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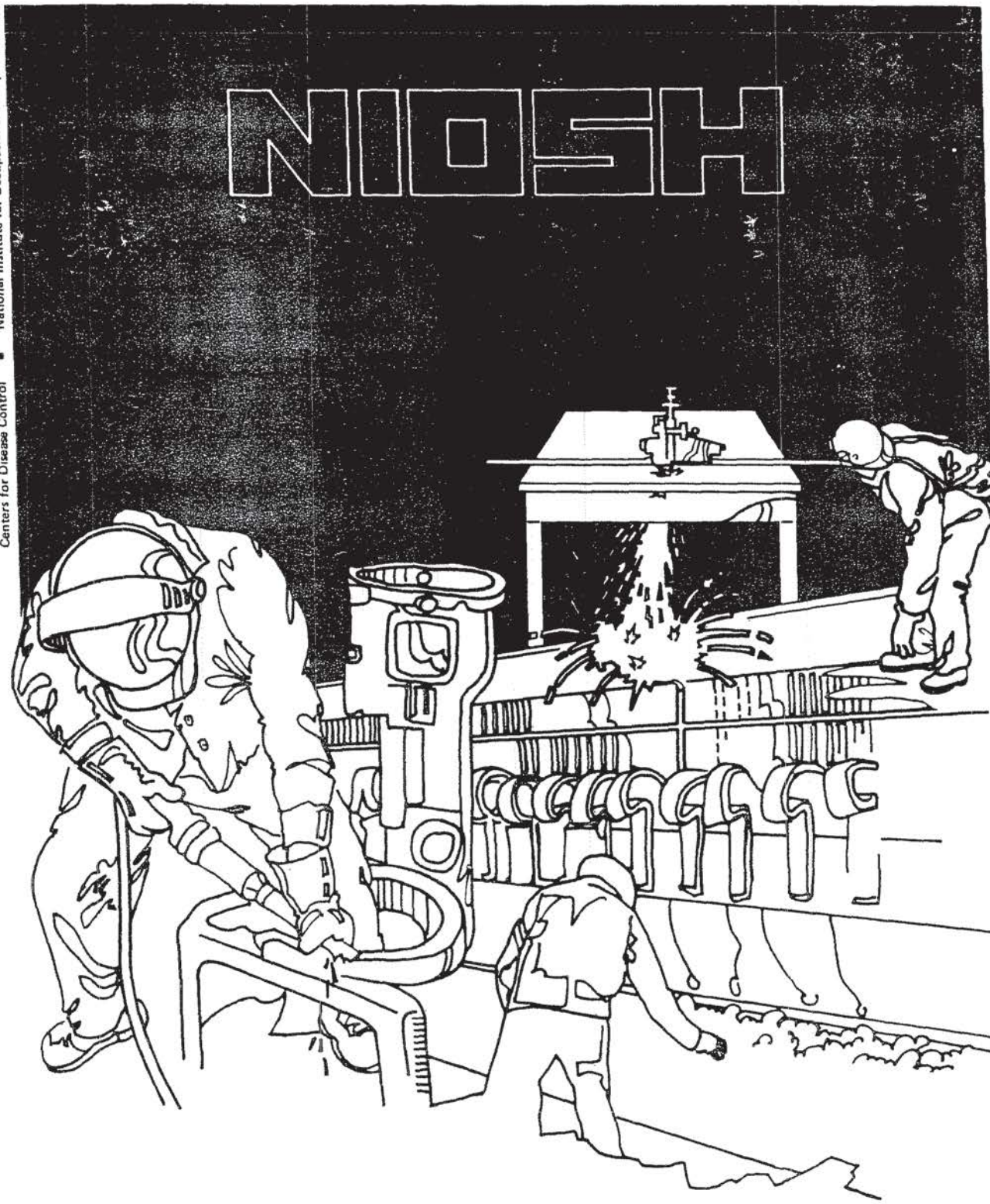
Centers for Disease Control ■ National Institute for Occupational Safety and Health



Health Hazard Evaluation Report

HETA 81-237-915
OUR LADY OF VISITATION ELEMENTARY SCHOOL
CINCINNATI, OHIO

PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) to Federal, state, and local agencies; labor; industry and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

HETA 81-237-915
July 1981
Our Lady of Visitation Elementary School
Cincinnati, Ohio

NIOSH INVESTIGATORS:
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I. SUMMARY

On March 18, 1981, the National Institute for Occupational Safety and Health (NIOSH) was requested by the Hamilton County Health Department to determine the extent of polychlorinated biphenyl (PCB) contamination in Our Lady of Visitation Elementary School in Cincinnati, Ohio. On December 3, 1980, a capacitor containing PCB for an electric motor in a unit heater overheated in a basement storage room (Room 27) of the School. Air and surface wipe samples were obtained throughout the school building to determine the presence of PCB. Background levels of PCB on surfaces in nearby areas were also determined.

PCB (reported as Arochlor 1254) was not detected in air samples obtained in Room 27 and the Principal's office. The lowest measurable level using this analytical method is 0.05 ug. Samples obtained from the floor, ceiling, desk and bookshelves in Room 27 showed a surface presence of <0.05 to 7200 ug PCB per 100 cm^2. Surfaces tested in other areas of the school showed a presence of <0.05 to 0.45 ug PCB per 100 cm^2. Surfaces tested in buildings in eastern, central and western Cincinnati showed a presence of <0.05 to 0.13 ug per 100 cm^2. Dibenzodioxins or dibenzofurans were not detected in samples showing the highest concentrations of PCB.

On the basis of air and surface wipe samples obtained, NIOSH concluded that PCB contamination was confined to Room 27. All other areas of the school showed PCB levels within the background range for the geographical area. Part VII of the report offers recommendations specifying decontamination of Room 27 and considerations for medical testing.

KEY WORDS: SIC 8210 (Elementary and Secondary Schools), PCB, polychlorinated biphenyl, dibenzodioxins, dibenzofurans, capacitor, surface wipe, and air concentrations.

II. INTRODUCTION

On December 3, 1980, a capacitor for a one-half horse power electric motor in a unit heater overheated in a basement storage room (Room 27) of Our Lady of Visitation Elementary School, located approximately 10 miles west of downtown Cincinnati, Ohio. On December 11, approximately one-half of the fifth grade students using three classrooms (Rooms 24, 25 and 26) in this basement area began reporting itching of skin. Preliminary investigations by the Hamilton County Health Department and the National Institute for Occupational Safety and Health (NIOSH) revealed no apparent cause for the reported skin problems.[1] On March 19, 1981, the Health Commissioner of Hamilton County, with knowledge from a consultant's report that the capacitor* contained a PCB dielectric fluid requested technical assistance from NIOSH to determine the extent of PCB contamination in the school. Testing for PCB was conducted by NIOSH on March 19 and 26, 1981. The results of all tests were presented to the Hamilton County Health Commissioner on April 1, 1981.

This report presents the findings of the NIOSH investigation related to determining the extent of PCB contamination within the School. A report of the NIOSH epidemiological investigation of the illnesses among students will be issued separately (HETA 81-184).

III. BACKGROUND

The Our Lady of Visitation school building, formerly a church, has been used as a school for about 30 years. An addition was constructed to the building in about 1960 and a second in 1970. In early 1960's the basement of the first addition was divided into three classrooms (Rooms 24, 25 and 26) and one storage room (Room 27).

On December 3, 1980, at about 12:15 p.m. a teacher and students in Room 22 (located directly above Room 27) detected a burning odor. Investigation by the school's electrician revealed that the motor for the unit heater in Room 27 had overheated. The power to the electric motor was turned off and the exterior door along the east wall (approximately 10 feet from the unit heater) was opened to ventilate the smoke from the room. The school uses a steam heating system and each room has its own unit heater where the air is locally recirculated. Therefore, central distribution via a mechanical system of the smoke throughout the school did not occur.

IV. METHODS

Environmental sampling was conducted throughout the school building to determine possible airborne concentrations of PCB and concentrations of PCB on surfaces. Background levels of PCB on surfaces in nearby geographical areas were also determined. Airborne PCB was collected on Florisil packed in approximately 7 cm long 4 mm I.D. glass tubes. The Florisil was packed into two sections separated by a polyurethane plug: the front section contained 100 mg and the backup section (used as the blank) contained 50 mg of Florisil.

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* The motor's capacitor contained a design specification dielectric fluid volume of 22 milliliters, of which 99.6% by volume (or 21.91 milliliters) was a biodegradable fluid and 0.4% by volume (or 0.08 milliliters) was PCB. One fluid ounce is equivalent to 28.4 milliliters.

The samples were collected using calibrated constant flow vacuum pumps operating at 0.20 liters per minute. The PCB was desorbed from the Florisil with toluene and analyzed using a gas chromatograph equipped with an electron capture detector according to NIOSH P&CA Method 244.[2] Air concentrations are reported as micrograms of PCB per cubic meter of air sampled (ug/m^3). Wipe samples of surfaces were collected to determine the presence of PCB. The samples were obtained by wiping an area of approximately 100 square centimeters using a Whatman smear tab moistened with pesticide quality cyclohexane. The wipe sample was immediately placed into glass vials with a teflon lined cap for shipment to the laboratory for analysis. Vinyl gloves were worn by the industrial hygienist during surface sampling and changed after each sample was taken. The samples were extracted using toluene and analyzed using the procedure described above.[2] The presence of PCB is reported as micrograms of PCB per 100 square centimeters of surface area.

Analyses of samples obtained on March 18, 1981, by a laboratory contracted to the Hamilton County Health Department identified PCB as Aroclor 1254. (Commercial PCB products manufactured in the United States have been marketed under the trade name "Aroclor". Several grades of Aroclor have been designated by numbers such as 1242, 1254 and 1260, where the last two digits represent the percent by weight of chlorine in the mixtures.) The presence of Aroclor 1254 was verified by comparing the chromatogram patterns of each sample with those obtained from U.S. EPA standard Aroclors 1016, 1242, 1248, 1254, and 1260. Gas chromatography-mass spectrophotometry confirmed the presence of PCB, particularly the tetrachloro-, pentachloro and hexachlorobiphenyl isomers.

V. RESULTS

Table I presents the results of the three general NIOSH air samples collected on March 19, 1981. Two samples were obtained in Room 27; one of which was obtained inside the unit heater as a primary source sample. A third was obtained in the principal's office as a reference sample. PCB was not detected in any air sample at the lowest level measurable using this analytical method (<0.05 ug per sample). These results are as expected based on the extremely low vaporization rate (0.000052 gm/cm^2/hour at 100°C) of Aroclor 1254.[3]

Table II summarizes the results for 63 wipe samples collected by NIOSH. Fifty-one of 63 samples were taken from surfaces within the school including books, desks, walls, floors, ceilings, and other surfaces (Tables III and IV). Two of 63 samples were taken from surfaces within a mobile classroom, which reportedly contained books from the school (Table IV). Ten of 63 samples were obtained from surfaces at three locations in eastern, central and western Cincinnati to establish an impression of background levels of PCB for this area (Table V).

Figures 1 and 2 show the location and concentrations of PCB in the 51 wipe samples obtained in the school. The 20 samples obtained in Room 27, containing the overheated capacitor, ranged from < 0.05 to 7200 ug/100 cm^2. The seven samples obtained in Room 27 with PCB concentrations of > 100 ug/100 cm^2 were taken from surfaces (a desk in storage and the heating unit) in direct contact with the PCB capacitor. Therefore, these samples may not represent the PCB that was distributed by the smoke during overheating; e.g., the 5.2 ug/100 cm^2 level measured on a wall cabinet and book shelf (Table III, Sample S-05). The remaining 31 samples obtained in the school showed PCB concentrations of < 0.05 to 0.45 ug/100 cm^2. These levels are not considered to be different than those found in the mobile classroom (0.06 ug/100 cm^2) and those indicative of background (< 0.05 to 0.13 ug/100 cm^2) for the Cincinnati area.

The two wipe samples (samples S-01 and S-02, Table 3) with the highest concentration of PCB were also analyzed for dibenzodioxins and dibenzofurans, with special emphasis on the 2,3,7,8-isomers. No dibenzodioxins or dibenzofurans were detected in either of the samples. The lower limits of analytical detection using this method are 0.10 and 0.09 ug per sample, respectively.

VI. DISCUSSION

Although laboratory experiments[4] and industrial studies[5] have documented cutaneous absorption of PCB's, there are no established health criteria for exposure to PCB's on surfaces. In fact, it is generally accepted that it is extremely difficult to link surface exposure to potential health risks. Based on results of wipe samples taken in the school and comparison areas in the community we believe that values of less than 0.5 ug PCB per 100 cm^2 surface area should be considered as background exposures. All surfaces tested, except those in Room 27, showed a PCB presence of< 0.5 ug per 100 cm^2.

VII. RECOMMENDATIONS

On April 1, 1981, in a meeting between representatives from the School, Hamilton County Health Commissioner's Office and NIOSH, the School agreed to have the University of Cincinnati Medical Center conduct a study to determine if any ill health effects occurred among children possibly exposed to the PCB's.

The following recommendations were offered to the Health Commissioner of Hamilton County in the same meeting:

1. The concentration of PCB on surfaces (i.e., floor, desks, bookshelves) in Room 27 should be reduced to background levels, i.e., less than 0.5 ug PCB per 100 cm^2 surface area.

2. Other than Room 27, no rooms require decontamination.

The School was reopened in all areas except the wing containing the contaminated storage Room 27, and nearby classrooms 24, 25 and 26. The State of Ohio EPA has agreed to oversee the decontamination procedures in this area.

VIII. AUTHORSHIP AND ACKNOWLEDGEMENTS

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IX. REFERENCES

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2. P & CAM No. 244, Manual of Analytical Method, 2nd Ed., Volume 1, National Institute for Occupational Safety and Health, Cincinnati, Ohio (1977).

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5. Maroni, M., Colombi, A. and Cantoni, S. Occupational Exposure to Polychlorinated Biphenyls in Electrical Workers. I Environmental and Blood Polychlorinated Biphenyl Concentrations. British Journal of Industrial Medicine 38:49-54 (1981).

X. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of the Determination Report are currently available upon request from NIOSH, Division of Technical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia. Information regarding its availability through NTIS can be obtained from NIOSH, Publications Office, at the Cincinnati address.

Copies of this report have been sent to:

1. Health Commissioner, Hamilton County Health Department, Cincinnati, Ohio 45202
2. Principal, Our Lady of Visitation Elementary School, Cincinnati, Ohio 45211
3. U.S. Department of Labor - OSHA, Region V
4. NIOSH, Region V

Table I

Analysis of Polychlorinated Biphenyls (PCB's) in Air Samples

HETA 81-184
Our Lady of Visitation School
Cincinnati, Ohio

March 19, 1981

Sample Location	Sample Period	Sample Volume (Liters)	Air Level
Room 27: inside heating unit on floor	7:35p-11:25p	45.2	N.D.*
Room 27: center of room on book shelf; sampler approx. 5.5' above floor	7:41p-11:24p	43.3	N.D.
Principal's office	8:30p-11:30p	34.7	N.D.

* N.D. or None Detected means that the PCB's were not detected at the lowest level (<0.05 ug/sample) capable of being measured by the analytical method equivalent to an airborne concentration of approximately < 1 ug/m^3 for these samples).

Table II

Summary of Polychlorinated Biphenyls (PCBs')* Wipe Sample Results

HETA 81-237
Out Lady of Visitation School
Cincinnati, Ohio

March, 1981

SAMPLE LOCATION	n	PCB LEVEL (ug/100 cm^2) Mean	Range
Room 27	20	771	<0.05 - 7200
Room 25	4	0.08	<0.05 - 0.14**
Room 24	3	0.05	<0.05 - 0.06***
Room 26	3	<0.05	<0.05****
Hallway between rooms 24-27	4	0.05	<0.05 - 0.07
Room 8	4	0.06	<0.05 - 0.08
Room 22	6	0.11	<0.05 - 0.29
Room 9	2	0.11	<0.05 - 0.16
Room 10	4	0.12	<0.05 - 0.20
Room 11	2	0.09	0.07 - 0.11
Room 12	2	0.08	0.06 - 0.09
A.V. Room	4	<0.05	<0.05
Principal's Office	3	0.21	0.05 - 0.45
Mobile Classroom	2	0.06	0.06
Background levels (3 locations- east, central and west Cincinnati, Ohio)	10	0.07	<0.05 - 0.13

* Reported as Aroclor 1254.
** A less than (<) value means that PCB's were not detected at the lowest level capable of being measured by the analytical method.
*** Excludes sample taken on surface of capacitor which showed a PCB presence of 4.9 ug/100 cm^2.
**** Excludes sample taken on surface of capacitor which showed a PCB presence of 2.3 ug/100 cm^2.
n = number of samples.

Table III

Analysis of Polychlorinated Biphenyls (PCB's)* in Wipe Samples

HETA 81-184
Our Lady of Visitation School
Cincinnati, Ohio

March 19, 1981

Sample Number	Sample Location	Micrograms per 100 Square Centimeters Surface Area
S-01	Room 27: inside heating unit on floor	7,200
S-02	Room 27: left-upper quadrant of student's desk where the overheated capacitor was placed	3,900
S-03	Room 27: right-lower quadrant of student's desk where the overheated capacitor was placed	140
S-04	Room 27: top surface of heating unit	240
S-05	Room 27: east wall cabinet/book shelf center of room	5.2
S-11	Room 25: top surface of teacher's desk	0.14
S-11A	Room 25: top surface of student's desk	0.06
S-12	Room 25: top surface of heating unit	0.08
S-13	Room 25: surface of crucifix	< 0.05**
S-10	Room 24: surface of student's desk/blackboard	0.06
S-25	Room 24: top surface of student's desk	< 0.05
S-26	Room 26: top surface of bookcase at back of room	< 0.05
S-14	Room 8: top surface of heating unit	0.07
S-15	Room 8: top surface of student's desk	0.08
S-07	Room 22: book shelf/top surface of heating unit	0.29
S-24	Room 22: top surface of student's desk	0.14
S-17	Room 9: top surface of heating unit	< 0.05
S-18	Room 9: top surface of student's desk	0.16
S-08	Room 10: top surface of student's chair	0.20
S-16	Room 10: surface of window sill	0.19
S-19	Room 11: top surface of heating unit	0.07
S-20	Room 11: top surface of student's desk	0.11
S-21	Room 12: top surface of heating unit	0.06
S-22	Room 12: top surface of student's desk	0.09
S-23	Audio-Visual room: top surfce of book removed from Room 24 or 26	< 0.05
S-06	Principal's Office: top surface of file cabinet	0.45
S-09	Principal's Office: top surface of file cabinet	0.12
S-27	F.O.B., Room 9023: top surface of bookcase	< 0.05
S-28	F.O.B., Room 9023: top surface of bookcase	0.12

* Reported as Aroclor 1254.
** A less than (<) value means that PCB's were not detected at the lowest level capable of being measured by the analytical method.

Table IV

Analysis of Polychlorinated Biphenyls (PCB's)* in Wipe Samples

HETA 81-237
Out Lady of Visitation School
Cincinati, Ohio

March 26, 1981

Sample Number	Sample Location	Micrograms per 100 Square Centimeters Surface Area
K-01	Room 27: inside heating unit on floor	1800
K-02	Room 27: left-upper quadrant of student desk where overheated capacitor was placed	2100
K-03	Room 27: top solid surface of heating unit	33
K-09	Room 27: duct above suspended ceiling above heater	< 0.05
K-10	Room 27: metal frame for suspended ceiling above heater	0.26
K-11	Room 27: metal frame for suspended ceiling - center of room	0.07
K-12	Room 27: metal frame for suspended ceiling - above door	< 0.05
K-13	Room 27: fluorscent light fixture - left rear corner of room	0.07
K-14	Room 27: book approximately 10 feet from heater	0.07
K-15	Room 27: book approximately 13 feet from heater	0.23
K-16	Room 27: book approximately 15 feet from heater	<0.05
K-17	Room 27: floor - center of room	1.00
K-19	Room 27: book - left rear corner of room	<0.05
K-20	Room 27: floor - 2 feet from right side of door	0.36
K-21	Room 27: 6 inches from door bottom - inside face	<0.05
K-18	Fire extinghisher outside Room 27	0.07
K-22	Tile kick board outside Room 24	<0.05
K-23	Tile kick board outside Room 26	<0.05
K-24	Surface of basement exit sign	<0.05
K-25	Room 24: capacitor for heater	4.90
K-26	Room 24: book	<0.05
K-27	Room 26: capacitor for heater	2.30
K-28	Room 26: book	<0.05
K-29	Room 26: student's desk - wood surface	<0.05
K-30	Room 22: student's desk - veneer surface	<0.05
K-31	Room 22: teacher's desk	<0.05
K-32	Room 22: book	<0.05
K-33	Room 22: floor above heater in Room 27	0.07

Table IV (Continued)
HETA 81-237
Our Lady of Visitation School
Cincinnati, Ohio
March 26, 1981

K-34	Room 10: teacher's desk	<0.05
K-35	Room 10: book	<0.05
K-36	A.V. room: book	<0.05
K-37	A.V. room: book	<0.05
K-38	A.V. room: notebook	<0.05
K-39	Room 8: book	<0.05
K-40	Room 8: horizontal surface - pepsi machine	<0.05
K-41	Principal's office: horizontal surface - file cabinet	<0.05
K-04	Mobile classroom: rear table	0.06
K-05	Mobile classroom: 5th grade speller	0.06

* Reported as Aroclor 1254.
** A less than (<) value means that PCB's were not detected at the lowest level capable of being measured by the analytical method.

Table V

Background Levels of Polychlorinated Biphenyls (PCB's)* in Wipe Samples

HETA 81-237
Out Lady of Visitation School
Cincinnati, Ohio

March, 1981

Sample Number	Sample Location	PCB LEVEL ug/100 cm^2)
S-27	F.O.B., Room 9023, Office 1: top surface of bookcase	<0.05
S-28	F.O.B., Room 9023, Office 1: top surface of bookcase	0.12
K-45	F.O.B., Room 9023, Office 4: surface of fluorescent light fixture	<0.05
K-46	F.O.B., Room 9403: top surface of bookcase	<0.05
K-42	Taft Labs: administrative office - surface of fluorescent light fixture	<0.05
K-43	Taft Labs: Room 126 - doorway sash	<0.05
K-44	Taft Labs: library - bookshelf	<0.05
K-06	Oak Hills School District transportation office	0.13
K-07	Our Lady of Visitation parish rectory: office 1	0.11
K-08	Our Lady of Visitation parish rectory: office 2	0.06

* Reported as Aroclor 1254.
** A less than (<) value means that PCB's were not detected at the lowest level capable of being measured by the analytical method.
FOB = Federal Office Building.

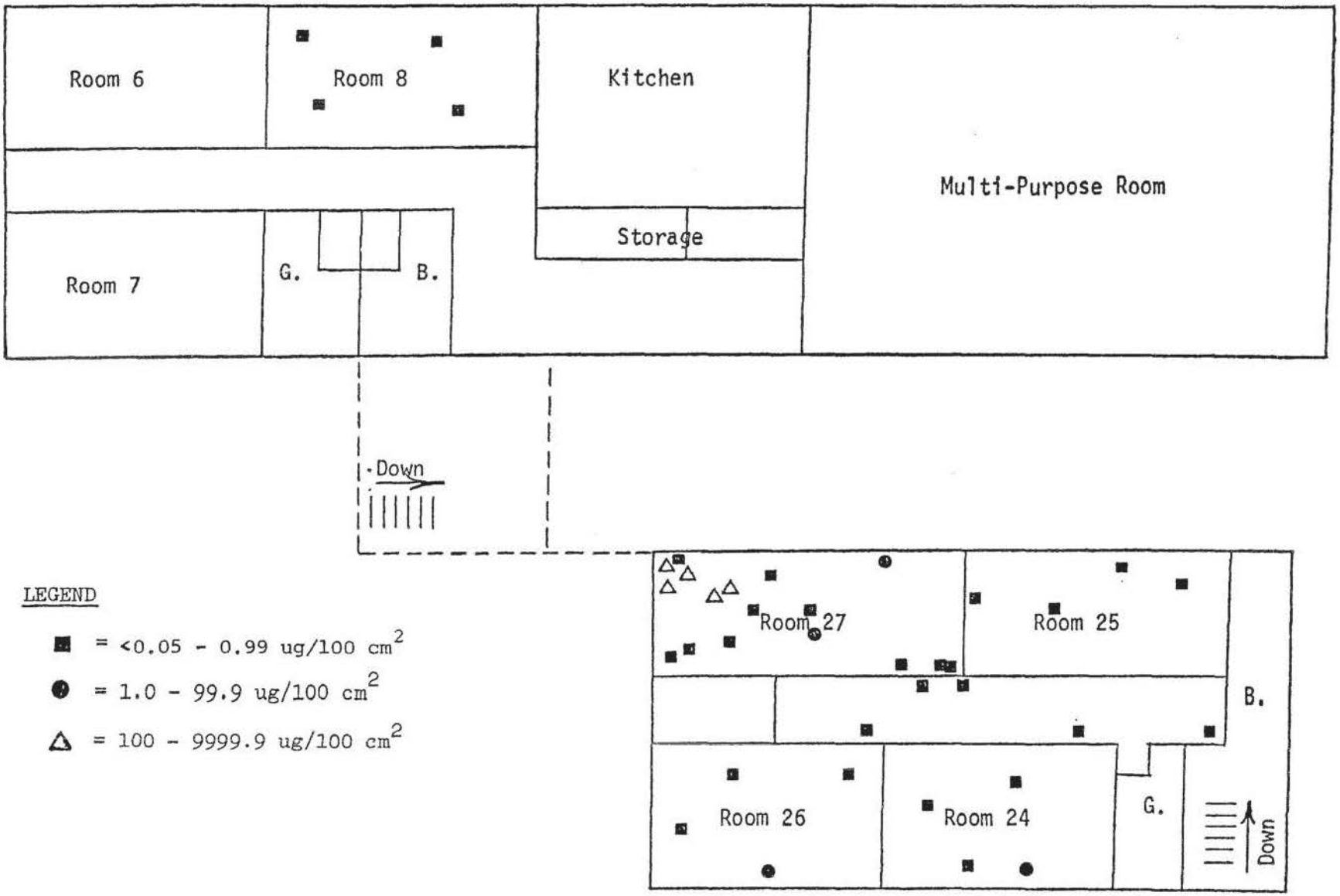

FIGURE 1: PCB WIPE SAMPLES - DOWNSTAIRS MAIN BUILDING

FIGURE 2: PCB WIPE SAMPLES - FIRST FLCOR MAIN BUILDING

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