U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
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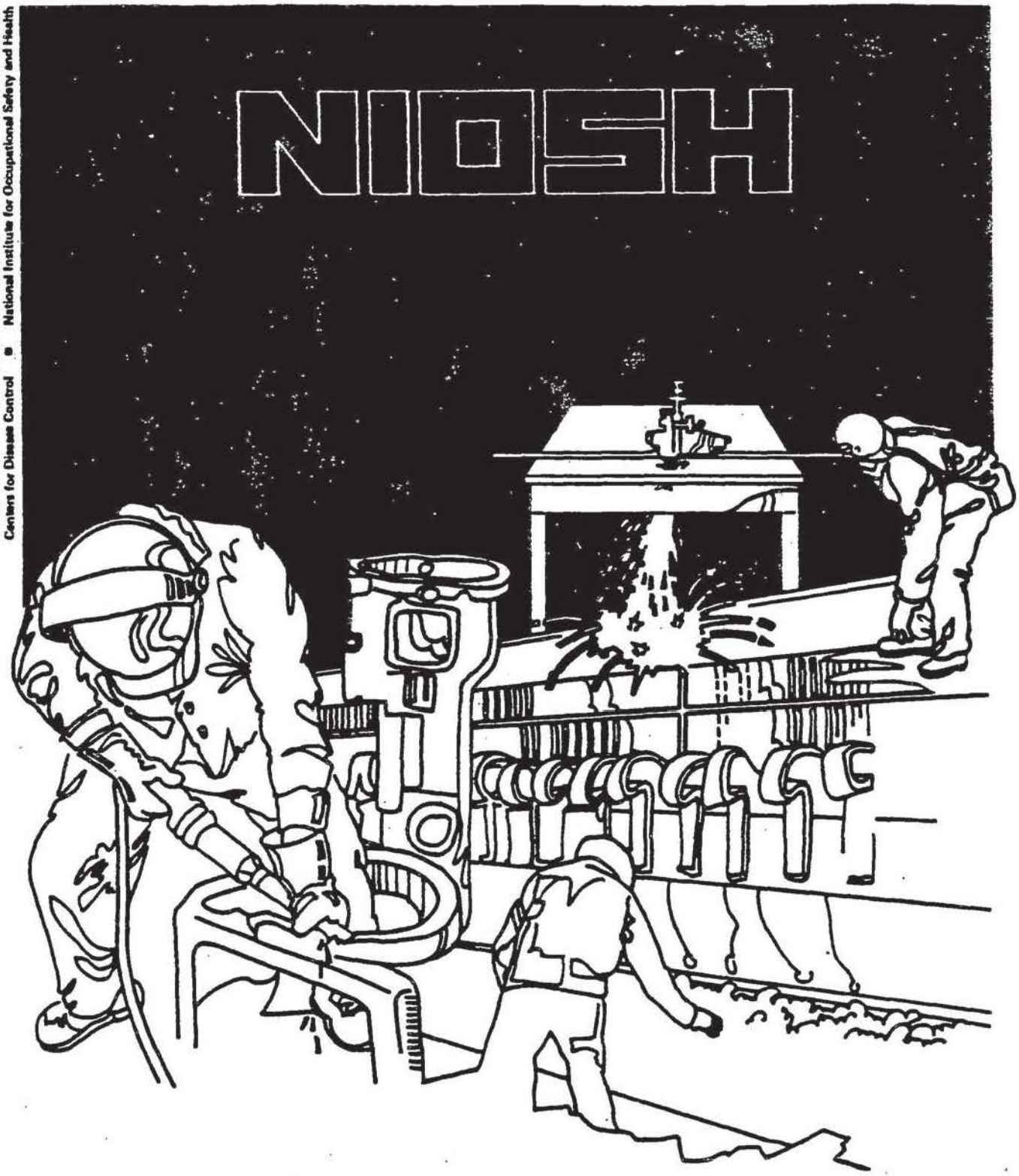
NIOSH



Health Hazard Evaluation Report

HETA 82-068-1111
MIAMITOWN GRADE 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 82-068-1111
MAY 1982
MIAMITOWN GRADE SCHOOL
CINCINNATI, OHIO

NIOSH INVESTIGATOR:
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I. SUMMARY

On December 4, 1981, the National Institute for Occupational Safety and Health (NIOSH) was requested by the Principal of the Miamitown Grade School to determine if the thermal-dielectric compound that had leaked from several fluorescent lamp ballast casings contained polychlorinated biphenyls (PCBs). On December 7, 1981, bulk solid and wipe samples were obtained to determine the presence of PCBs.

A sample of the thermal-dielectric compound obtained from the surface of a luminaire in the cafeteria (where a ballast had previously burned-out) contained 3600 micrograms of PCB (reported as Aroclor 1242). Samples obtained from the top surfaces of ballasts from the Art Room and Principal's Office contained 0.9 and 0.6 micrograms of PCB per 100 square centimeters (reported as Aroclor 1260), respectively. These results indicate that the ballasts tested may have inadequate internal thermal protective mechanisms to prevent overheating and ultimate burnout, both of which are causes of leakage of the thermal-dielectric compound from the fluorescent lamp ballasts.

Based upon the health effects associated with exposure to PCBs and studies demonstrating that significant quantities of PCBs are released during ballast burnout, NIOSH recommends replacement of thermally unprotected ballasts with thermally protected units of Class P classification before burnouts occur. Part V of the report offers guidelines for identifying such unprotected ballasts.

KEYWORDS: SIC 8210 (Elementary and Secondary Schools), PCB, polychlorinated biphenyl, ballast, fluorescent lamp, and surface wipe.

II. INTRODUCTION

On December 4, 1981, the National Institute for Occupational Safety and Health (NIOSH) received a request for technical assistance from the Principal of Miamitown Grade School in Miamitown, Ohio. The Principal asked NIOSH to determine if the black, tar-like thermal-dielectric compound, that had leaked from several fluorescent lamp ballast casings, contained polychlorinated biphenyls (PCBs). On December 7, 1981, wipe samples were obtained to determine the presence of PCBs.

On April 7, 1982, NIOSH distributed an interim report that presented (a) the results of the environmental samples for PCB contamination and (b) recommendations for identification and replacement of thermally unprotected ballasts.

III. METHODS

Except for a bulk solid sample, samples were obtained by wiping the surface of the ballast casing. An area of approximately 100 square centimeters was wiped using a Whatman smear tab moistened with pesticide quality cyclohexane. Vinyl gloves were worn by the industrial hygienist during surface sampling and changed after each sample was obtained. The wipe sample was immediately placed into a glass vial with a teflon-lined cap for shipment to the laboratory for analysis. The PCBs were extracted from the smear tabs using toluene and analyzed using a gas chromatograph equipped with an electron capture detector according to NIOSH P&CA Method 244.[1] The presence of PCBs is reported as micrograms of PCBs per sample for the bulk solid sample and as micrograms of PCBs per 100 square centimeters surface area for all the other samples.

IV. RESULTS

Table I presents the analyses for the three wipe samples obtained. The analyses represent the surface concentration of PCBs reported as micrograms of PCBs per sample (W-01) or micrograms of PCBs per 100 square centimeters surface area (W-02 and W-03). A sample (W-01) obtained from the surface of a luminaire in the cafeteria, where a ballast had previously burned-out with resultant deposition of the black compound, contained 3600 micrograms of PCBs. Samples (W-02 and W-03) obtained from the top surfaces of ballasts from the Art Room and Principal's Office contained 0.9 and 0.6 micrograms of PCBs, respectively. These results indicate that the ballasts tested may have inadequate internal thermal protective mechanisms to prevent overheating and ultimate burnout, both of which are causes of leakage of the thermal-dielectric compound from fluorescent lamp ballasts.

V. DISCUSSION AND CONCLUSION

The significance and health implications of these results are indicated by studies that have shown that during burnout of certain types of fluorescent light ballasts, significant quantities of PCBs are released into the atmosphere.[2-4]

In one study,[4] measurements made in a room immediately after a ballast burned-out showed PCB air concentrations of 118 to 166 micrograms per cubic meter (ug/m^3) at one meter from the ballast; 31 to 46 ug/m^3 at two meters; 18 ug/m^3 at three meters; 12 ug/m^3 at four and one-half meters; and 14 ug/m^3 at six meters from the ballast. By comparison, the NIOSH recommended permissible exposure limit is 1 ug/m^3.[5] The recommendation is based on the potential carcinogenic effects of PCBs.

It is necessary to realize that the airborne exposure concentrations will vary according to available air circulation, and space geometry and dimensions where ballast burnout occurs. Recent measurements made by NIOSH shortly after (within 4 hours) a thermally unprotected fluorescent lamp ballast burned-out in an office building corridor did not show detectable air concentrations of PCBs.[6] (Analytical limit of detection was 0.4 ug/m^3.) The thermal-dielectric compound that had leaked from the ballast contained 260 micrograms of PCB (reported as Aroclor 1254).

In conclusion, though the exposure concentration will vary according to each situation, a potential for significant exposure to airborne PCBs does exist. Therefore, the risk of exposure to PCBs by students and school personnel that accompanies burnout of ballast should be eliminated by replacement of the thermally unprotected PCB containing ballast.

VI. RECOMMENDATIONS

Since 1969, ballasts manufacturers have incorporated thermal protective cut-off switches into the units to prevent overheating and burnout. Thus, units now used as replacements should not overheat, rupture, and emit PCBs. However, because of the long life of ballasts (estimated at 12 years average by the Illuminating Engineers Society[7]), many of the older thermally unprotected units are still in use at the present. The presence of this type at the Miamitown Grade School is evidence by the ballast that overheated in the cafeteria. Therefore, based upon the potential health effects associated with PCBs and the referenced studies demonstrating that significant quantities of PCBs are emitted during burnout, NIOSH recommends replacement of such unprotected units with thermally protected units of Class P ballast classification [according to the National Electrical Code Section 410-73(e)] before burnouts occur.

An inventory of the ballast currently in use should be immediately conducted to determine the number of non-Class P ballasts for replacement. Class P ballast are identified by the catalog number (CAT. NO.) located on the top surface of the ballast casing. The four manufacturers of ballasts and the respective Class P identification information is presented in Table II.

Ballast replacement should be prioritized to first include those that display visible compound leakage. Compound leakage may be considered as a good end-of-life indicator.

VII. REFERENCES

1. National Institute for Occupational Safety and Health. NIOSH manual of analytical methods. Vol 1, 2nd ed. Cincinnati, OH: National Institute for Occupational Safety and Health, 1977. P & CAM No. 244.

2. Staiff, D.C., G.E. Quinby, D.L. Spencer and H.C. Starr: Polychlorinated Biphenyl Emission from Fluorescent Lamp Ballasts. Bull. Environ. Contam. Toxicol. 12: 455-463 (1974).

3. Sources of Emissions of Polychlorinated Biphenyls into the Ambient Atmosphere and Indoor Air. U.S. Environmental Protection Agency Publication No. 600/4-79-022 (1979).

4. Williams, D.T., G.L. LeBel and T. Furmanczyk: Polychlorinated Biphenyl Contamination of Laboratory Air. Chemosphere 9 (1): 44-50 (1980).

5. National Institute for Occupational Safety and Health. Criteria for a recommended standard: occupational exposure to polychlorinated biphenyls. Cincinnati, OH: National Institute for Occupational Safety and Health, 1977. (DHEW Publication no. (NIOSH) 77-225).

6. Kominsky, J.R. Health hazard evaluation -- Cincinnati, Ohio. Report no. 82-063. Cincinnati, Ohio: NIOSH, 1982.

7. IES Lighting Handbook, 4th edition, Illuminating Engineering Society, New York, N.Y. (1966).

8. Final Ban Rule for Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce and Use Publication. Federal Register (44 CFR 31514). (May 31, 1979).

VIII. AUTHORSHIP AND ACKNOWLEDGEMENTS

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IX. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), 5285 Port Royal, Springfield, Virginia 22161. 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. Principal, Miamitown Grade School, Miamitown, Ohio.
2. Health Commissioner, Hamilton County Health Department, Cincinnati, Ohio.
3. NIOSH, Region V
4. OSHA, Region V

TABLE I

Analyses of Polychlorinated Biphenyls (PCBs) in Wipe Samples

Miamitown Grade School
Miamitown, Ohio
HETA 82-068

December 7, 1981

Sample No.	Sample Description	Micrograms of PCBs	Comment
W-01	Cafeteria: Surface of luminaire - tar like material deposited during ballast burnout	3600 (bulk solid)*	General Electric Ballast Catalog No. 7G1011
W-02	Art Room: top surface ballast	0.9 ug/100 cm^2**	General Electric Ballast Catalog No. 7G1022
W-03	Principal's Office: top surface of ballast	0.6 ug/100 cm^2**	General Electric Ballast Catalog No. 7G1022

* Reported as Aroclor 1242
** Reported as Aroclor 1260

TABLE II

Ballast Manufacturers and Class P Identification Data

Miamitown Grade School
Miamitown, Ohio
HETA 82-068

December 1981

Manufacturer*	Class P Identification Code	Example of Catalog No.
Universal Manufacturing Corp. Paramus, New Jersey 07652 (201) 967-7600	CAT. NO. suffix -TC-P	446-LR-TC-P
General Electric Corp. Cleveland, Ohio 44112 (216) 266-4256	CAT. NO. prefix 8G	8G3742W
Advance Transformer Co. Chicago, Illinois 60618 (312) 267-8100	CAT. NO. suffix TP	HM-1P30-TP
Jefferson Electric Co. Chicago, Illinois 60104 (312) 626-7700	CAT. NO. suffix 800 series	254-4701-800

* On May 31, 1979, U.S. Environmental Protection Agency issued a Final PCB Ban Rule, which includes a prohibition rule to terminate the manufacture of any new PCB capacitors.[8] Ballasts containing non-PCB capacitors is so stated on the face of the ballast casing.