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U.S. POST OFFICE BUILDING
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I. SUMMARY

On February 13, 1987, the National Institute for Occupational Safety and Health (NIOSH) received a request from the U.S. Department of Justice on behalf of the U.S. Postal Service for technical assistance in conducting a study to determine the background concentrations of polychlorinated biphenyls (PCBs) in the U.S. Post Office Building in Oklahoma City, Oklahoma. The objective of the study was to determine the air and surface concentrations of PCBs present as normal levels of background contamination in a building similar to the Page Belcher Federal Building in Tulsa, Oklahoma. These buildings are similar in that both were constructed in the mid-1960s, and have served as mail handling as well as office buildings. However, the Page Belcher Building is uniquely dissimilar in that it experienced a soot-producing electrical transformer malfunction in 1982.

Air samples were obtained throughout the workspace of the Oklahoma City Post Office (OCPO) Building and ambient air. Wipe samples were obtained on workspace surfaces (floors, walls, desks, cabinets, etc.), and air supply diffuser surfaces (towards the ventilation duct) for 18 of 21 air-handling units.

Fourteen of 18 air samples collected in the workspace of the OCPO Building showed non-detectable (<0.006 ug/m^3) concentrations of PCBs; four of 18 showed detectable concentrations ranging from 0.006 to 0.10 ug/m^3 (geometric mean = 0.01 ug/m^3). Thirty-seven samples collected in the Page Belcher Federal (PBF) Building all showed measurable airborne concentrations ranging from 0.11 to 0.37 ug/m^3 (geometric mean = 0.21 ug/m^3).

The surface concentrations of PCBs present on OCPO Building air supply diffusers from 18 air handling systems ranged from non-detected (<0.36 ug/m^2) to 44 ug/m^2 (n = 36, geometric mean = 6.6 ug/m^2). These concentrations are significantly lower (t = -5.71, p <0.0001) than the concentrations (n = 78, range = 2 to 332 ug/m^2, geometric mean = 37 ug/m^2) present in the air handling systems in the PBF Building.

The concentrations of PCBs on OCPO Building workspace surfaces ranged from non-detected (<0.28 ug/m^2) to 56 ug/m^2 (n = 108, geometric mean = 1.5 ug/m^2). These concentrations are not significantly different (t = -1.38, p >0.16) from the concentrations (n = 207, geometric mean = 1.9 ug/m^2, range = <0.32 to 92 ug/m^2) present on workspace surfaces in the basement, floors one through four, and first and second mezzanines in the PBF Building. Comparison of the workspace concentrations in the mail handling workrooms (first and second floors) show that the concentrations in the OCPO Building (n = 41, geometric mean = 1.4, range = <0.28 to 56 ug/m^2) are significantly lower (t = -3.35, p <0.001) than those present in the PBF Building (n = 59, geometric mean = 4.1 ug/m^2), range = <0.32 to 58 ug/m^2). The air handling systems servicing these areas in the PBF Building showed the highest concentration of contamination (geometric mean = 82 ug/m^2, range = 14 to 332 ug/m^2). The concentrations of PCBs on workspace surfaces in areas other than the mail workroom floors are not significantly different (t = 0.83, p >0.41) in these buildings.

Based upon these environmental sampling results, it is concluded that the concentrations of PCBs present in air and on air handling system surfaces in the Oklahoma City Post Office Building are significantly lower than the concentrations present in the Page Belcher Federal Building. It also is concluded, that overall, there is not a significant difference in the concentrations of PCBs present on workspace surfaces in these buildings. In the OCPO Building, the surface concentrations of PCBs are below the 50 ug/m^2 evaluation criteria used by NIOSH investigators in assessing PCB contamination on surfaces in commercial office buildings.

KEYWORDS: SIC 9199 (Office Building), polychlorinated biphenyls, PCBs, background, air, surface.

II. INTRODUCTION

On February 13, 1987, the National Institute for Occupational Safety and Health (NIOSH) received a request from the U.S. Department of Justice on behalf of the U.S. Postal Service for technical assistance in conducting a study to determine the background concentrations of polychlorinated biphenyls (PCBs) in the U.S. Post Office Building in Oklahoma City, Oklahoma. The objective of the study was to determine the concentrations of PCBs present as normal levels of background contamination in a building similar to the Page Belcher Federal Building (U.S. Post Office and Court House) in Tulsa, Oklahoma. These buildings are similar in the following ways: both were constructed in the mid-1960's and both have served as mail handling as well as office buildings. However, the Page Belcher Building is uniquely dissimilar in that it experienced a soot-producing PCB transformer malfunction in April 1982 [1].

On April 10-14, 1987, NIOSH researchers conducted a study to determine the surface and airborne concentrations of PCBs present in the Oklahoma City Post Office Building. This report presents the results of the background contamination study and compares the PCB contamination concentrations present in the two buildings.

III. BACKGROUND

A. U.S. Post Office Building, Oklahoma City, OK

1. Structure

The Oklahoma City Post Office Building is a four story structure containing approximately 238,000 square feet of floor space with a half basement. It was constructed between 1964 and 1966, and occupied in 1966.

The basement level consists of an employee training area, offices, printing and maintenance workshops, and storage areas. In addition, there is a conveyor tunnel used for transport of the mail from the east and south dock areas to the mail handling workroom floors.

The first floor constructed at street level consists of a public lobby and a mail handling workroom with exterior loading docks on the west and south sides. Offices, lunchrooms, and miscellaneous mail processing rooms are located at the east and west perimeter sides of the workroom.
The second floor consist of administrative offices at the north end and a mail handling workroom. Offices, lunchrooms, and miscellaneous mail processing rooms are located at the east and west perimeter sides of the workroom.

The third and fourth floors consist of administrative offices. In addition, the fourth floor has a boiler room and refrigeration room along the south perimeter.

2. HVAC System

The building's air is conditioned (heated or cooled) and circulated throughout the building by 21 separate air handling units (AHUs) located in the basement, first, second, and third floor mechanical equipment rooms. These units comprise the building's heating, ventilation, and air-conditioning (HVAC) system. The AHUs and the areas of the building serviced are summarized below:

AHU	Area of Building Serviced
1-B, 1-A	North end of second floor, and floors three and four
B-1	Basement
1-1 through 1-9	Floor one
2-1 through 2-9	Floor two

The individual AHUs supply air to specific zones on each floor. There are a total of 21 interior air supply zones in the building plus two perimeter air supply zones for each of floors three and four, and the north end of the second floor.

B. Page Belcher Federal Building, Tulsa, OK

1. The Structure

The Page Belcher Federal Building is a four story structure containing approximately 375,000 square feet of floor space with a half sub-basement, a full basement, two mezzanines, and a roof penthouse.

The sub-basement area consists of a boiler room and chiller room, and within the latter are the air handling equipment control and lunch rooms. The basement level consists of offices mail handling areas and work shops. In addition, there are two conveyor tunnels used for transport of the mail from the west and north dock areas to the work room floors.
The first floor constructed at street level consists of two public lobbies and the main mail handling area with two exterior loading docks on the north and west sides. The first floor mezzanine located on the perimeter of the building contains a snack room, lounges, locker rooms, and air handling unit rooms.

The second floor consists of offices, mail handling areas, and a maintenance shop. The second floor mezzanine consists of offices along the south side of the building. The third floor is used primarily as miscellaneous office space. The fourth floor consists of judge's courtrooms, meeting rooms and offices. The roof penthouse level contains mechanical rooms for air handling units and elevator equipment rooms.

2. HVAC System

The building's air is conditioned (heated or cooled) and circulated throughout the building by 27 separate air handling units located in the sub-basement, first and second floor mezzanines, third floor, and penthouse mechanical equipment rooms. The individual air handling units supply air to specific zones on each floor. There are a total of 77 interior air supply zones in the building

plus one to three perimeter air supply zones for each of four floors and two mezzanines. An air handling unit may serve from one to nine distribution zones.

IV. STUDY DESIGN AND METHODS

A. Study Design

The objective of the study was to determine the concentrations of PCBs present as normal levels of background contamination in the Oklahoma City Post Office Building and compare these concentrations to those present in the Page Belcher Federal Building in Tulsa, Oklahoma [1].

The airborne and surface concentrations of PCBs were measured with building's HVAC system operating under normal occupancy conditions. The fresh-air intakes were tested to determine the concentration of PCBs in the ambient air entering the building. The frequency of the air and surface samples collected by area of the building are summarized below:

	Number of PCB Samples	
Area	Air	Surface
4th Floor	3	20
3rd Floor	3	13
2nd Floor North End	2	13
2nd Floor exc. North End	3	19 (1)*
1st Floor	4	28 (1)
Basement	3	15
Interior HVAC System	0	36
Roof Fresh Air-Intake	2	0
Field Blanks	3	14
Total	23	158

*Value in parentheses represents the number of samples lost in chemical analysis.

Samples were obtained to determine the PCB concentrations on both building's surfaces (floors, vertical, elevated horizontal, and high skin contact surfaces), as well as interior HVAC system surfaces. Vertical surfaces include walls, structural columns, and sides of equipment. Elevated horizontal surfaces are those surfaces at a height of greater than six-feet above the floor; these surfaces include tops of ventilation ducts and pipes, and tops of storage shelves and cabinets. High skin contact surfaces are those with which a person would probably have frequent and/or prolonged direct dermal contact. Typical high skin contact surfaces include desks, tables, counters, file cabinets, mail handling equipment and miscellaneous work surfaces. The HVAC system samples were obtained by removing a duct ceiling diffuser and wiping the surface towards the duct. The ceiling diffusers were either 41-, 24-, or 12-inches in diameter. In the case of the 12-inch diameter diffuser, the vertical interior side of the duct also was wiped to obtain an area of 0.25 square meters.

B. Sampling and Analytical Methods

1. Air and Surface Sampling Methods

Air samples for PCBs were collected using NIOSH Method 5503 [2]. The method involves a two-stage sampling device consisting of a 13-mm glass fiber particulate filter preceded by 150 mg of florisil adsorbent (100 mg front and 50 mg back sections). The samples were collected using constant

flow vacuum pumps at a flowrate of 1.0 liters per minute (L/min) for approximately 2880 minutes. The filter and sorbent tube were changed at approximately 1440 minutes. The two filters and sorbent tubes were then composited by the laboratory chemists as a single sample. The extended sampling period has been evaluated by a NIOSH investigator [1,15].

Surface wipe samples for PCBs were collected using 3" x 3" soxhlet extracted cotton gauze pads, which were wetted with 8-ml of pesticide grade hexane prior to sampling [18]. The sampling procedure consisted of marking off a surface into a 0.25 m^2 area using a galvanized steel template or a metal tape measure. Each 0.25 m^2 area was wiped, with a gauze pad held with a gloved-hand, in two directions; the second direction was performed at a 90° angle to the first direction. The gauze pad sample was then placed in a glass sample container equipped with a Teflon-lined lid.

2. Air and Surface Analytical Methods

The gauze samples were prepared for analysis by extraction in 40 milliliters of hexane. The concentrated hexane eluant was cleaned on a florisil column and the sample was brought to a final volume of 3 milliliters.

The florisil tubes were separated into two A and two B sections. Each section pair was desorbed in 1.5 milliliters of iso-octane with sonication for 1/2 hour. The glass fiber filters were desorbed in 1 milliliter of toluene with sonication for 1/2 hour.

The gas chromatographic analysis was performed on a Hewlett-Packard Model 5730A gas chromatograph equipped with an electron capture detector and accessories for capillary column capabilities. A 30 m x 0.31 mm fused silica WCOT capillary column coated internally with DB-5 was used with temperature programming from 210°C (held for two minutes) to 310°C at a rate of 8°C/minute. Five percent methane in argon was used as the carrier gas. The injector was operated in the splitless mode of operation.
The presence of an Aroclor was determined by comparison with standard samples of Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260 obtained from the EPA. Quantitation was performed by summing the peak heights of the five major peaks of the standards and comparing those sums to the sums of the same peaks in the sample.

3. Quality Assurance
The laboratory quality assurance included (a) 10% replicate analysis; (b) 15% spiked audit samples; and (c) 15% and 10% field blanks for air and surface samples, respectively. Replicate analysis of samples provides a measure of analytical precision. A second aliquot of the sample extract is analyzed and results are compared to evaluate the variability inherent in the analytical method. Analysis of spiked audit samples provides an assessment of analytical accuracy. Spike samples were prepared by the laboratory quality assurance officer by adding a known quantity of Aroclor 1248, 1254 or 1260 to a clean cotton gauze pad; or Aroclor 1242, 1254 or 1260 to a florisil tube and Aroclor 1260 to a glass fiber filter.

3. Sample Chain-of-Custody

Sample Chain-of-Custody procedures were an integral activity of both sampling and analytical activities. Chain-of-Custody procedures provided documentation of samples through all phases of activities from the time the sampling devices were prepared to be sent to the field through reporting of the

analytical results. Sample Chain-of-Custody was initiated by the sampling personnel upon receipt of the sampling devices. Each sampling device was assigned a unique identification number. The Chain-of-Custody procedures were in accordance with those specified in NIOSH's manual of Standard Operating Procedures for Industrial Hygiene Sampling and Chemical Analyses, SOP No. 019, December 19, 1984.

4. Statistical Treatment of Data

In the statistical analysis of the surface wipe data, none detected values were treated using the L/2 approximation method [3,4]. This approach assumes that all none detected (ND) values are equal to half the detection limit (L), i.e., ND = L/2.
The PCB surface data were tested for normality [5,6] to determine if the data followed a normal or log normal distribution. The Shapiro-Wilk Statistic, W, was used to test for normality if the sample size was less than 51. The Kolmogorov Statistic, D, was used if the sample size was greater than 50. These tests showed the data to be log normally distributed. Therefore, the geometric mean was used as the primary measure of central tendency. The statistical comparisons were performed using log transformed data.

A t-statistic [5,6] was used to test the null hypotheses of no difference between the mean log surface concentrations of PCBs present in the U.S. Post Office Building and those present in the Page Belcher Federal Building.

V. EVALUATION CRITERIA

A. Toxicology

Commercial PCBs are mixtures of isomers of chlorinated biphenyls. PCBs were manufactured in the United States and marketed under the "Trade name Aroclor" according to the average percent chlorine content of the mixture. The Aroclor products were designated by numbers such as 1221, 1242, 1248, 1254, and 1260, with the last two digits representing the approximate percent by weight of chlorine in the mixtures. Aroclor 1016, however, contained 41% chlorine.

The International Agency for Research on Cancer has concluded that the evidence for PCBs' carcinogenicity to animals and to humans is limited. "Certain polychlorinated biphenyls are carcinogenic to mice and rats after their oral administration, producing benign and malignant liver neoplasms. Oral administration of polychlorinated biphenyls increased the incidence of liver neoplasms in rats previously exposed to N-nitrosodiethylamine" [7].

In a mortality study among workers at two capacitor manufacturing plants in the United States [8] a greater than expected number of observed deaths from cancer of the liver and cancer of the rectum were noted. Neither increase was statistically significant for both study sites combined. However, in a recent update of this study, with follow-up through 1982, the excess in liver/biliary tract cancer was statistically significant (5 observed vs. 1.9 expected)/ whereas, the excess in cancer of the rectum was still elevated but not statistically significant. In a mortality study among workers at a capacitor manufacturing plant in Italy [9] males had a statistically significant increased number of deaths from all neoplasms. When analyzed separately by organ system, death from neoplasms of the digestive organs and peritoneum (3 observed vs. 0.88 expected) and from lymphatic and hematopoietic tissues (2 observed vs. 0.46 expected) were elevated. This study was

recently expanded to include all workers with one week or more of employment with vital status follow-up through 1982. In the updated results, there was a statistically significant excess in cancer among both females (12 observed vs. 5.3 expected) and males (14 observed vs. 7.6 expected). In both groups there were non-significant excesses in lymphatic/hematopoietic cancer and a statistically significant excess in digestive cancer among males (6 observed vs. 2.2 expected). Unfortunately, not enough information is provided to determine the risk specifically for liver cancer.

B. Exposure Criteria

The National Institute for Occupational Safety and Health (NIOSH) recommends that exposure to PCBs in the workplace be limited at or below the minimum reliable detectable concentration of 1 ug/m^3 determined as a time-weighted average for up to a 10-hour workday, 40-hour workweek. The NIOSH recommended exposure limit (REL) was based on the findings of adverse reproductive effects in experimental animals, on the conclusion that PCBs are carcinogens in rats and mice and, therefore, potential human carcinogens in the workplace, and on the conclusion that human and animal studies have not demonstrated a level of exposure to PCBs that will not subject the worker to possible liver injury [10,11].

The Occupational Safety and Health Administration (OSHA) promulgated its permissible exposure limit (PEL) of 1 mg/m^3 for airborne chlorodiphenyl products (PCBs) containing 42% chlorine and 0.5 mg/m^3 for chlorodiphenyl products containing 54% chlorine determined as 8-hour time-weighted average (TWA) concentrations based on the 1968 Threshold Limit Values (TLVs) of the American Conference of Governmental Industrial Hygienists (ACGIH) [12]. The TLVs, which have remained unchanged at 1 mg/m^3 and 0.5 mg/m^3 through 1986, are based on the prevention of liver injury in exposed workers [13]. The OSHA PEL and the ACGIH TLV include a "Skin" notation which refers to the potential contribution to overall exposure by the cutaneous route.

There are no NIOSH RELs, OSHA PELs or ACGIH TLVs for assessing exposure from surfaces contaminated with PCBs. Data collected by NIOSH researchers [14,15] show that the concentrations of PCBs present as normal levels of background contamination in commercial office buildings ranged from non-detected (<1 ug/m^2) to 21 ug/m^2 (mean 9 ug/m^2) on high skin contact surfaces, and 3 to 110 ug/m^2 (mean 18 ug/m^2) on elevated horizontal surfaces. Based upon these data and other data [16] collected by NIOSH researchers, a surface guideline of 50 ug/m^2 is used by NIOSH researchers to assess exposure to PCBs on surface in commercial office buildings. U.S. EPA [17] has recommended a cleanup criteria of 10 ug/100 cm^2 (equivalent to 1000 ug/m^2) for high skin contact surfaces contaminated with PCBs.

VI. RESULTS AND DISCUSSION

A. Airborne and Surface Concentrations of PCBs

A total of 20 air samples were collected for the analysis of PCBs (Table 1). Two of these samples were collected at the roof fresh air intake to determine the concentration of PCBs entering the building through the ambient air; and 18 samples were collected in the occupied workspace of the building. The ambient air samples did not show detectable concentrations of PCBs at a detection limit of approximately <0.006 ug/m^3. Four of the 18 workspace samples showed concentrations above the detection limit; these four samples ranged from 0.006 to 0.1 ug/m^3 (geometric mean = 0.01 ug/m^3). The PCB in three of the four samples was identified as Aroclor 1260; the fourth sample showed a combination of Aroclor 1254 and 1260.

The PCB analyses of 36 samples collected from the surface of air supply diffusers of ventilation ducts from 18 air-handling units (AHUs) are presented in Table 2. Each of the air-handling systems were sampled at two locations in the workspace. Thirty-one of the 36 samples showed detectable concentrations of PCBs. Overall, the concentrations ranged from non-detected (<0.36 ug/m^2) to 44 ug/m^2 (geometric mean = 6.6 ug/m^2) with a 5-95 percentile range of non-detected (<0.36 ug/m^2) to 39 ug/m^2. (The 5-95 percentile range encompasses 90% of the sample concentrations.) The PCB was identified as Aroclor 1260 in the 31 samples; other Aroclors 1016, 1221, 1232, 1242, 1248, and 1254 were not present at the same detection limit.

The PCB analyses of 108 samples collected from various workspace surfaces throughout the building are presented in Table 3. Ninety-five of the 108 samples showed detectable concentrations of PCBs. Overall, the concentrations ranged from non-detected (<0.28 ug/m^2) to 56 ug/m^2 (geometric mean = 1.5 ug/m^2) with a 5-95 percentile range from non-detected to 21 ug/m^2. One value (56 ug/m^2) exceeded 50 ug/m^2. This sample was collected on an elevated horizontal surface (top of a ventilation duct) in the first floor mail workroom. The PCB was identified as Aroclors 1248, 1254 or 1260; Aroclors 1016, 1221, 1232 and 1242 were not detected.

The analyses of the 108 workspace samples are summarized in Table 4 by area of the building (basement through floor four) and location within the area (floors, vertical, elevated horizontal and high skin contact surfaces). Vertical surfaces include walls, structural columns and sides of equipment; elevated horizontal surfaces are those surfaces at a height of greater than six-feet above the floor such as tops of cabinets, bookshelves, and ventilation ducts; and high skin contact surfaces include desks, tables, counters and file cabinets. Higher concentrations were present on floors and elevated horizontal

surfaces (geometric means = 3.5 and 3.2 ug/m^2, respectively) than on high skin contact and vertical surfaces (geometric means = 2.3 and 0.60 ug/m^2, respectively).

B. Comparison of PCB Contamination Concentrations: Oklahoma City Post Office Building versus Page Belcher Federal Building [1].

The samples collected in the Oklahoma City Post Office (OCPO) Building generally showed that the air contained non-detectable (<0.006 ug/m^3) concentrations of PCBs; four of the 18 workspace samples that showed detectable concentrations ranged from 0.006 to 0.10 ug/m^3 (geometric mean = 0.01 ug/m^3). The samples collected in the Page Belcher Federal (PBF) Building in February 1986 all showed detectable air concentrations of PCBs (geometric mean = 0.21 ug/m^3, range = 0.11 to 0.37 ug/m^3, n = 37), and the concentrations did not vary with area of the building ($F = 1.44$, $p = 0.21$).

The surface concentrations of PCBs present in the 18 air-handling systems in the OCPO Building were compared to the concentrations present in the 26 air-handling systems in the PBF Building. The concentrations of PCBs present in the OCPO Building (geometric mean = 6.6 ug/m^3, range = <0.28 to 44 ug/m^2, n = 36) are significantly lower ($t = -5.71$, $p < 0.0001$) than the concentrations present in the PBF Building (geometric mean = 37 ug/m^2, range = 2 to 332 ug/m^2, n = 78).

The concentrations of PCBs on the workspace surfaces in the two buildings were compared. The areas of the PBF Building were limited to the basement, floors one through four, and first and second mezzanines. The surface concentrations of PCBs in the OCPO Building (geometric mean = 1.5 ug/m^2, range = <0.28 to 56 ug/m^2, n = 108) are not significantly different ($t = -1.38$, $p > 0.16$) from the concentrations present in the PBF Building (geometric mean = 1.9 ug/m^2, range = <0.32 to 92 ug/m^2, n = 207).

The concentrations on the workspace surfaces in the main mail handling workrooms in each building also were compared. The concentrations in the OCPO Building (geometric mean = 1.4 ug/m^2, range = 0.28 to 56 ug/m^2, n = 41) were significantly lower (t = -3.35, p <0.001) than the concentrations present in the PBF Building (geometric mean = 4.1 ug/m^2, range = <0.32 to 58 ug/m^2, n = 5.9). This difference is consistent with the contamination levels present in the ventilation system of the PBF Building; seven of the air-handling systems that service these floors contained the highest surface concentrations of PCBs (geometric mean = 82 ug/m^2, range 14 to 332 ug/m^2, n = 29). These concentrations also are significantly greater (t = -8.21, p <0.0001) than the concentrations present in the air-handling systems that service the mail workroom areas in the OCPO Building.

The concentrations of PCBs on workspace surfaces in the areas of the two buildings, excluding the main mail handling workrooms also were compared. The concentrations in the OCPO Building (geometric mean = 1.6 ug/m^2, range = <0.28 to 22 ug/m^2, n = 67) are not significantly different (t = 0.83, p >0.41) from the concentrations present in the PBF Building (geometric mean = 1.4 ug/m^2, range = <0.32 to 23 ug/m^2, n = 148).

VII. CONCLUSIONS

A study was conducted to determine the air and surface concentrations of polychlorinated biphenyls (PCBs) present as background contamination in the Oklahoma City Post Office Building, and compare these data to the concentrations present in the Page Belcher Federal Building in Tulsa, Oklahoma. The buildings are similar in that both were constructed in the mid-1960's, and have served as mail handling as well as office buildings. The Page Belcher Building is uniquely dissimilar in that it experienced a soot-producing PCB-transformer malfunction in 1982.

The air in the Oklahoma City Post Office (OCPO) Building generally contained non-detectable concentrations of PCBs. Measurable concentrations of PCBs were consistently present on workspace surfaces, as well as on air-handling system surfaces. The surface concentrations were below the 50 ug/m^2 evaluation criteria used by NIOSH investigators in assessing PCB contamination on surfaces in commercial office buildings.
Comparison of the OCPO Building background contamination data to the contamination levels present in the Page Belcher Federal (PBF) Building showed the following:

1. The air in the OCPO Building generally contained non-detectable concentrations of PCBs, whereas, the air in the PBF Building contained measurable concentrations which did not vary with area of the building.

2. The surface concentrations of PCBs present in the air-handling systems in the OCPO Building are statistically significantly lower than the concentrations present in the air-handling systems in the PBF Building.

3. The overall PCB concentrations on workspace surfaces throughout the two buildings are not significantly different. (The comparison excludes the contamination levels present on the west loading dock, conveyor tunnels, and sub-basement areas of the PBF Building). However, comparison of the concentrations present in the main mail workrooms showed that significantly lower concentrations were present in the OCPO Building than in the PBF Building.

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1. Assistant United States Attorney, Tulsa, Oklahoma
2. Office of Counsel, U.S. Postal Service, Washington, D.C.
3. Field Director of Human Resources, U.S. Post Office, Oklahoma City, Oklahoma

For the purpose of informing affected employees, copies of this report shall be posted by the employer in a prominent place accessible to the employees for a period of 30 calendar days.

Table 1

Airborne Concentrations of Polychlorinated Biphenyls

U.S. Post Office Building
Oklahoma City, Oklahoma

April 10-12, 1987

Sample Number	Sample Location	Sample Volume Liters	Aroclor Conc. ug/m^3 1254	1260
	Mail Handling:			
204AB	1st floor at column F7	3028	ND[a]	ND[a]
205AB	1st floor weighers station	3112	ND	ND
206AB	1st floor at column D14	3104	ND	ND
207AB	2nd floor at column F7	3092	ND	ND
208AB	2nd floor room 233	3134	ND	0.006
209AB	2nd floor at column F14	3013	ND	0.007
	Office Tower:			
210AB	Basement room 019A	3077	ND	ND
211AB	Basement room 06A	2968	ND	ND
212AB	Basement room 018	3060	ND	ND
203AB	1st floor service counter	3098	ND	ND
219AB	2nd floor room 219	3036	ND	ND
220AB	2nd floor room 209A	2208	ND	ND
216AB	3rd floor room 302	2941	0.09	0.007
217AB	3rd floor room 317A	2787	ND	ND
218AB	3rd floor room 305A	2992	ND	ND
213AB	4th floor room 406	2882	ND	ND
214AB	4th floor room 405	2881	ND	ND
215AB	4th floor room 403	2994	ND	0.01
201AB	Roof fresh air intake	3143	ND	ND
202AB	Roof fresh air intake	3090	ND	ND
221AB	Field blanks	0	ND	ND
222AB	Field blanks	0	ND	ND
223AB	Field blanks	0	ND	ND

[a]Denotes non-detected. The limit of detection for Aroclors 1254 and 1260 is <0.02 ug per sample, which is equivalent to approximately <0.006 ug/m^3 assuming an air volume of 3022 liters.

Table 3

Surface Concentrations of Polychlorinated Biphenyls

U.S. Post Office Building
Oklahoma City, Oklahoma

April 10-12, 1987

Sample Number	Sample Location	Aroclor Concentration ug/m^2 1248	1254	1260	Total
	BASEMENT:				
WP116	Room 018 top of file cabinet at column J6	0.96	ND	ND	0.96
WP117	Room 018 top of table at column J7/J8	ND[a]	[0.40][b]	ND	[0.40][b]
WP118	Room 03 top of storage cabinet at column K6	ND	ND	0.72	0.72
WP119	Room 05 top of table	ND	ND	0.64	0.64
WP120	Field Blank	ND	ND	ND	ND
WP121	Room 05 concrete floor	1.6	ND	ND	1.6
WP122	Room 06 top of storage locker at columns K9/K10	ND	ND	1.6	1.6
WP123	Room 019A top of table	1.6	ND	ND	1.6
WP124	Room 019A top of metal storage cabinet	ND	ND	1.2	1.2
WP125	Room 019A top of desk	1.1	ND	ND	1.1
WP126	Room 019A top of metal storage cabinet	[0.76]	ND	ND	[0.76]
WP127	Room 08 ceramic tile floor	2.2	ND	ND	2.2
WP128	Room 020 wall at column G11	[0.88]	ND	ND	[0.88]
WP129	Room 022 top of table	1.9	ND	ND	1.9
WP130	Room 022 top of storage locker	ND	ND	16.8	16.8
WP131	Room 022 top of storage cabinet	ND	ND	7.2	7.2
	FIRST FLOOR: North End				
WP110	Lobby at columns C2 terrazo tile floor	1.2	ND	ND	1.2
WP111	Room 103 at column 2C wall	ND	[0.72]	ND	[0.72]
WP112	Room 105 top of storage cabinet	ND	ND	7.6	7.6
WP113	Room 105 top of wall for postique room	ND	ND	4.0	4.0
WP114	Room 105 top of service counter	ND	ND	ND	ND
WP115	Room 105 top of safe	ND	ND	1.2	1.2

Table 3 (continued)

Sample Number	Sample Location	Aroclor Concentration ug/m^2 1248	1254	1260	Total
	FIRST FLOOR:				
WP62	Room 130 top of desk	ND[a]	ND	ND	ND
WP63	Column J14 top of ventilation duct	ND	ND	23.3	23.3
WP64	Column G13 top of file cabinet	ND	ND	ND	ND
WP65	Column G12/G13 top of ventilation duct	ND	ND	12.8	12.8
WP66	Column J11/J12 top of ventilation duct	ND	ND	56.0	56.0
WP67	Column J9 top of storage cabinet	ND	ND	12.0	12.0
WP68	Column G9/G10 top of ventilation duct	ND	ND	24.4	24.4
WP69	Column F8/F9 top of ventilation duct	ND	ND	13.2	13.2
WP70	Column D9/D10 top of ventilation duct	ND	ND	21.2	21.2
WP71	Column C12/C13 top of ventilation duct	ND	24.8	ND	24.8
WP72	Field blank	ND	ND	ND	ND
WP132	Field blank	ND	ND	ND	ND
WP133	Room 114 top of table	1.2	ND	ND	1.2
WP134	Column D7/D8 flat case table	0.96	ND	ND	0.96
WP135	Column C5 top of table	[0.80][b]	ND	ND	[0.80]
WP136	Room 161 top of table	[0.40]	ND	ND	[0.40]
WP137	Room 161 vinyl floor tile	1.7	ND	ND	1.7
WP138	Room 149 top of table	[0.84]	ND	ND	[0.84]
WP139	Column G16 wall	[0.60]	ND	ND	[0.60]
WP140	Room 128 top of table	[0.72]	ND	ND	[0.72]
WP149	Room 118 top of service counter	ND	ND	ND	ND
WP150	Column J9/J10 top of flat sorting machine	*	*	*	*
WP151	Column G7 top of file cabinet	1.5	ND	1.4	2.9
WP152	Room 156 top of table	ND	ND	1.4	1.4
WP153	Column E12/E13 top of table	ND	ND	ND	ND
	SECOND FLOOR: North End				
WP95	Room 200 top of mail case	ND	ND	2.6	2.6
WP96	Field blank	ND	ND	ND	ND
WP97	Room 200 top of desk	1.6	ND	0.96	2.6
WP98	Room 204 wall at column F1	ND	ND	3.8	3.8
WP99	Room 207 top of desk	1.5	ND	0.92	2.4
WP100	Room 209B top of partition wall	ND	ND	10.8	10.8
WP101	Room 209A top of file cabinet	ND	ND	3.0	3.0
WP102	Room 211 top of desk	ND	ND	1.2	1.2
WP103	Room 217 vinyl tile floor	ND	4.0	ND	4.0

Table 3 (continued)

Sample Number	Sample Location	Aroclor Concentration ug/m^2 1248	1254	1260	Total
	SECOND FLOOR: North End (continued)				
WP104	Room 217 ceramic tile floor	ND	4.4	ND	4.4
WP105	Room 219A top of metal storage cabinet	ND	ND	1.7	1.7
WP106	Room 219A top of desk	[0.72]	ND	[0.52]	[1.2]
WP107	Room 219A top of file cabinet	ND	ND	1.3	1.3
WP108	Field Blank	ND	ND	[0.44]	[0.44]
WP109	Room 219A top of storage cabinet	ND	1.5	ND	1.5
	SECOND FLOOR:				
WP78	Column F9/F10 top of ceiling air supply diffuser	ND	9.6	ND	9.6
WP79	Column E6/E7 top of letter case	ND	ND	ND	ND
WP80	Column J6 top of storage cabinet	ND	[0.52]	ND	[0.52]
WP141	Column C8 top of file cabinet	[0.44]	ND	ND	[0.44]
WP142	Column E16 top of work table	[0.44]	ND	ND	[0.44]
WP143	Column F14 top of table	[0.10]	ND	ND	[0.40]
WP144	Field blank	ND	ND	ND	ND
WP145	Column G8 top of file cabinet	[0.84]	ND	[0.44]	[1.3]
WP146	Column F7/E7 top of file cabinet	[0.84]	ND	ND	[0.84]
WP147	Column E8 top of file cabinet	[0.88]	ND	ND	[0.88]
WP148	Field blank	ND	ND	ND	ND
WP154	Room 250 top of table	[0.80]	ND	ND	[0.80]
WP155	Column D13/D14 flat case table	[0.64]	ND	ND	[0.64]
WP156	Field blank	ND	ND	ND	ND
WP157	Column D13/D14 flat case table	*	*	*	*
WP158	Room 241 top of table	ND	ND	ND	ND
WP159	Room 243 top of disc decoder	ND	ND	ND	ND
WP160	Room 257 top of table	ND	ND	0.88	0.88
WP73	Column C11/C12 top of storage locker	ND	0.68	ND	0.68
WP74	Column C17/C18 top of storage locker	ND	[0.36]	ND	[0.36]
WP75	Column D16/D17 top of storage cabinet	ND	ND	8.4	8.4
WP76	Column J16/J17 top of partition wall	ND	3.2	ND	3.2
WP77	Column F13/F14 top of storage cabinet	ND	2.1	ND	2.1

Table 3 (continued)

Sample Number	Sample Location	Aroclor Concentration ug/m^2 1248	1254	1260	Total
	THIRD FLOOR:				
WP81	Room 302 top of table	ND	3.8	ND	3.8
WP82	Room 304 top of file cabinet	ND	ND	1.1	1.1
WP83	Corridor wall at column F3	ND	ND	ND	ND
WP84	Field blank	ND	[0.52]	ND	[0.52]
WP85	Room 305A top of table	2.6	ND	ND	2.6
WP86	Room 307A top of storage cabinet	ND	ND	1.7	1.7
WP87	Room 310 top of storage cabinet	ND	ND	1.0	1.0
WP88	Room 310 top of desk	1.0	ND	ND	1.0
WP89	Mens restroom vinyl tile floor	4.8	ND	2.7	7.5
WP90	Mens restroom ceramic tile floor	4.8	ND	3.1	7.9
WP91	Room 317A top of desk	1.5	ND	ND	1.5
WP92	Room 318 top of desk	[0.48]	ND	ND	[0.48]
WP93	Room 318 top of bookcase	ND	ND	1.8	1.8
WP94	Room 318A top of kardex file	0.92	ND	ND	0.92
	FOURTH FLOOR:				
WP25	Room 403 top of desk	ND	ND	1.6	1.6
WP26	Room 404 top of desk	ND	2.1	ND	2.1
WP27	Room 405 top of desk	2.0	ND	1.4	3.4
WP28	Room 405 top of file cabinet	ND	ND	1.1	1.1
WP29	Room 405 top of storage cabinet	ND	ND	6.0	6.0
WP30	Room 405 top of storage cabinet	ND	21.6	ND	21.6
WP31	Room 402 wall	ND	ND	[0.37]	[0.37]
WP32	Room 406 top of storage cabinet	ND	ND	ND	ND
WP33	Room 406 top of desk	2.0	ND	1.2	3.2
WP34	Room 408 top of table	1.4	ND	ND	1.4
WP35	Room 408B top of storage cabinet	ND	ND	ND	ND
WP36	Field blank	ND	ND	ND	ND
WP37	Corridor wall at Room 409	ND	ND	ND	ND
WP38	Room 409 top of desk	ND	ND	ND	ND
WP39	Room 409 top of storage cabinet	ND	1.5	ND	1.5

Table 3 (continued)

Sample Number	Sample Location	Aroclor Concentration ug/m^2 1248	1254	1260	Total
WP40	Room 409 top of file cabinet	ND	1.0	ND	1.0
WP41	Room 408B top of desk	ND	3.2	ND	3.2
WP42	Room 406 top of file cabinet	ND	1.1	ND	1.1
WP43	Room 418 vinyl tile floor	7.6	ND	5.6	13.2
WP44	Room 415 ceramic tile floor	ND	3.2	ND	3.2
WP45	Room 404 top of file cabinet	ND	ND	[0.76]	[0.76]

[a]Denotes non-detected. The limit of detection for Aroclors 1248, 1254, and 1260 are 0.28 to 0.56 ug/m^2, 0.20 ug/m^2, and 0.14 to 0.40 ug/m^2, respectively.

[b]PCB concentration is between the limit of detection and limit of quantitation. The limit of quantitation for Aroclors 1248, 1254 and 1260 are 0.88 to 1.8 ug/m^2, 0.64 ug/m^2, and 0.52 to 1.3 ug/m^2, respectively.

* Sample lost in chemical analysis.

Table 2

Surface Concentrations of Polychlorinated Biphenyls:
Surface of Supply Air Diffuser Towards Ventilation Duct

U.S. Post Office Building
Oklahoma City, Oklahoma

April 10-12, 1987

Sample Number	Sample Location	Aroclor 1260 ug/m^2
	SECOND FLOOR MAIL HANDLING:	
WP1	AHU* 2-3 column J5/J6	ND (0.36)[a]
WP17	" " " J7/J8	7.6
WP2	AHU 2-2 column J4/J5	ND (0.36)
WP18	" "Room 266	15.6
WP3	AHU 2-1 Room 241	5.2
WP15	" " "243	20.8
WP4	AHU 2-4 column J10/J11	3.0
WP16	" " " J9/J10	20.0
WP5	AHU 2-6 column J12/J13	8.4
WP9	" " " J13/J14	7.6
WP6	AHU 2-5 Room 257	2.2
WP19	" " "262	ND (0.36)
WP7	AHU 2-7 Room 252	9.2
WP8	" " "251	9.6
WP10	AHU 2-8 column G15/G16	7.2
WP11	" " " G14/G15	9.2
WP13	AHU 2-9 column G17/G18	6.8
WP14	" " " D17/D18	10.4
WP12	Field blank	ND (0.36)
	FIRST FLOOR MAIL HANDLING	
WP20	AHU 1-2 column J5/J6	18.8
WP21	" " " G5/G6	28.8
WP22	AHU 1-1 column E3/F3	15.2
WP23	" " " F4/F5	8.8
WP46	AHU 1-4 column J7/J8	ND (0.36)
WP47	" " " D8/D9	ND (0.36)
WP49	AHU 1-5 column D10/D11	30.4
WP50	" " " C10/C11	44.0
WP51	AHU 1-7 column C15/C16	15.2
WP52	" " " D15/D16	22.0
WP53	AHU 1-8 column D17/D18	8.8
WP54	" " " E17/E18	23.6

Table 2 (continued)

Surface Concentrations of Polychlorinated Biphenyls:
Surface of Supply Air Diffuser Towards Ventilation Duct

U.S. Post Office Building
Oklahoma City, Oklahoma

April 10-12, 1987

Sample Number	Sample Location	Aroclor 1260 ug/m^2
WP55	AHU 1-9 Room 145	3.1
WP56	" " "158	32.8
WP57	AHU 1-3 Room 119	8.0
WP58	" " "118	38.0
WP59	AHU 1-6 Room 128	15.6
WP61	" " "130	15.2
WP24	Field Blank	ND (0.36)
WP48	" "	ND (0.36)
WP60	" "	ND (0.36)

[a] Denotes non-detected. Value in parentheses is the limit of detection.

* Denotes air-handling unit.

Table 4
Summary of Polychlorinated Biphenyl (PCB) Concentrations on Workplace Surfaces by Area and Location
U.S. Post Office Building
Oklahoma City, Oklahoma
April 10 - 12, 1987

		PCB Concentration ug/m^2				
Area	Location of Surface	Geometric n/N*	Geometric Mean[a]	Mean[a]	Std. Dev.	Range
4th Floor	Floor	2/2	8.2	6.4	2.8	3.2 - 13
	Vertical	0/2	-	-	-	ND[b]
	High Skin Contact	10/11	1.7	1.4	2.1	ND - 3.4
	Elevated Horizontal	3/5	5.9	1.6	7.5	ND - 22
	Overall	15/20	3.3	1.4	3.7	ND - 22
3rd Floor	Floor	2/2	7.7	7.7	1.0	7.5 - 7.8
	Vertical	0/1	-	-	-	ND
	High Skin Contact	6/6	1.7	1.4	2.1	0.48 - 2.8
	Elevated Horizontal	4/4	1.4	1.3	1.4	0.92 - 1.8
	Overall	12/13	2.4	1.5	2.8	ND - 7.8
2nd Floor	Floor	2/2	4.2	4.2	-	4.0 - 4.4
(North End)	Vertical	1/1	3.8	3.8	-	-
	High Skin Contact	6/6	2.0	1.8	1.5	1.2 - 3.0
	Elevated Horizontal	4/4	4.1	2.9	2.5	1.7 - 11
	Overall	13/13	3.1	2.5	1.9	1.2 - 11
2nd Floor	High Skin Contact	8/11	0.66	0.57	1.9	ND - 1.3
(Mail Workroom)	Elevated Horizontal	8/8	3.1	1.4	4.3	0.36 - 9.6
	Overall	16/19	1.7	0.83	3.0	ND - 9.6
1st Floor	Floor	1/1	1.2	1.2	-	-
(North End)	Vertical	1/1	0.72	0.72	-	-
	High Skin Contact	1/2	0.67	0.41	-	ND - 1.2
	Elevated Horizontal	2/2	5.8	5.5	-	4.0 - 7.6
	Overall	5/6	2.5	1.3	4.0	ND - 7.6
1st Floor	Floor	1/1	1.7	1.7	-	-
(Mail Workroom)	Vertical	1/1	0.60	0.60	-	-
	High Skin Contact	8/12	0.84	0.58	2.5	ND - 2.9
	Elevated Horizontal	8/8	23	21	1.7	12 - 56
	Overall	18/22	9.1	2.2	6.5	ND - 56

Table 4 (continued)

Area	Location of Surface	PCB Concentration ug/m^2 n/N*	Geometric Mean[a]	Mean[a]	Std. Dev.	Range
Basement	Floor	2/2	1.9	1.9	-	1.6 - 2.2
	Vertical	1/1	0.86	0.86	-	-
	High Skin Contact	6/6	1.1	0.95	1.8	0.4 - 1.9
	Elevated Horizontal	6/6	4.7	2.2	3.6	0.72 - 17
	Overall	15/15	2.6	1.5	2.5	0.4 - 17

* n/N denotes the number of samples above the detection limit/the total number of samples collected.

[a] Arithmetic and geometric means calculated with non-detected values treated as one-half the detection limit.

[b] ND denotes non-detected. The limit of detection ranged from 0.14 to 0.56 ug/m^2.