3</sup>	0.48	0.34 <sup>3</sup>	<0.025	<0.025	0.013
Cadmium	µg/ft <sup>2</sup>	na <sup>2</sup>	na <sup>2</sup>	0.15 <sup>3</sup>	1.13	0.94 <sup>3</sup>	0.022	0.38	0.21
Lead	µg/ft <sup>2</sup>	na <sup>2</sup>	na <sup>2</sup>	1.82 <sup>3</sup>	7.98	9.46 <sup>3</sup>	0.13	2.5	1.3
Mercury	µg/ft <sup>2</sup>	na <sup>2</sup>	na <sup>2</sup>	0.011 <sup>3</sup>	0.063	0.067 <sup>3</sup>	0.004	0.038	0.026
PCB <sup>4</sup>	µg/100 cm <sup>2</sup>	0.2	1.8	< 0.01	< 0.01	na <sup>2</sup>	0.001 <sup>3</sup>	0.015	0.008 <sup>3</sup>
PCDD/PCDF TEQs	pg/100 cm <sup>2</sup>	0.74	2.7	0.25 <sup>3</sup>	2.43	1.83 <sup>3</sup>	0.00007	0.00086	0.001
PNA	µg/100 cm <sup>2</sup>	na <sup>2</sup>	na <sup>2</sup>	0.035 <sup>3</sup>	0.46	0.29 <sup>3</sup>	0.005	0.13	0.053

1 Average value for asbestos excludes the "unusually high" value (270,000 s/cm<sup>2</sup>) reported by Ewing et al., 1996.

The next highest value excluding this level cannot be determined from this publication.

2 Not available

3 Values were selected for Appropriate Levels for the Building. See text for explanation.

4 The estimated detection limit ("<") for the Cold Spot Analysis PCB results are based on a method detection limit of 0.05 micrograms for Aroclor 1232 and a 500 cm<sup>2</sup> sampled area.

### 4.1 Asbestos

The results of the various sources of information were remarkably similar. The range of values from the literature, cold spot analysis, and Background Building evaluation had considerable overlap, and the 95%-95% UTL from the cold spot and Background Building analyses were very close. Accordingly, the 95%-95% UTL from the cold spot analysis, i.e., 801 s/cm<sup>2</sup>, was selected as the Maximum Appropriate Level for asbestos. The arithmetic average from the cold spot analysis (156 s/cm<sup>2</sup>) was selected as the Average Appropriate Level.

### 4.2 Beryllium

No published values for beryllium could be located. The average and 95%-95% UTL from the cold spot analysis were higher than the Background

Building analysis. Therefore, the probable pre-WTC Event surface concentrations for this metal were probable at or below those identified in the Background Buildings. However, in keeping with the nature of the Maximum Appropriate Level, the higher cold spot 95%-95% UTL (0.34  $\mu\text{g}/\text{ft}^2$ ) was selected for the Building. The arithmetic average from the cold spot analysis (0.036  $\mu\text{g}/\text{ft}^2$ ) was selected as the Average Appropriate Level.

### 4.3 Cadmium

No published values for cadmium in commercial/public building surfaces could be located. The average and 95%-95% UTL from the cold spot analysis were approximately four to seven times higher than the Background Building analysis. Therefore, the probable pre-WTC Event surface concentrations for this metal were at or below those identified in either the Background Building or cold spot analysis. However, in keeping with the nature of the Maximum Appropriate Level, the higher cold spot 95%-95% UTL (0.94  $\mu\text{g}/\text{ft}^2$ ) was selected for the Building. The arithmetic average from the cold spot analysis (0.15  $\mu\text{g}/\text{ft}^2$ ) was selected as the Average Appropriate Level.

### 4.4 Lead

No published values for lead in commercial/public (i.e., non-residential) building surfaces could be located. The average and 95%-95% UTL from the cold spot analysis were approximately seven and 14 times higher than the Background Building analysis. Therefore, the probable pre-WTC Event surface concentrations for this metal were at or below those identified in either the Background Building or cold spot analysis. However, in keeping with the nature of the Maximum Appropriate Level, the higher cold spot 95%-95% UTL (9.46  $\mu\text{g}/\text{ft}^2$ ) was selected for the Building. The arithmetic average from the cold spot analysis (1.8  $\mu\text{g}/\text{ft}^2$ ) was selected as the Average Appropriate Level.

### 4.5 Mercury

No published values for mercury in comparable commercial building surfaces could be located. Mercury was infrequently detected in the cold spots of the Building and Background Building surface evaluations. The average and 95%-95% UTL from the cold spot analysis were less than three times higher than the Background Building analysis. Therefore, the probable pre-WTC Event surface concentrations for this metal were at or below those identified in either the Background Building or cold spot analysis. However, in keeping with the nature of the Maximum Appropriate Level, the higher cold spot 95% UTL (0.067  $\mu\text{g}/\text{ft}^2$ ) was selected for the Building. The arithmetic average from the cold spot analysis (0.011  $\mu\text{g}/\text{ft}^2$ ) was selected as the Average Appropriate Level.

#### 4.6 Polychlorinated Biphenyls (PCBs)

No PCBs were detected in the cold spot analysis, and only two samples from the Background Building evaluation had a detectable level of this contaminant. Using the average reported in the literature was considered, but because the cold spot analysis was negative for all samples, it was decided that the average and 95%-95% UTL from the Background Building study be used for both the Average and Maximum Appropriate Levels. Accordingly, the 95%-95% UTL (0.008, rounded to 0.01  $\mu\text{g}/100\text{ cm}^2$ ) and arithmetic average (0.001  $\mu\text{g}/100\text{ cm}^2$ ) values from the Background Building analysis were selected as the Maximum and Average Appropriate Levels for this WTC Hazardous Substance.

#### 4.7 PCDD/PCDF TEOs

The results of the cold spot analysis and reported literature values are similar. In contrast, the results from the Background Building evaluation revealed much lower levels of this WTC Hazardous Substance. Therefore, the probable pre-WTC Event surface concentrations for this WTC Hazardous Substance were at or below those identified in either the Background Building or cold spot analysis. However, in keeping with the nature of the Maximum Appropriate Level, the higher cold spot 95%-95% UTL (1.83  $\text{pg}/100\text{ cm}^2$ ) was selected for the Building. The arithmetic mean from the cold spot analysis (0.25  $\text{pg}/100\text{ cm}^2$ ) was selected as the Average Appropriate Level. An additional indicator that the dioxins were contaminants unique to the Building is that in the Santa Fe, Boston, and Utica studies, and in the Background Building analysis, no sample contained detectable amounts of the 2,3,7,8-TCDD isomer, the most toxic dioxin, but twenty three per cent of the samples at the Building did contain 2,3,7,8-TCDD.

#### 4.8 Polynuclear Aromatics (PNAs)

No published values for PNAs in comparable commercial building surfaces could be located. The results from the Background Building evaluation revealed much lower levels of this WTC Hazardous Substances. Therefore, the probable pre-WTC Event surface concentrations for this WTC Hazardous Substance were at or below those identified in either the Background Building or cold spot analysis. However, in keeping with the nature of the Maximum Appropriate Level, the higher cold spot 95%-95% UTL (0.29  $\mu\text{g}/100\text{ cm}^2$ ) was selected for the Building. The arithmetic average from the cold spot analysis (0.035  $\mu\text{g}/100\text{ cm}^2$ ) was selected as the Average Appropriate Level.

## 5.0 Bibliography

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## 6.0 Glossary

*Appropriate Level* - Appropriate levels were established for each contaminant from the WTC Event by an extensive review of scientific literature, sampling in Background Buildings not impacted by the WTC Event, and samples taken from the Building. For each contaminant, the appropriate level at the 95-95% upper tolerance limit was established (the "Maximum Appropriate Level") and an appropriate level at the arithmetic mean was established ("Average Appropriate Level") as a clearance standard. To reach clearance, a surface must have no readings above the Maximum Appropriate Level and the average reading must be at or below the Average Appropriate Level.

*Aroclor* - The industrial trade name for a mixture of polychlorinated biphenyls (See PCBs). The convention is the word "Aroclor" followed by a 4 digit number. The last two digits of the number refer to the amount of chlorination by weight. For example, Aroclor 1254 contains approximately 54% chlorine by weight.

*Asbestos* - The name given to a group of naturally occurring minerals used in certain products, such as building materials and vehicle brakes, to resist heat and corrosion. *Asbestos* includes chrysotile, amosite, crocidolite, anthophyllite asbestos, tremolite asbestos, and actinolite asbestos, and any of these materials that have been chemically treated and/or altered.

*Background Building* - Eight Class A office buildings not impacted by the WTC Event which were sampled by RJ Lee Group for WTC Hazardous Substances.

*Beryllium* - A brittle, gray metal.

*Building* - Specifically refers to the Deutsche Bank property at 130 Liberty Street, New York, NY, 10006.

*Cadmium* - A soft, bluish-white metal.

*Class A Office Building* - A building that has excellent location and access, attracts high quality tenants, and is managed professionally. Building materials are high quality and rents are competitive with other new buildings.

*Cold Spot Analysis* - Analysis performed in a pre-determined sampling pattern, with no preference to sampling parameters (see "Insurance Claim Report, Volume II: Section 2.2). See also Dr. Gibbons' reports attached to this document.

*Confidence Interval, 95%* - The calculated concentration range in which there is a 95% confidence that the average will be present.

*Correlation Coefficient* – A number between -1 and 1 that indicates the degree of linear relationship between two sets of numbers. A value of +1.0 indicates a perfect positive correlation and means that as the value of one variable increases, the value of the correlated variable increases.

*Dioxins/Furans* – A group of chemical compounds that share certain chemical structures and biological characteristics. Several hundred of these compounds exist and are members of three closely related families: the chlorinated dibenzo-p-dioxins (PCDDs), chlorinated dibenzofurans (PCDFs) and certain polychlorinated biphenyls (PCBs). Dioxins are formed as a result of combustion processes and from burning fuels (like wood, coal or oil).

*Lead* – A base metal.

*Log Normal Distribution* – A distribution where the log of the values fit a normal distribution. A normal distribution is continuous and is recognizable as a classic bell curve.

*Mercury* – Naturally occurring element commonly used in fluorescent light tubes.

*Metals* – Included as metals are: arsenic, beryllium, cadmium, chromium, lead, aluminum, antimony, cobalt, copper, iron, manganese, mercury, molybdenum, nickel, selenium, silver, tin, vanadium, and zinc.

*Method Detection Limit (MDL)* - the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.

*Non-Detect* – Concentration of contaminants below the analytical sensitivity of the method.

*Occupied Space* – Office space, closets, maintenance rooms, etc. It is defined as the area below the false ceiling and outside of mechanical chases in the Building, whether occupied by personnel or not.

*(PCBs)* – *Polychlorinated Biphenyl*. Any of 209 individual chlorinated biphenyl compounds.

*PCDD* – Acronym for Polychlorinated dibenzo-p-dioxins (see dioxins/furans)

*PCDF* - Acronym for Polychlorinated dibenzofurans (see dioxins/furans)

*(PNAs)* – Polynuclear Aromatic Compounds. Organic compounds resulting from incomplete combustion of building materials. PNAs are known carcinogens.

*ppb* – Parts per billion.

*ppm* – Parts per million.

*structures/cm<sup>2</sup>* – Structures per square centimeter.

*Standard Deviation* – A measure of variability (dispersion) of observations or measurements.

*Standard Error* - A measure of variability that is equal to the standard deviation of the population divided by the square root of the sample size.

*Structures* – Individual fibers or bundles of asbestos.

*Toxicity Equivalent (TEQ)* – Standard for contamination levels of dioxins/furans.

*Unoccupied Space* – Areas that are not subject to normal occupation by building tenants including spaces above the false ceilings in the building, chases, and some mechanical spaces.

*95-95% Upper Tolerance Limit (UTL)* - The limit below which 95% of all values are expected to occur, calculated for a stated confidence of 95%.

*WTC* – World Trade Center

*WTC Dust* – Refers to the combination of contaminants generated during the WTC Event, which include soot, dust, dirt, debris and contaminants.

*WTC Event* – Refers to the attacks on and subsequent collapse of the WTC towers, including WTC fires, building fires, demolition activities, and any other related activities that resulted in contamination of the Building from September 11, 2001 to December 5, 2001.

*WTC Hazardous Substances* – Refers to the hazardous constituents found in WTC Dust, such as asbestos, polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), expressed as 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) Equivalents (TEQ), total polynuclear aromatic hydrocarbons (PNAs), total polychlorinated biphenyls (PCBs) - reported as Aroclors, cadmium, lead, mercury and beryllium.