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I. SUMMARY

On February 24, 1986 the National Institute for Occupational Safety and Health (NIOSH) received a request for a Health Hazard Evaluation from a representative of the National Federation of Federal Employees, Local 422, Parker, Arizona. The representative was concerned that several employees who work in the power yard at the Colorado River Agency were experiencing skin problems which could be related to exposures to the transformer oil or polychlorinated biphenyls (PCBs).

On May 7 and 8, 1986 an initial environmental and medical survey was conducted at the Colorado River Agency. Seven personal and area air samples were collected for PCBs, but none was detected in any of the samples. Five wipe samples were collected from the surface of equipment used to handle and transport PCB contaminated equipment. The wipe samples detected Aroclor 1260 which ranged in concentration from none detected to 1.9 ug/100 cm^2. There are no specific health criteria or EPA standards or policy regarding surface contamination with PCBs. The limited data collected by NIOSH, based on several studies of schools and an office building, suggests an upper background level of 0.5 ug/100 cm^2 for PCBs on surfaces.

Six bulk soil samples were collected from several locations both inside and outside the yard where the soil appeared to be discolored due to the spraying of oil. Aroclor 1260 was identified in the bulk samples which ranged from 0.98 ppm of soil to 87 ppm. The EPA regional PCB policy (May, 1986) allows an average soil background level of 1 ppm or less for high exposure levels.

All PCB transformers and contaminated accessories have been removed from the yard. Soil testing is under progress to determine the extent of contamination after which a decision will be made regarding the yard clean-up.

Based on environmental air sampling results, no airborne PCB exposures were measured on the dates of this survey. The wipe samples collected from the machinery indicated the presence of PCBs which may contaminate the workers when driving the vehicles or handling the power yard equipment. The bulk soil samples detected PCBs which could be a problem during dry dusty conditions. There were no medical findings suggestive of current PCB exposure. Recommendations are included in section VIII of this report to prevent unnecessary exposures.

KEY WORDS: SIC 4911 (Establishments engaged in the generation, transmission and distribution of electric energy for sale) transformers, capacitators, Polychlorinated Biphenyls.

II. INTRODUCTION

On February 24, 1986 the National Institute for Occupational Safety and Health received a request for a health hazard evaluation from a representative of the National Federation of Federal Employees, Local 422, Parker, Arizona. The representative was concerned that employees who work in the power yard at the Bureau of Indian Affairs, Colorado River Agency were experiencing skin problems which may be due to exposures to the transformer oil, or to polychlorinated biphenyls (PCBs) which are a contaminant of some of the transformers currently stored in the yard.

On May 7-8, 1986 an initial environmental and medical survey was conducted at the Colorado River Agency. On May 16, 1986, an interim report was prepared and sent to the company, and in August 1986, the environmental air sampling results were telephoned to the company and union representatives.

III. BACKGROUND

The Colorado River Agency has operated a power yard since the 1930's where all out-of-service transformers are stored. Twenty people are employed by the agency of whom five work in the yard and 15 work as line crew. The crew generally works Monday through Friday eight hours a day.

In 1982, the old transformer oil was being sprayed in the yard to control yard dust until the agency learned that the oil may contain PCBs. During that year, the Bureau of Indian affairs collected oil samples from 10 transformers but no PCBs were detected. Soil samples were tested and found to contain about 79 ppm of polychlorinated biphenyls.

In January, 1984 a PCB coordinator and assistant were appointed to identify which major equipment contained PCBs and the type of Aroclor. The equipment primarily consisted of transformers, but also included power capacitors, power circuit breakers, reclosers, and storage tanks. As a result of this effort, two storage areas were established for PCB and non-PCB containing equipment. A chart was prepared to identify all units containing PCBs and their concentration (ppm). Also, all 55-gallon storage containers were identified as to their contents e.g. disposable clothing, contaminated soil, kerosene, sample vials or capacitators. Currently four areas are cordoned off of which three contain PCB spillage.

Workers who handle the major equipment wear a neoprene glove and under- glove, vinyl sole boots with a disposable Tyvek booty and coverall, and a face shield. A full-face MSAç combination cartridge respirator was worn by the coordinators whenever they collected oil samples for PCB analysis. All tools used to handle PCB transformers were color coded red. These tools were decontaminated with kerosene after each use, and the kerosene was placed in a storage barrel for disposal with the transformers etc. It should be noted that at the time of this investigation, all equipment had been tested, and no further testing was anticipated. In fact, two contracts were out to bid to perform the following: (1) To remove and dispose of all PCB containing transformers, storage barrels and related items; (2) To collect soil samples to determine the extent of PCB contamination so that the soil can be removed and properly disposed.

In order to properly evaluate the yard soil for PCB contamination, a plan was devised by the coordinators to have a contractor sample soil at an interval of 30 feet and a depth of two feet. A chart was devised which contains 69 pre-designated sample sites which are 30 feet from one another. These sample sites were staked and numbered at the time of this survey. The remaining samples were to be collected along the dirt access road to the yard that is adjacent to the Public Health Service Hospital. Also, five soil samples were to be collected from a remote storage site.

During the last week of April, 1986 a Federal Occupational Safety and Health Administration (OSHA) inspector conducted a survey at the power yard. Eight environmental air samples and 9 bulk soil samples were collected; however, the results were not available at the time of our survey. In August, 1986 it was learned that these air samples did not detect any PCBs, and one of the eight soil samples detected PCB (Aroclor 1242) at a concentration of 0.003 percent (300 ppm).

IV. EVALUATION DESIGN AND METHODS

A. Environmental

Several environmental air samples were collected on a combination 13-millimeter (mm) glass fiber filter plus a 150-milligram (mg) florisil tube. Each filter and front section of the tube was desorbed with 1-milliliter (ml) of hexane and sonicated for 1 hour. A gas chromatographic (G-C) analysis was performed on a Hewlett-Packard Model 5711A gas chromatograph equipped with an electron capture detector and accessories for capillary column capabilities.

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 Environmental Protection Agency (EPA). The NIOSH calculated limit of detection was 0.18 micrograms/ sample (ug/sample) and the NIOSH calculated limit of quantitation was 0.59 ug/sample.

Wipe samples were collected using a gauze pad impregnated with hexane. The field wipe samples were collected and transferred to a scintillation vial. The gauze samples were prepared for analysis by extraction in 40-ml of hexane with shaking for 30 minutes. The hexane was transferred to a concentrator tube and the gauze was rinsed twice with 10-ml of hexane. The concentrated hexane eluent was cleaned and brought to a final volume of 3-ml.

The G-C analysis was performed on a Hewlett-Packard Model 5711A gas chromatograph equipped with an electron capture detector and accessories for capillary column capabilities. The presence of an Aroclor was determined by the method described above. The NIOSH calculated limit of detection was 0.15 ug/sample and the estimated limit of detection was 0.09 ug/sample. The NIOSH calculated limit of quantitation was 0.50 ug/sample.

Bulk soil surface samples were collected and placed in a scintillation vial. The samples were prepared for analysis by weighing the samples and placing the samples in glass bottles with teflon-lined caps. Three consecutive extractions were performed by adding 20-ml of hexane to each bottle and rotating for one hour. The extracts were blown down with nitrogen and cleaned on micro-florisil columns. The extracts were brought to a final volume of 3-ml. One-ml was transferred to a GC vial for analysis. The GC analysis was performed in the same manner reported above and compared to the EPA standard samples. The NIOSH calculated limit of detection was 0.05 ug/ gram, and the calculated limit of quantitation was 0.17 ug/gram.

B. Medical

The medical survey consisted of interviews with 20 of the crew to determine the extent of the skin problems, and also to learn of any other medical complaints they might have.

V. EVALUATION CRITERIA

A. Environmental Criteria

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria for assessment of a number of chemical and physical agents. These criteria are intended to suggest levels of exposure to which most workers may be exposed up to 10 hours per day, 40 hours per week for a working lifetime without experiencing adverse health effects. It is, however, important to note that not all workers will be protected from adverse health effects if their exposures are maintained below these levels. A small percentage may experience adverse health effects because of individual susceptibility, a pre-existing medical condition, and/or a hypersensitivity (allergy).

In addition, some hazardous substances may act in combination with other workplace exposures, the general environment, or with medications or personal habits of the worker to produce health effects even if the occupational exposures are controlled at the level set by the evaluation criterion. These combined effects are often not considered in the evaluation criteria. Also, some substances are absorbed by direct contact with the skin and mucous membranes, and thus potentially increase the overall exposure. Finally, evaluation criteria may change over the years as new information on the toxic effects of an agent become available.

The primary sources of environmental evaluation criteria for the workplace are: 1) NIOSH Criteria Documents and recommendations, 2) the American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values (TLV's), and 3) the U.S. Department of Labor (OSHA) occupational health standards. Often, the NIOSH recommendations and ACGIH TLV's are lower than the corresponding OSHA standards. Both NIOSH recommendations and ACGIH TLV's usually are based on more recent information than are the OSHA standards. The OSHA standards also may be required to take into account the feasibility of controlling exposures in various industries where the agents are used; the NIOSH-recommended exposure limits, by contrast, are based primarily on concerns relating to the

prevention of occupational disease. In evaluating the exposure levels and the recommendations for reducing these levels found in this report, it should be noted that industry is legally required to meet those levels specified by an OSHA standard.

A time-weighted average (TWA) exposure refers to the average airborne concentration of a substance during a normal 8- to 10-hour workday. Some substances have recommended short-term exposure limits or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from high short-term exposures.

TABLE A

Recommended Exposure Limit

Substance	8-Hour Time-Weighted Exposure Basis	Source
PCB - all Aroclors	1 ug/m^3(1)	NIOSH

(1) ug/m^3 - Micrograms of a substance per cubic meter of air.

B. Toxicological

Polychlorinated biphenyls[2,3] are poorly metabolized and tend to accumulate in the body, particularly in fatty tissue and other tissue rich in lipids. The greater the degree of chlorination, the longer it takes the body to rid itself of the PCB and the greater the accumulation in the tissues. PCBs can be absorbed by all routes, including the skin. They are not very toxic acutely, but can be irritating to skin and mucus membranes. Chronic exposure leads to accumulation in the body and can lead to skin rashes and chloracne (appearance similar to adolescent acne but not confined to the face, neck, and upper back). There may also be increased pigmentation. Toxic effects on the liver include enzyme induction (which can lead to faster metabolism of many drugs), changes in liver function tests, and even liver damage. Digestive disturbances have also been reported. Reproductive studies in animals have shown lowered fertility, birth weight and survival. A study of a population accidentally exposed to PCBs in their food for a period of months showed that pregnant and nursing mothers can transmit sufficient PCBs to the baby for the baby to show signs of toxicity.

PCBs have been shown to cause liver tumors in both rats and mice in feeding experiments. NIOSH therefore considers that PCBs should be handled as potential human carcinogens. Exposure should be reduced to a minimum. Long term epidemiologic studies on exposed workers have not, so far, established PCBs as a human carcinogen.

It has been shown that when PCB containing equipment is involved in a fire a number of related compounds are formed which have much the same toxic effects as PCBs, but which are considerably more toxic than PCBs themselves. Thus soot from such fires requires considerable care in cleanup. Although PCBs are very stable in the environment, exposing them to sunlight will slowly dechlorinate them, leading to their ultimate destruction.

VI. RESULTS AND DISCUSSION

A. Environmental.

On May 7 and 8, 1986 NIOSH collected personal and area air samples to determine whether any employees currently working in the power yard were being exposed to polychlorinated biphenyls. In addition, wipe samples and bulk soil samples were collected to characterize the extent of PCB contamination throughout the yard.

Seven personal and area air samples were collected in the yard, i.e. meter shop and areas adjacent to PCB spills that are roped off, during both days of the investigation; however no PCBs were detected on the filters or sorbent tubes.

Wipe samples (Table I) were collected from the surface of equipment used to drain the transformer oil, and from the machinery used to transport the transformers. The wipe samples detected Aroclor 1260 which ranged in concentration from none detected to 1.9 ug/100 cm^2. There are no EPA standards or policy regarding surface contamination with PCBs. However, NIOSH has collected samples to establish a background level of PCBs based on several studies of schools and an office building.[4] The limited data suggests an upper background level, for PCB wipe samples, of 0.5 ug/100 cm^2.

Four bulk soil samples (Table II) were collected from several locations inside the yard where the soil appeared to be discolored due to the spraying of oil. Aroclor 1260 was identified in the bulk samples which ranged from 0.98 ppm of soil to 87 ppm. The highest concentration was found at the lowest part of the yard where, when it rains, all of the surface water would accumulate. Since the soil appears to be hardpan and thus impervious to much of the water, oil, etc. it was anticipated that oil spillage onto the soil would tend to stay at the top of the soil. It should be noted that the power yard appears to have a drop of about 2 feet from the high spot where the contaminated equipment is stored to the low spot of the yard. During the rains, it was suspected that any of the surface contamination would tend to be washed down to the low spot of the yard. The highest soil sample was collected adjacent to where there had been an oil spill which contained PCBs; however, it was reported that the oil spill, which is roped off, did not spill onto the soil sampling location. Consequently, it is unclear whether the highest PCB soil sample is due to the rain runoff, or the proximity of the sample site with respect to the oil spill or a combination of the two factors. Additionally, two soil samples were collected along the access dirt road leading to the yard which is adjacent to the Public Health Service Hospital. The soil samples were collected at locations where the top soil appeared oil stained, but no PCBs were identified on the access road.

The EPA Regional Office in San Francisco was contacted to determine if there is a standard regarding background soil contamination. The EPA is reportedly working on a national policy regarding PCB background contamination. In May, 1986 the EPA regional office established a PCB regional policy. In areas of "high exposure" eg. schools and work areas where individuals are exposed to PCBs 8 hours per day or more, the EPA allows an average background of 1 ppm or less. For "Reduced Access" areas, the EPA policy allows 25 ppm concentration.

At the writing of this report, the PCB coordinator at the facilities was contacted to determine whether any of the contracts for work had been awarded. It was learned that all the PCB containing equipment and accessories had been removed from the power yard as of August 22, 1986. Soil testing, i.e. 100 soil samples were to be collected at a depth of one foot, was to be started on August 26, 1986 and completed within three days. These analytical results will be available two weeks from that date at which time a new contract would be drafted to remove the soil or the power yard and shop would be moved.

B. Medical

Interview data identified two major opportunities for exposure to PCBs in the past: 1) when servicing PCB containing equipment, and 2) when setting taps on the older style transformers on the distribution lines.

Because high levels of electrical usage will cause the voltage in the distribution lines to drop, the line transformers have several "taps" on their secondary coils. By resetting which tap is used, the voltage to the consumer can be maintained even when the line voltage has dropped due to heavy use. In the line transformers currently in use, this resetting can be done from the outside of the transformer. In the older transformers it was necessary to open the top of the casing and reach into the transformer fluid to reset the taps.

Several workers noted that the old transformer oil was more drying to the skin than the current oil. One worker exhibited signs consistent with chloracne, although a similar clinical picture is often seen in patients with Favre-Racouchot Syndrome (solar comedones) and in patients with acne vulgaris. Seven of the workers currently have some skin problems not necessarily related to transformer oil exposures. For several the skin problems appear to relate to the hot environment; and none of the skin problems specifically suggest PCB exposures.

VII. CONCLUSIONS

Based on the environmental air sampling results collected by NIOSH during the dates of this investigation and from the Federal OSHA inspection, no airborne exposures to PCBs were measured. Wipe samples indicate that there is contamination of the vehicles used to handle the transformers, and bulk soil samples indicate that there is soil contamination particularly at the low spot of the yard.

VIII. RECOMMENDATIONS

1. Since some of the vehicles have some PCB contamination, it is recommended that the equipment identified (Table I) be wiped down with kerosene to thoroughly decontaminate the vehicles. The kerosene should be disposed of as contaminated material.

IX. REFERENCES

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3.National Institute for Occupational Safety and Health. Current Intelligence Bulletin 45--Polychlorinated Biphenyls (PCBs): Potential Health Hazards from Electrical Equipment Fires or Failures. Cincinnati, Ohio: National Institute for Occupational Safety and Health, 1986. (DHHS (NIOSH) Publication No. 86-111).

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XI. 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. National Federation of Federal Employees, Local 422, Parker, Arizona

2. NIOSH, Region IX

3. U.S. Department of Labor, Region IX

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 I

PCB Wipe Sample Results

Bureau of Indian Affairs
Colorado River Agency
Parker, Arizona
May 7, 1986

Sample Number	Description/Location	PCB Concentration ug/100cm^2(1)
W-1	Oil filtering equipment	0.13
W-2	Fork lift knobs	N.D.(2)
W-3	Fork lift levers and blades	1.9
W-4	G.I. truck, tail gate	N.D.
W-5	Coffing hoist	0.21

Limit of Detection per sample for Aroclor 1260	0.09 ug
Limit of Quantitation per sample for Aroclor 1260	0.50 ug

(1) Micrograms of a substance per 100 square centimeters of surface area

(2) None detected

TABLE II

Bulk Soil Sample Results

Bureau of Indian Affairs
Colorado River Agency
Parker, Arizona
May 7, 1986

Sample Number	Description/Location	PCB Concentration (ppm)(1)
S-1	Aluminum and Copper Reel storage area	1.1
S-2	Aluminum and copper reel storage area	0.98
S-3	Collected at stake site # 28 near large spill	1.3
S-4	Collected at stake site # 15 near large spill	87
S-5	Collected from top of storage crate at the north fence line	2.3

Limit of Detection per gram of soil for Aroclor 1260	0.05 ug/g (2)
Limit of Quantitation per gram of soil for Aroclor 1260	0.17 ug/g

(1) Parts of a vapor or gas per million parts of contaminated air by volume
(2) ug/g-Microgram per gram of soil. The detection and quantitive limits are reported as ug/gram of soil. One ug/gram of soil is equivalent to 1 ppm.