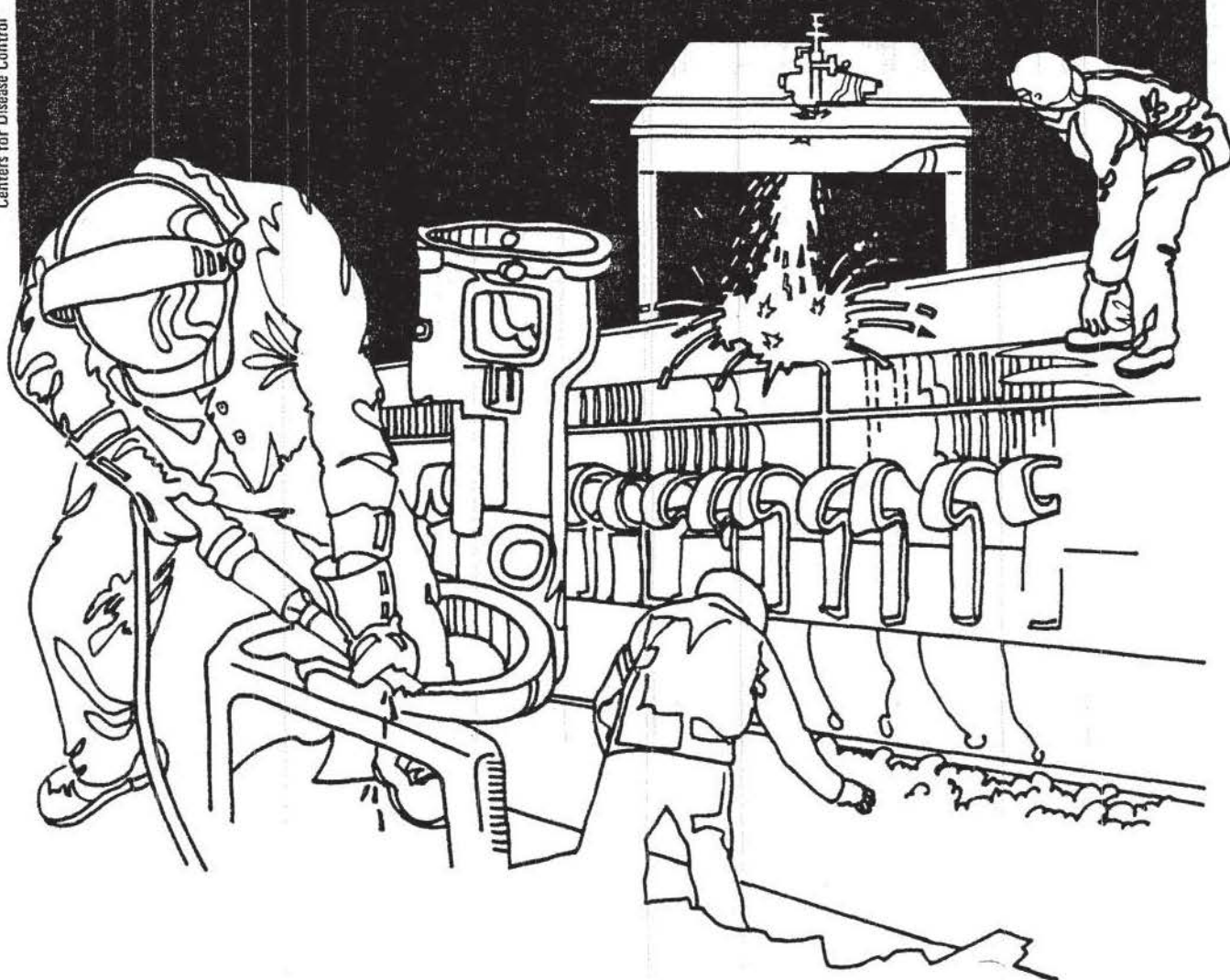


NIOSH



Health Hazard Evaluation Report

80-017-770

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. 699(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.

Mention of company names or products does not constitute endorsement by the National Institute for Occupational Safety and Health.

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NOVEMBER 1980
ILLINOIS POWER COMPANY
BELLVILLE, ILLINOIS

NIOSH INVESTIGATORS:
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I. SUMMARY

In November, 1979, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation at the Illinois Power Company in Bellville, Illinois. The request was prompted by reports of skin and eye irritation and uncertainty as to whether or not polychlorinated biphenyls (PCBs) were being encountered in the workplace.

NIOSH made two site visits to the Illinois Power Company, February 12-14, 1980 and August 26-27, 1980, to discuss working conditions and to interview workers. Interviews were designed to determine the frequency and extent of contact with transformer or capacitor fluids, the extent of use of personal protective clothing and equipment and whether any employees had health problems associated with their job.

Information obtained during the site visits indicated that no PCBs are used in any of the transformers or other substation equipment. (Exposure to PCBs by substation electricians would not exist unless cross contamination had occurred at the manufacturers.) It was established, however, that the capacitors maintained by the company contain PCBs. The linemen who work on the capacitors estimated frequency of contact with PCBs from once every five years to 18 times per year. (Some workers indicated they were unsure of their frequency of exposure due to the fact that they did not know which fluids were PCBs and which were mineral oil.) The duration of exposure is usually less than one hour. During the study, no exposure levels were measured because sampling was infeasible due to the short and infrequent exposures.

Thirty-one of sixty-six employees were interviewed. Twenty-four of the interviewed employees indicated that they did not use any protective clothing or equipment specific for PCBs and also indicated no knowledge of the hazards or toxicity associated with PCBs. None of the 31 employees thought they had occupationally related health problems. Fourteen employees reported at least one of a variety of symptoms specifically asked, but no pattern suggestive of PCB toxicity was apparent.

Employees at Illinois Power Company appear to be a low risk group for PCB toxicity based on the reported frequency of contact and extent of exposures. However, since PCB exposure does exist, certain work practices should be instituted in order to minimize potential exposures and contact with PCBs. These work practices are listed on pages 9-11 of this report.

KEYWORDS: SIC 4911 (Electric Services), polychlorinated biphenyls

II. INTRODUCTION

On November 11, 1979, an authorized representative of the International Brotherhood of Electrical Workers (Local 309) requested a health hazard evaluation of employee exposure to polychlorinated biphenyls (PCBs). This study was requested because of reports of skin and eye irritation among workers.

An interim report dated April 1980, detailed the findings of the initial site visit on February 12-14, 1980. A second site visit was made on August 26-27, 1980.

III. DESCRIPTION OF PROCESS AND WORK FORCE

The Illinois Power Company's Bellville operations provide electrical service to surrounding businesses and private residences. The work includes, among other normal duties, replacing failed capacitors on power poles and maintaining function in substations. It is estimated that there are 600 capacitors, 16,000 transformers, and 25 substations under the company's jurisdiction. There is also one transformer vault located in downtown Bellville and associated with the courthouse.

It is estimated that 95% of existing capacitors (nationwide) contain PCBs.¹ The amount of liquid PCBs is capacitor-size dependent; however, line capacitors usually contain approximately 1-2 cups.² Transformers, however, contain much more PCB than capacitors, but the percentage of PCB transformers is smaller (5%). Depending on the location of the transformer, it may or may not contain PCBs. Indoor installations, in non-vault types of locations, usually contain PCBs because of their low flammability in comparison to mineral oil. Mineral oil is used in locations (vaults, substations) where there is little fire hazard.

According to recent Environmental Protection Agency PCB regulations³, there are three types of electrical equipment: PCB equipment, which contains PCB in concentrations greater than 500 ppm; PCB-contaminated equipment, which contains PCB in concentrations of 50-500 ppm; and non-PCB equipment, which contains less than 50 ppm PCB.

Illinois Power Company maintains that while their capacitors contain PCBs, none of their transformers or other substation equipment (circuit breakers) contain PCBs. This is an economically reasonable claim, since PCBs are considerably more expensive than mineral oil as a dielectric fluid and presumably the company would want to minimize equipment costs whenever allowable. However, from conversations with a national firm providing a transformer testing service,⁴ supposedly non-PCB transformers containing trace quantities and greater of PCBs are encountered on a routine basis. It is speculated that, before the health effects of PCBs and subsequent environmental controls were widely known and accepted, manufacturers of electrical equipment such as transformers would use the same equipment to fill the transformers with PCBs as they used with mineral oil.

The job categories in the electrical utility industry which involve potential PCB exposure are linemen and substation electricians, and to a lesser extent, truck drivers and storehousemen.

Linemen, in the course of their duties, are occasionally required to replace line capacitors which fail. Occasionally, but not as a rule, capacitors will rupture and burn, spilling their contents into the environment, contaminating the capacitor pole and surrounding soil. Contact with PCBs can occur when the lineman disconnects and carries the ruptured capacitor down the pole and to the truck. Truck drivers are exposed when loading and unloading the capacitor from the truck. Capacitors are not serviced; when one fails it is disposed of and replaced with a new capacitor. Disposal is arranged with a contractor.

Storehousemen are potentially exposed when ruptured capacitors were stored in the warehouse. This practice has been discontinued.

Substation electricians may be exposed to PCBs when they are replacing a new transformer on-line or providing periodic servicing of the dielectric fluid to restore its proper operating characteristics. This is done by filtering impurities out of the liquid by means of an electric filter press. The liquid is pumped out of the transformer or circuit breaker through a filter and into 55 gallon drums. Then it is pumped back and forth through the filter until the substation electrician visually determines that it is acceptable. Circuit breakers and transformers are tested for clarity, dielectric strength, moisture, and acidity. Visual measurements of clarity usually are sufficient to judge whether other requirements also are acceptable. During the filtering process, hoses are changed back and forth, causing leakage of the liquid and contamination of the hands of the substation electrician. Cleanup is with old rags which are used over and over. Filtering is done in the spring and fall, which are off-peak electrical use periods. It is estimated that substation electricians spend 4 months per year filtering.

There are 51 linemen, 8 substation electricians, 5 storehousemen, and 2 truck drivers employed by Illinois Power Company in the Bellville area. Only one shift (day) is operated.

Health Hazard Evaluation Design

Initially, NIOSH investigators had no knowledge of the extent of exposure to be found involving this work force. Therefore, it was decided that it would be necessary first to gather data on the extent (frequency) of exposure among the workers in order to decide whether or not industrial hygiene sampling was required, and whether or not there were any health complaints that could be associated with PCB exposure and which might warrant further medical study.

In addition, work practices and use of protective clothing were reviewed. Attempts were made to privately interview linemen, substation electricians, truck drivers, and storehousemen in order to collect the above

information. During the February visit, 27 of 66 employees were interviewed. Three of 9 substation electricians were interviewed during the August visit.

Evaluation Criteria

The major effects that have been found in workers exposed to PCBs are chloracne and irritation of skin and mucous membranes. Indications of liver injury can be found in reports of both occupational studies and animal experiments. Findings from animal experiments indicate that PCBs have potential carcinogenic activity in humans and may produce adverse reproductive effects. Based on the findings of adverse reproductive effects and on its conclusion that PCBs are potential carcinogens in humans, NIOSH has recommended that occupational exposure to PCBs be controlled so that no worker is exposed to PCBs at a concentration greater than 1 ug/M^3 determined as a TWA concentration for up to a 10 hour workday, 40 hour workweek.

IV. RESULTS

Twenty-four linemen, 4 substation electricians, 2 storehousemen, and 1 truck driver were interviewed. All were male, ranging in age from 25 to 63, and all had worked at least 1 year with the company. The estimated frequency of contact with PCBs ranged from unknown (attributed to the fact that they were unsure which fluids were PCB and which were mineral oil) to 18 times per year.

Twenty-four of the interviewed employees indicated that they did not use any protective clothing or equipment specific for PCBs and also indicated no knowledge of the hazards or toxicity associated with PCBs. None of the 31 employees thought they had occupationally related health problems. Fourteen employees reported at least one of a variety of symptoms specifically asked but no pattern suggestive of PCB toxicity was apparent.

V. DISCUSSION

No environmental sampling was conducted. The duration of exposure of linemen to PCB is short and infrequent. It takes no more than 1 hour to change a failed capacitor and this simply involves releasing electrical contacts. The chemical properties of PCBs i.e., low vapor pressure, reduce the probability of detectable airborne levels.

From observations of the filtering process, it is apparent that this operation provides little potential for PCB contact via inhalation. Moreover, unless cross contamination occurred at the manufacturer, substation electricians will not come in contact with PCB or PCB-contaminated articles. Illinois Power Company does not provide any maintenance other than dielectric strength testing and filtering. All equipment in need of more extensive repair is taken off-line and returned to the manufacturer.

Medical questionnaire data revealed a low frequency of PCB contact among linemen and an absence of job-related complaints among the 31 employees interviewed. This work group thus appears to represent a low-risk group for PCB exposure.

VI. RECOMMENDATIONS

This work group does not appear to be at significant risk to PCB exposure, and questionnaire data do not indicate an acute health problem from any previous exposure that may have occurred. However, contamination of certain electrical equipment with PCBs prior to field use is a possibility, and almost all capacitors contain PCBs. In order to minimize PCB exposure, even though it occurs on an infrequent basis, certain work practices should be instituted.

1. Employees should be made aware of the toxicity of PCBs and the hazards associated with their use. This could be accomplished either by informational bulletins distributed to each worker or placed on a readily accessible health and safety bulletin board.
2. Written work procedures should be made available to all employees and be on hand any time a hazardous procedure or a hazardous chemical is used. This includes cleaning of equipment. A chain of command should be adopted which will be able to provide ready consultation in the event that written procedures fail to answer pertinent questions. Employees should utilize this information source.
3. Protective clothing, such as single-use coveralls, aprons, footwear coverings, gloves, and protective eyewear should be provided during all operations where the chance of spilling or splashing of hazardous liquids is present. This is especially necessary when leaking capacitors are encountered. Eyewear should always be worn, regardless of the toxicity of the liquid, if spillage or splashing is a possibility. Gloves should be used when handling mineral oil. Although no adverse health effects have been reported from contact with mineral oil, it is best to prevent contact if possible.
4. Clothing that is contaminated with PCBs or other hazardous materials should be removed immediately and disposed of properly. Contaminated skin should be washed with soap and water or some other mild hand cleaner. Washing with solvents can damage the skin and may make it more permeable to PCBs or other chemicals.

VII. REFERENCES

1. "Criteria for a Recommended Standard ... Occupational Exposure to PCB's." DHEW (NIOSH) Pub. No. 77-225, Sept. 1977.
2. Personal communication, International Brotherhood of Electrical Workers.

3. "Final Rule for PCBs Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions." Environmental Protection Agency. 44 Federal Register 31514, May 31, 1979.

4. Personal Communication, Transformer Consultants Akron, Ohio 44310

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IX. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this report are currently available upon request from NIOSH, Division of Technical Services, Publications Dissemination, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia 22161.

Copies of this report have been sent to:

1. Local 309, International Brotherhood of Electrical Workers
2. International Office, International Brotherhood of Electrical Workers
3. Shop Steward, Local 309, International Brotherhood of Electrical Workers
4. Illinois Power Company
5. OSHA Region V
6. NIOSH Region V

For the purposes of informing the approximately 66 affected employees, copies of the report shall be posted by the employer in a prominent place accessible to the employees, for a period of 30 calendar days.

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