

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45226

HEALTH HAZARD EVALUATION REPORT
NO. 80-85-745

PACIFIC GAS AND ELECTRIC COMPANY
OAKLAND, CALIFORNIA

SEPTEMBER 1980

I. SUMMARY

In February 1980 the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation at Pacific Gas and Electric (PG&E), East Bay Division, Oakland, California. The request originated from employees' concerns for potential health effects, both short and long term, from polychlorinated biphenyls (PCBs) exposure while servicing transformers and capacitors. The request specified that all linemen, as well as a special emergency crew (East Bay Division specialist crew for handling PCB's) were potentially exposed to PCBs during routine line work, inspections, spills, explosions, clean-up, etc.

NIOSH conducted an industrial hygiene evaluation on March 27, 1980, of the occupations in question. At the March meeting NIOSH met with PG&E and employee representatives who were responsible for procedures for handling PCBs and information was exchanged regarding the company's present position on PCBs. This information, as well as information collected from the requestor and a review of the pertinent literature regarding PCBs, were used to determine the effectiveness of PG&E's polychlorinated biphenyls program.

Based on the data obtained in this evaluation, NIOSH has determined that Pacific Gas and Electric Company East Bay Division's program for maintenance and emergency handling of PCBs should afford workers reasonable protection from health hazards due to potential PCB exposures. However, there are certain areas in Pacific Gas and Electric's PCB program which need to be improved. These include an improved respiratory protection program, environmental monitoring, medical surveillance, additional training and education, and an improved sanitation practice program for those employees who handle PCBs. Recommendations to further assure employee protection against possible PCB exposures are included on pages 10-14 of this report.

II. INTRODUCTION

On February 26, 1980, an authorized representative of Pacific Gas and Electric, East Bay Division, Oakland, California, submitted a request pursuant to Section 20(a)(6) of the Occupational Safety and Health Act of 1970.¹ The request stated that all PG&E linemen and an emergency crew were potentially exposed to PCBs used in capacitors and transformers in the East Bay District.

III. BACKGROUND

Pacific Gas and Electric is a utility company which provides and services primarily natural gas and electric power to areas throughout California. Among the various locations serviced by PG&E is the Northern California area which is broken down into several divisions of which East Bay is one of their larger divisions. There are approximately 5,000 service personnel throughout the entire PG&E network who work as linemen. The work shifts are 8:00 A.M. - 4:00 P.M., 4:00 P.M. - 12:00 Midnight, and 12:00 Midnight - 8:00 A.M.

The total number of capacitors and transformers containing PCBs is unknown; however, it was estimated that the majority of PCBs, about 96 percent, are used in capacitors. Each of these units has been identified according to the Environmental Protection Agency (EPA) marking system and, therefore, each of these units can be easily recognized as containing PCBs. Over the last three years there have been approximately 17 incidences per year which have required linemen to attend to transformers or capacitors containing PCBs.

The following is a compilation of the information presented to NIOSH from PG&E. This includes their PCB handling procedures, Region IX EPA recommendations to PG&E for PCB spills, and PG&E's policy for safety and health while handling PCBs.

PG&E's Handling Procedures for PCBs

During the control and clean-up of PCB leaks, spills, explosions, etc., PG&E employees are required to follow the specific safe work practices and environmental safeguards set forth in their PCB bulletins and standard practice statements. Each of these are issued by PG&E's Electric Transmission and Distribution, Electric Substation, and Materials Departments.

PG&E's standard procedures require that upon receipt of notice of a potential PCB problem, a PG&E troubleman is dispatched to the scene to determine whether a full maintenance crew is immediately required. Notice is typically received in either the form of a telephone call from a customer to report a leak and/or explosion of a capacitor, or in

¹ Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 19 U.S.C. 669(a)(6), authorizes the Secretary of Health, Education, and Welfare, following a written request by any employer or authorized representative to 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 form of an automatic circuit relay alarm which is observed by the PG&E district operator. The troubleman is dispatched by the district operator and normal response time is 15 to 20 minutes.

Once at the scene the troubleman will electrically isolate a damaged capacitor bank using a 35-foot "extendo" stick and, if needed, he will place traffic cones around the contaminated area. The troubleman's call for the full maintenance crew is handled by the Electric Transmission and Distribution Department, hereinafter referred to as "T and D", at the Oakland Service Center. If the capacitor unit is observed by the troubleman to be intact and not damaged, on instructions from the district operator the troubleman will re-fuse the bank and test the unit to determine its effectiveness.

Should the troubleman observe a capacitor unit to be swollen but not ruptured, again on instructions from the district operator, he will electrically isolate the damaged unit and the replacement will be scheduled as a routine matter for the maintenance crew. The re-fusing procedure discussed above is not employed during night work in order to minimize the potential of a PCB incident during the hours of darkness.

The PCB emergency maintenance crew is a special 3-man electric crew under the supervision of a Line Subforeman. The maintenance line crew uses a 35-foot bucket truck in the majority of PCB clean-up cases. The crew is also equipped with an electric line truck with a 40-foot boom to which an aerial basket may be attached. In cases where the pole is not accessible, linemen are required to climb the pole in order to remove the damaged capacitor unit.

After dispatching the PCB maintenance crew, T and D will notify the East Bay Division PCB Coordinator of the situation and, if required, he will arrange for a Contract Clean-up Employer to handle removal of spilled PCB. PG&E has had this type of contract since 1974. T and D then notifies the Materials Department warehouse of the need for PCB clean-up and a warehouse crew is dispatched to the scene with the required barrels and boxes for clean-up and removal of PCB contaminated materials.

The boxes are 4' x 4' x 4' plywood boxes which are designed specifically for handling leaking PCB equipment and contaminated material.

These boxes are built for maximum strength and are coated with a tar substance inside. To assure complete containment of PCB fluids the following is also done to the boxes:

1. The boxes are lined with a heavy gauge plastic sheet of clear polyethylene or equivalent. The sheet is secured by stapling it to the top edge of the box. Care is taken to assure that the plastic sheet is touching all inside surfaces of the box to avoid tearing when heavy articles are inserted.
2. An "oil-dry" compound is then poured into the box until the bottom is covered by at least a 3 inch layer.

NOTE: PG&E is presently seeking a sealing substance that will be applied at the time of fabrication of the box.

The lined boxes are equipped with a shovel, mop, and broom and are partially filled with absorbent clay material. The mop and broom are disposed of after use, but the shovel, which has a lacquered hardwood handle, is decontaminated with naphtha and re-used.

PG&E's policy on using protective clothing states that "If PCBs cannot be handled without prolonged skin contact or contamination of personal work clothing, disposable work clothing shall be worn." This clothing consists of impervious paper-like coveralls, plastic overshoes, rubber-like gloves, impervious apron, face shield, and a respirator which uses acid gas and inorganic vapor type cartridges. Disposable work clothing is made available at all district and Division operating headquarters where PCB clean-up and/or handling could be required.

At the scene, the crew dons disposable clothing and erects barricades utilizing red and white barricade tape to isolate the contaminated area. The Clean-up Contractor, if necessary, deposits all contaminated materials in either the barrels or boxes provided by PG&E. Utilizing the bucket truck permits the crew, in many cases, to lower the damaged capacitor directly into the debris box without handling the electrical equipment. Contaminated materials, including but not limited to soil, foliage, bricks, disposable clothing, and electrical equipment, are transported by the PG&E warehouse crew to the Oakland Service Center.

After completion of PCB handling or clean-up, the disposable work clothing is removed immediately and examined for PCB contamination. Personal work clothing is also examined and, if found to be contaminated, removed. The contaminated clothing, as well as the other contaminated material, are then placed in the leak-proof container and transported to the crew headquarters where it is stored at a location previously agreed upon with the Materials Department.

The contaminated debris is subsequently transported by the Materials Department warehouse crew from the Oakland Service Center to the PG&E Decoto Pipe Yard located in Union City, California. Barrels and boxes of PCB contaminated materials are marshalled at the Decoto Pipe Yard prior to consignment to a contract common carrier for shipment to an approved disposal site.

It should be noted that the assignment of all PCB maintenance to a single electric line crew is unique to the Central District of PG&E's East Bay Division. All Electric Department linemen are instructed in the safe handling procedures regarding a PCB incident. If needed, in East Bay Division's Central District, additional line crews may be called upon to provide standby assistance to the PCB maintenance crew. Finally, although the maintenance line crew may complete its work and leave the scene before the arrival of the Contract Clean-up Crew, a PG&E management supervisor remains at the scene to monitor the entire PCB decontamination operation.

EPA Recommendations for PCB Spills

The following are those recommendations given to PG&E by Region IX EPA for managing typical liquid PCB spill situations. These are general recommendations and each real spill situation is reviewed carefully to determine the best course of action to protect both health and the environment.

1. Spillage on Cement/Concrete Surfaces:

All free-flowing material should be contained and removed with absorptive materials (i.e. sawdust).

Following this, the surface should be scrubbed with rags or cloths soaked in a recommended solvent (i.e., naphtha, xylene, toluene, kerosene, etc.). Never hose down PCB's with water.

2. Spillage into Soil:

All contaminated soil should be removed immediately, and deposited in a disposal drum.

While there are no hard and fast rules for determining the depth of soil to be removed following PCB contact, it is recommended that good judgment be used to determine the depth of penetration of the chemical during the time period since initial contamination.

Test samples of soil are not necessarily required; however, they are recommended to evaluate the extent of penetration.

3. Spillage onto Vegetation:

Contact with lawns would necessitate entire removal of grasses, and at least two inches of underlying soil.

Remove and dispose of all bushes and nongrassy plants contaminated with PCB.

Large trees (i.e., contaminated as a result of a ruptured pole-mounted capacitor) should be trimmed of those branches and leaves which are visibly contaminated.

4. Spillage on Nonremovable, Nondisposal Items:

Frequent spillage occurs on equipment or articles in the vicinity of PCB equipment. Good judgment as regards clean-up should prevail. Surfaces should be scrubbed with solvent and cleaned as is reasonably possible. Some items, however, cannot be cleaned with solvent due to potential damage to or marring of protective finishes by these chemicals (i.e., automobiles, trucks, etc.). In these situations, dry cloths should be used to collect as much contamination as possible.

5. Spillage into Swimming Pools:

This situation is by no means a rare occasion in this Region. Due to the vast numbers of private outdoor swimming facilities in California, frequent failures of pole-mounted PCB units have resulted in many instances of contamination. It is recommended that, under such circumstances, responsible parties contact the EPA Office for procedures on skimming floating surface contamination and suctioning off PCB precipitate on the pool bottom. Under no circumstances should contaminated pool water be drained out without contacting EPA.

6. Disposal of Spill Clean-Up Materials:

It is recommended that, when scrubbing contaminated areas with solvent, it is wise not to generate large volumes of waste solvent. This liquid will contain significant concentrations of PCBs, and hence subject to stringent disposal requirement.

PG&E's Policy on Safety and Health

PG&E's policy on safety and health concerns for PCB exposures is somewhat limited. The following is the present information disseminated to the employees:

"PCBs are chemically stable, noncombustible, and do not react with other material used in equipment designed for its use. There does not appear to be any acute local or systematic toxic effects from PCBs with brief physical contact at room temperature. However, hot PCBs can emit vapors which should be avoided."

It is further stated that:

"If accidentally spilled on the hands, PCBs have a solvent action similar to paint thinner and exposure may lead to drying and chapping. In case of contact, wash the skin with soap and water. Eye contact with PCBs may result in painful, temporary irritation, but no permanent damage to the tissues will occur. If contact with the eye occurs, flush with large amounts of water and, as with all eye first aid, refer to a Company physician."

IV. EVALUATION CRITERIA

1. Environmental

There are several criteria used to evaluate the toxic air contaminants of an employee's work environment: (1) NIOSH Criteria Documents for a Recommended Occupational Health Standard, (2) Proposed and Recommended Threshold Limit Values (TLV's), as suggested by the American Conference of Governmental Industrial Hygienists (ACGIH), 1979, and (3) the Occupational Safety and Health Administration (OSHA) standards. The values are based upon the current state of

knowledge concerning toxicity of these substances. The values for each contaminant are designed to allow an occupational exposure for an 8-hour work day up to a 10-hour work day, 40-hour work week Time Weighted Average (TWA) over a normal lifetime, without the worker experiencing discomfort.

The following is the present criteria established by ACGIH, OSHA, and the justification for the present NIOSH recommended criteria.

The ACGIH has two Threshold Limit Values (TLVs) for PCBs - 0.5 milligrams per cubic meter of air (mg/M^3) for chlorodiphenyl (54% chlorine) and 1.0 mg/M^3 for chlorodiphenyl (42% chlorine), and these were adopted by OSHA and are enforceable today. NIOSH recommends that worker exposure be limited to 1 microgram per cubic meter of air (ug/M^3) - a level lower than any OSHA standard by a factor of at least 500. This recommended criteria (published in 1977) is based on an exhaustive review of available literature - animal toxicity testing, epidemiological data, and industrial experience - which showed basically that there was no detectable level at which there was not some demonstration of liver dysfunction.

- It should be understood that OSHA is always reviewing and updating its standards based on need; as expressed by the number of workers involved, technical feasibility, economic impact, etc. Thus, the standard on PCBs happens to be one that has not had its turn in review. Therefore, based on this information, the NIOSH recommended criteria of 1 ug/M^3 will be used as a guideline in this evaluation.

2. Medical

The medical criteria used to determine a toxic response to the substance under investigation consists of signs and symptoms which the agent produces when a toxic exposure occurs. These factors, as well as other investigative strategies as described above, were used to determine the toxicological effects of PCBs and these are discussed in the following paragraphs.

The most famous incident of non-occupational exposure to PCB's was the Yusho, Japan, incident. This domestic poisoning focused attention on PCBs and provided much of the human exposure/effect data, and this information is often used when comparing occupationally-related exposures.

Briefly, in 1968 approximately 1057 cases of a similar poisoning occurred in Japan. Epidemiological investigations ultimately determined that these people had consumed rice bran oil contaminated with PCBs. During the manufacture of rice oil, a heat exchange unit had leaked PCBs into the product. The disease became known as Yusho, or rice oil disease.

The predominant symptoms associated with this exposure were acneiform eruptions, eye discharges, chloracne, and hyperpigmentation of the skin, nails, and mucous membranes. Other clinical signs were alterations in liver function, fetal contamination (indicating placental crossing of PCBs), and passage of PCBs to the infant via mother's milk. In addition large quantities of PCB were found in adipose tissue samples, indicating storage and slow release. Follow-up of these patients indicated that symptoms persisted for several years after exposure. The period of ingestion was only a few months, but the average amount ingested was estimated to be about 2 grams of PCB.

NOTE: Although much was learned about the effects of PCBs on humans from Yusho, the application of this exposure/effect data to occupational exposures must be done cautiously. The route of entry (ingestion) will be different (except in the most bizarre circumstances) than normal occupational routes of entry, i.e., skin contact, inhalation, etc.

In 1974 the Division of Occupational Health and Radiation Control of the Health Commission of New South Wales, Australia, conducted a study of a condenser manufacturing firm that used PCBs. Breathing zone concentrations ranged from 0.32 - 2.22 mg/M³. Significant clinical findings included rashes, chloracne, and high blood PCB levels; hepatic function tests were normal.

NIOSH conducted an industrial hygiene study of two capacitor manufacturing facilities in April, 1977. In plant #1, the personal breathing zone samples ranged from 24 ug/M³ to 383 ug/M³. In plant #2, the personal breathing zone levels ranged from 170 ug/M³ to 1260 ug/M³. A medical study (not in conjunction with the NIOSH study) conducted previously on 326 volunteer workers in plant #1 revealed mostly dermatological problems and decreased lung capacity; there was little increase in abnormal liver findings although there were liver enzyme changes associated with the PCB exposed versus the non-exposed workers. The NIOSH epidemiologist identified cancer of the rectum and cancer of the liver as the only 2 categories of cancer which were greater than expected (4 observed vs. 1.2 expected, and 3 observed vs. 0.9 expected respectively). Cancer of the liver is noteworthy in this study for its finding parallels those animal studies where PCBs were found to cause liver damage.

NIOSH (June 1977), in a discussion on local and systemic effects from PCBs, described the local effects as deriving from prolonged skin contact with PCB fumes. This can cause the formation of comedones, sebaceous cysts, and pustules known as chloracne. Other local effects are irritation to the eyes, nose, and throat. The systemic concerns are derived from toxic effects which are dependent upon the degree of chlorination; the higher the degree of substitution, the stronger the effects. It is also stated that acute and chronic exposures can cause liver damage. Signs and symptoms include edema, jaundice, vomiting, anorexia, abdominal pains, and fatigue.

Finally, in two recent investigations both NIOSH and OSHA determined that both linemen and maintenance personnel (performing repairs, clean-up, etc.) were exposed to PCBs levels as high as 40-60 times the recommended standard.

In the NIOSH survey investigators found PCB values ranging from non-detectable levels to 60 ug/M³. A total of 19 samples were taken over a period of 1-6 hours. Among the various medical effects described in this investigation were skin rashes, headaches, sterility, and loss of appetite.

Federal OSHA investigators, monitoring similar operations, found PCB levels ranging from 20-40 ug/M³ for 1-2 hour sampling periods.

V. SUMMARY AND RESULTS

Employee exposure to polychlorinated biphenyls, via skin absorption and suspected airborne concentrations (either as vapors or in dust laden form), were evaluated. Due to the nature of the potential exposure, environmental sampling of the workers was not feasible. That is, NIOSH found it impractical to perform environmental monitoring due to the intermittent and occasional situations which render special conditions for handling PCBs. That is, the only time a lineman and/or emergency crew from this division would be in contact with PCBs is during a complaint, spill, explosion, etc. Thus, it would be impractical for NIOSH to evaluate conditions that would require a standby situation, as well as an immediate response, in order to adequately monitor these exposures. Therefore, a thorough evaluation of the East Day Division's protocol for handling PCBs was conducted. This included the normal operating procedures which are outlined in PG&E's "Standard Practices and Bulletins," as well as information for emergency situations which require special handling and disposal techniques. The following are the results and conclusions of this evaluation.

1. Environmental

It is difficult to adequately determine whether PG&E's program for eliminating PCB exposures to employees is successful without environmental data. However, after reviewing the numerous Bulletins and Standard Practices concerning PCB handling, it appears that the majority of safe practices, as outlined in NIOSH's Criteria Document (1977), have been addressed. These include: (1) proper handling techniques, (2) use of special equipment to reduce exposures, (3) educational programs, and (4) proper storage, transportation, and disposal techniques of contaminated materials. Two other programs practiced by PG&E, continual education and a special crew to handle PCB problems, are excellent for reducing exposure to a larger percentage of the workforce and should be continued.

The personal protective program outlined by PG&E includes each of the items required to adequately safeguard the employees from PCBs, i.e., disposable clothing, face shields, and impervious gloves, aprons, and shoes.

However, the respiratory program designed by PG&E to protect employees from PCBs differs from that recommended by NIOSH; NIOSH recommends self-contained breathing apparatus for any exposure to PCBs which exceed $1 \text{ ug}/\text{M}^3$. This recommendation may be appropriate for a portion of the linemen at PG&E, i.e., their special crews who respond to and resolve spills, fires, explosions, etc., but may be too stringent for the lineman who occasionally comes upon a problem not as severe as those just mentioned. Thus, environmental data should be collected to better understand that population at risk, and then provide other types of respiratory protection as deemed necessary. (Refer to Section VI, Recommendations.)

At present the only PCB environmental monitoring being performed by PG&E is for soil and residual contaminants. This policy is good, but again, the need for personal environmental monitoring is essential in order to characterize individual exposures and classes of exposures, i.e., low versus high risk operations. These environmental evaluations are especially necessary in light of the high levels of PCBs found in the recent NIOSH and OSHA surveys mentioned earlier.

2. Medical

The present medical education program described by PG&E is minimal in terms of adequately discussing the signs and symptoms which can develop from acute or chronic exposures. (Refer to Section III, Background/PG&E's Policy on Safety and Health, page 6.) This discussion describes brief exposures at room temperature and only lightly discusses concerns for exposures from hot PCBs. Also, based on review of the medical program, it appears that PG&E needs a more thorough medical monitoring program than presently exists.

VI. RECOMMENDATIONS

In view of the findings of NIOSH's environmental and medical evaluation, as well as personal communications with individuals at the Oakland facility, the following recommendations are made to further reduce and/or eliminate employee exposures to PCBs.

1. Environmental

A. Respiratory Protection

The NIOSH Criteria Document states that there are three conditions under which compliance with the permissible exposure limit may be achieved by use of respirators, as opposed to engineering controls. These are (1) during the time necessary to install or test the required engineering controls, (2) non-routine maintenance or repair activities and (3) during emergencies when concentrations of airborne PCBs may exceed the permissible limit. Based on this information, it is assumed that the present evaluation covers the latter two conditions, and therefore the employer should establish and enforce a

respiratory protection program meeting the requirements of 29 CFR 1910.134. The employer is also required to provide respirators as described in Table 1.

TABLE 1

RESPIRATOR SELECTION GUIDE

Concentration of PCBs	Respiratory Type Approved under Provisions of 30 CFR 11
Greater than 1.0 ug/cu m or <u>Emergency</u> (entry into area of unknown concentration)	(1) Self-contained breathing apparatus with full facepiece operated in pressure-demand or other positive pressure mode. (2) Combination Type C supplied-air respirator with full facepiece operated in pressure-demand or other positive pressure mode and an auxiliary self-contained breathing apparatus operated in pressure demand or other positive pressure mode.

However, due to the variety of conditions under which an exposure can occur to PG&E linemen, it is very possible that a self-contained breathing apparatus or air-supplied respirator could be a hinderance, and thus, a potential safety hazard to the worker. It should also be kept in mind that these workers are only occasionally exposed to PCBs and rarely, if ever, exposed to PCBs as defined in the criteria document, i.e., "up to a 10 hour workday, 40 hour workweek, over a normal working lifetime". Therefore, Table 2 is the recommended respiratory program which should best favor the variety of situations which the lineman and emergency crews may be confronted with.

TABLE 2

Recommended Respiratory Guide

1. Inside Spill -- Self-contained and/or airline respirators described in Table 1.
2. Explosion/Fire/Heat -- Self-contained and/or airline respirator as described in Table 1.
3. Outside Leak -- Full face respirator with acid gas/organic vapor cartridge with high efficiency pre-filter. Care should be taken to replace these cartridges as necessary.
4. Leak on Pole -- Full face respirator with acid gas/organic vapor cartridge with high efficiency pre-filter. Care should be taken to replace these cartridges as necessary.

NOTE: These recommendations are based on personal communications with NIOSH Regional Consultants (Regions VIII and X), NIOSH Morgantown representatives, and OSHA recommended PCB respiratory program/Region V.

B. Environmental Monitoring

Personal breathing zone environmental monitoring should be performed on a sub-sample of the linemen who normally respond to the various PCB problems. This evaluation is particularly needed for those linemen who are designated as the emergency PCB crews. This data will be useful in determining which of the exposed groups and/or conditions require the respiratory protection as outlined above. Therefore, for each time weighted average concentration determination, a sufficient number of samples should be taken to characterize the various conditions and each employee's exposure during the various types of operations. Until environmental data is available that rules out the possibility of PCB exposure in excess of 1 ug/M^3 , the above respiratory program should be complied with routinely. Also, if the environmental survey illustrates excursion above the standard, surveys should be repeated at least once every year. Records of these evaluations, including the basis for any conclusion that there may be no exposure to PCBs, should be retained until the following year when the next survey has been completed.

Finally, environmental monitoring data should be retained for at least 30 years after the employee's last exposure. (Refer to the Criteria Document for further details.)

2. Medical

A. The following medical surveillance should be made available to those linemen and emergency crew members who may come in contact with or routinely respond to PCB problems.

(1) Preplacement or initial medical examinations for workers should include:

(a) Comprehensive medical and work histories with special emphasis on hepatic function, skin condition, and reproductive history.

(b) Comprehensive physical examination with particular attention to the skin and to hepatic function including determinations of serum glutamic-oxaloacetic transaminase (SGOT) and serum glutamic-pyruvic transaminase (SGPT) activities. The responsible physician may also wish to obtain measurements of serum triglyceride concentrations or of other indices of fat metabolism.

(c) A judgment of the employee's ability to use positive pressure respirators.

- (2) During examinations, applicants or employees having medical conditions, as described in Section IV (Evaluation Criteria/Medical), that could be directly or indirectly aggravated by exposure to polychlorinated biphenyls or formulations containing polychlorinated biphenyls should be counseled on the increased risk of impairment of their health that might result from working with these substances.
- (3) All workers should be advised of the potential adverse effects of PCBs on the unborn child, especially those of childbearing age. Those who bear children while working with PCBs should be counseled concerning the advisability of nursing their babies.
- (4) Initial medical examinations should be made available to all workers as soon as practicable.
- (5) Periodic examinations should be made available at least annually and include: (1) interim medical and work histories, and (2) physical examinations as outlined in paragraphs (A)(1) and (A)(2) of this section.
- (6) If evidence of adverse effects of exposure to PCBs is suspected or confirmed, appropriate medical care should be made available to the affected worker(s).
- (7) Pertinent medical records should be maintained for all employees exposed to PCBs in the workplace. Such medical records should be maintained for the period of employment plus 30 years. These records should be made available to the designated medical representatives of the Secretary of Health and Human Services, of the Secretary of Labor, of the employer, and of the employee or former employee.

3. Sanitation Practices

- A. Facilities for shower baths should be provided for employees exposed to PCBs. Therefore, after working with PCBs, workers should shower before changing into street clothes..
- B. Employees exposed to PCBs should be advised to wash their hands and exposed skin before eating, drinking, smoking, or using toilet facilities during work with PCBs.
- C. Food, drink, or smoking materials should not be permitted in areas where PCBs are handled.

4. PCB Training and Education

The training and education of employees regarding safe work practices is the key to reducing and/or eliminating exposures to PCBs. Therefore, in order to maximize the present PG&E employee training program regarding PCBs, the following information should be referred to and emphasized as necessary.

- A. PG&E should continue their education program to ensure that all employees occupationally exposed to PCBs have current knowledge of job hazards, proper maintenance and cleanup methods, and proper use of protective clothing and equipment, including respirators. Emphasis should be placed on using this protective clothing and equipment any time an exposure to PCBs may exist. The instructions should include a general description of the medical surveillance program and of the advantages to the employee of participation. Special attention should be given to women in the workplace. They should be made aware of the potential adverse effects of PCBs on the unborn child, and of the known transport of PCBs to breast milk. Other elements of the program should emphasize:

- Emergency procedures and drills;
- Instruction in handling spills and leaks;
- Decontamination procedures;
- First-aid procedures, equipment location, and use;
- Rescue procedures;
- Confined space entry procedures;
- Low warning (odor) properties of PCBs'

- B. All new and present employees in any area in which PCBs are used should be informed of the hazards, relevant symptoms, and effects of overexposure to PCBs, and the precautions to be observed for safe use and handling of these materials.
- C. Each employee involved with the use, transport, or storage of PCBs should be informed that PCBs have been found to induce tumors in experimental animals after repeated oral ingestion and that because of these findings it is concluded that PCBs are potential human carcinogens; employees shall also be informed that adverse reproductive effects may result from occupational exposure to PCBs.
- D. In order to simplify the training and education of employees regarding PCBs, each of the various Bulletins and Standard Practices NIOSH received from PG&E regarding their PCB program should be summarized into one document and up-dated as necessary.
- E. Finally, all the information explaining the hazards of working with PCBs should be kept on file and be readily accessible to workers at all places of employment where PCBs are used, stored, or transported. Required information should be recorded on the "Material Safety Data Sheet."

VII. REFERENCES

1. Industrial Hygiene and Toxicology, second edition, Frank Patty (editor), Interscience Publishers, 1967, Vol. II.
2. Industrial Toxicology, third edition, Hamilton and Hardy, Publishing Service Group, Inc., 1974.

3. "Threshold Limit Values for Chemical Substances in Workman Air", American Conference of Governmental Industrial Hygienists, (1979).
4. Encyclopedia of Occupational Health and Safety, International Labor Office, McGraw-Hill Book Company, New York.
5. U.S. Department of Health, Education, and Welfare. Occupational Diseases, A Guide to Their Recognition, Public Health Service Publication (NIOSH) No. 77-181.
6. Criteria for a Recommended Standard...Occupational Exposure to Polychlorinated Biphenyls. NIOSH Publication No. 77-225, (September 1977).
7. Personal Communications with:
 - a. Respirator Section, Testing and Certification Branch, Division of Safety Research, NIOSH, Morgantown, West Virginia.
 - b. Stanley Reno, NIOSH, Region VIII, Denver, Colorado.
 - c. Walter Ruch, NIOSH, Region X, Seattle, Washington.
 - d. Clifford Moseley, Hazard Evaluation and Technical Assistance Branch, Division of Surveillance, Hazard Evaluations, and Field Studies, NIOSH, Cincinnati, Ohio.
 - e. Linda Muecke, OSHA, Region VIII, Denver, Colorado.
8. Ouw, H.K. et al., "Use and Health Effects of Arocolor 1242, A PCB, in an Electrical Industry." Archives Env. Health, July/August 1976, pp. 189-194.
9. Brown, D.P., Jones, M. "Mortality and Industrial Hygiene Study of Workers Exposed to PCBs." NIOSH, April 1977. (Study not yet published.)
10. MacLeod, K.E. "Sources of Emissions of PCBs into the Ambient Atmosphere and Indoor Air." EPA Publication No. 600/14-79-022, March, 1979.
11. Kutz, F.W., Strassman, S.C. "Residues of PCBs in the general population of the U.S." Proceedings on the National Conference on PCBs. EPA Publication No. 560/6-75-004. 1976.
12. Calabrese, E.J., Sorensen, A.J. "The Health Effects of PCBs with Particular Emphasis on Human High Risk Groups." Review Env. Health, 2#4:304, 1977.

IX. AUTHORSHIP AND ACKNOWLEDGMENTS

Report Prepared By:

Paul Pryor, M.S.
Regional Industrial Hygienist
NIOSH, Region VIII
Denver, Colorado

Evaluation Assistance: Pierre Belanger
Regional Industrial Hygienist
NIOSH, Region IX
San Francisco, California

Originating Office: Hazard Evaluation and Technical
Assistance Branch
Division of Surveillance, Hazard
Evaluations and Field Studies
NIOSH, Cincinnati, OH

Report Typed By: Marilyn K. Schulenberg
NIOSH, Region VIII
Denver, Colorado

XI. DISTRIBUTION AND AVAILABILITY

Copies of this 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. International Brotherhood of Electrical Workers, Local 1245, Walnut Creek, California.
2. Pacific Gas and Electric.
3. U.S. Department of Labor/OSHA - Region IX.
4. NIOSH - Region IX.
5. California Department of Health Services.
6. State Designated Agency.

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