

**Industrial hygiene summary report for
workers exposed to polychlorinated biphenyls (PCB)
in a capacitor manufacturing plant (plant 2; 1938-1977)**

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Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

Abstract.

This industrial hygiene summary report summarizes information about workers who manufactured large and small capacitors using polychlorinated biphenyls (PCBs) at a plant operating from 1938 through 1977. The first step in making a capacitor was to wind bales of foil and paper together tightly. This winding and the insertion of connectors was done automatically. Tops for the capacitors were assembled, and connectors were welded to the terminals of the capacitor tops. The assembled bale and capacitor top was then placed into the capacitor can and welded shut. There was a small opening in the top for filling with PCB oil: a process called impregnation. Trays of capacitors were placed into an impregnation oven heated to approximately 150°C and brought under vacuum to remove all moisture from the capacitors before PCBs were pumped in. The impregnation cycle usually took place in a 200-gallon (800-liter) oven (30 ovens at this plant) at 150°C for about 24-60 hours and a maximum of 125 hours depending on the size of the capacitors. Once impregnated, the capacitors were removed from the ovens dripping wet with PCBs, and transported by pushcarts to the “hot room” or the fill-hole soldering department where the impregnation hole was soldered shut by hand. Once the capacitors were closed they were conveyed through a trichloroethylene degreaser to remove the excess oil and finally painted. Before packing and shipping the capacitors were put through a heat test operation where possible cracks were spotted. The rejected capacitors were repaired or salvaged. Other types of non-PCB-filled capacitors (mica, electrolytic and tubular) were also manufactured before 1972. Exposures in the impregnation area were regulated for PCB exposure by only opening one or two impregnation ovens rather than all 30 ovens during a shift. Industrial hygiene controls included general ventilation or ceiling fans throughout the plant, and local exhaust ventilation for each of the 30 impregnation ovens. At the time of the NIOSH survey (1976), very few workers wore protective gloves, aprons, or safety glasses. PCB oil spills were found throughout the plant. The capacitor manufacturing process did not significantly change over the years. The use of PCB mixtures, commercially called Aroclors, changed over time. Aroclor 1254 was used from 1939 until a switch was made to Aroclor 1242, and finally Aroclor

1016 in 1976. The difference between the mixtures was the distribution of the chlorination of the congeners. The average chlorination for Aroclors 1242 and 1016 was 41-42%, and for Aroclor 1254 was 54%. A total of 104 department codes and 732 operation title codes were recorded, and a unique operation code was a combination of a department code and an operation code. All unique operations ever recorded at this plant were categorized into 29 categories based on inhalation and dermal exposure. The values for inhalation exposure were derived from the air concentrations measured at the plant in 1977. There was a potential for significant dermal exposure for some jobs. Dermal exposures were ordinarily rated separately for each job and each category. Dermal exposures were in the same general magnitude as inhalation exposures. Both inhalation and dermal exposure estimates were used to develop a combination JEM.

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1.1 Introduction

NIOSH included Aerovox in their mortality study for workers in the capacitor manufacturing industry using PCBs. The initial study published by Brown and Jones (1981) was based on a selective group in this industry, on which they later published a follow-up study (1987). The exposure assessment was based on work histories, a walk-through survey, and an industrial hygiene survey.

1.2 The rationale for developing a specialized JEM for Aerovox

The criterion for entry into the Brown retrospective cohort study was a minimum of three months of employment in areas of the plant which were deemed to represent those workers with the heaviest exposure to PCBs. Estimates of exposures were based on job classifications. The assignments into exposure categories were designated by the company and verified by the unions in the New York plants. Moreover, a cross-sectional industrial hygiene survey of area and personal air samples (for PCBs) confirmed the exposure classification (Brown and Jones, 1981).

The initial study found mortality elevated for both rectal cancer (SMR=336; 95% CL:92-860; $p=0.066$) and liver, biliary tract and gallbladder cancers (hereafter referred to as the liver cancer group) (SMR=280; 95% CL:58-820; $p=0.187$). Females at Aerovox, however, did have an increase in cancer of the rectum (SMR=600; $p=0.029$). Moreover, an excess mortality from cirrhosis of the liver (SMR=156; $p=0.603$) was noted among females in this same plant. No associations were noted between these cancers and duration of employment in a PCB exposed job.

Due to the small number of deaths ($n=163$) and short observation period, a follow-up study through 1983 was performed, adding an additional seven years of observation and 132 deaths. Similar results were found with lower than expected deaths from all causes (SMR=93; $p=0.000$) and from all neoplasms (SMR=78; $p=0.033$). An excess in mortality in the liver cancer group (SMR=263; $p=0.088$) remained. In addition, the excess of deaths from rectal cancer remained although the risk was lower than in the original study

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(SMR=211; $p=0.251$). Even with the additional seven years worth of follow-up data, the findings were inconclusive, in part because of the relative rareness of the diseases studied and the few number of deaths.

A job exposure matrix will permit better estimation of exposures. The Aerovox job exposure matrix (JEM) is based on the same work histories as Brown (1987), but includes the rest of the workforce from 1939 through 1975 (when the work histories were copied). All job codes existing in 1975 were included in the JEM. The industrial hygiene surveys done by NIOSH and others were used to quantitate the JEM. The plant is no longer operating.

1.3 Background for the Aerovox manufacturing plant

Aerovox Industries, also previously known as Aerovox Corporation, manufactured capacitors in New Bedford, Massachusetts beginning 1938. At Aerovox PCBs were used to make oil-filled capacitors starting in 1939. Aerovox also made several other types of capacitors, including mica, electrolytic and tubular until 1972. The production process for these three types of capacitors was transferred to other locations following the change in ownership in 1972 (Aerovox Industries bought AVX Corporation in 1972). In 1976, only oil-filled capacitors were produced in New Bedford. Most of the “oil” used was PCB, but mineral oil and castor oil were also used for specified units (NIOSH 1976).

NIOSH conducted two surveys at Aerovox, one in 1976 (Brown, 1976 (trip report)) and in 1977. During NIOSH’s second survey in 1977, there were 380 employees at the New Bedford facility. Three hundred of these employees were involved in production processes of which approximately two thirds were women. NIOSH estimated that there were approximately 104 of the 380, or 27% employees who had potential exposure to polychlorinated biphenyls. Aerovox, however, estimated a total of 40 exposed employees, 10% of the work stock (Jones *et al.* 1977).

1.4 Manufacture of capacitors at Aerovox

The process of manufacturing capacitors at Aerovox did not change much from 1947-77. The PCB used at Aerovox in 1976-77 was Aroclor 1016 from Monsanto. In addition to PCB oils, castor oils and mineral oils were also used. There had been a change in the use of Aroclors from Aroclor 1254/52 to Aroclor 1016 but when the change occurred was not known.

In 1976 the New Bedford facility provided 400,000 square feet for manufacturing operations, but not all the space was being utilized. The manufactured products included AC capacitors for application in air conditioning equipment, the lighting industry and by motor manufacturers. Also manufactured were light and heavy-duty energy discharge and storage capacitors (NIOSH 1976).

There were 380 employees at the New Bedford facility at the time of NIOSH's second survey in 1977. Three hundred of these employees were involved in the production processes of which approximately two-thirds were women. The union at this plant was Local #1754 of the International Brotherhood of Electrical Workers. However, this union only represented approximately 25 maintenance employees. Since 1939 several thousand employees (3000-4000) have worked for Aerovox.

1.5 Reference

NIOSH Industrial hygiene survey of Aerovox Industries Inc. New Bedford, Massachusetts.

Survey date March 21-23, 1977. Report by Jones et al. dated November 29, 1977.

NIOSH Walk-through survey of Aerovox Industries, Inc. New Bedford, Massachusetts, January 5, 1976 (report date February 23 1976). Brown.

Personal Communication; Letter from the commonwealth of Massachusetts Executive office of manpower affairs Department of labor and industries, Division of occupational hygiene to Aerovox Industries dated December 17, 1976.

2 Background for the Aerovox manufacturing plant

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There were 380 employees at the New Bedford facility at the time of NIOSH's second survey in 1977.

Three hundred of these employees were involved in the production processes of which approximately two-thirds were women. The union at this plant was Local #1754 of the International Brotherhood of Electrical Workers. However, this union only represented approximately 25 maintenance employees (NIOSH 1976). Since 1938 several thousand employees (3000-4000) have worked for Aerovox. The following table is an approximate breakdown of the working population by work area given by Brown (NIOSH) and Massachusetts Department of Labor and Industry (NIOSH 1976).

Table 1 Breakdown of working population in 1976 (NIOSH 1976):

Work Area	Number of workers	
	Mass. Dep. of Labor & Ind.	NIOSH
Pump room	12	3
Impregnation	18	14
Final testing		60
Maintenance		25
Winding paper and foil		15-20
Sub-assembly		40
Large (power) capacitors		15
Top making		?
Packing and shipping		?
Total	460	380

This breakdown did not include the total number of workers on all shifts. (Total work force in manufacturing was 300). The NIOSH estimate was in January of 1976. The Massachusetts Department of Labor and Industry's estimate was in December of 1976, and from their trip report the number of workers had increased to 460 employees, 18 of which are in the impregnation department and 12 in the fill-hole soldering department (Personal Communication).

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Capacitors of many sizes were made at this plant. Description of operations at Aerovox given in the NIOSH walk through survey is reproduced below (NIOSH 1976):



FIG. 18. Preparing capacitor sections for assembly.

1. First, bales of foil and paper were wound automatically. This machine automatically wound the exact amount of paper and foil needed for the specified capacitor. During this operation, connectors were automatically inserted into the bales of smaller capacitors.
2. On another floor the tops for the capacitors were assembled.
3. Next the connectors were welded to the terminals of the capacitor tops.

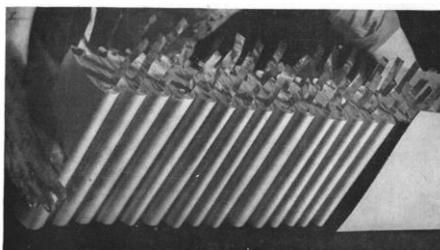


FIG. 19. Assembling capacitor sections in insulation barriers to produce a 15-kvar capacitor.

4. The assembled bale and capacitor top was then put into the capacitor can and unit crimped with a double seal. There was a small opening in the top for

impregnation.

5. Trays of capacitors were then placed into an impregnation chamber. The chamber was heated to approximately 150°C and brought under vacuum to remove all moisture from the capacitor.
6. Next, PCB was pumped into the heated chamber for impregnation of the capacitors. The capacitors were then put into trays and readied for impregnation. Impregnation was done in a separate room, which housed numerous chambers. The tray of capacitors was lowered into the chambers, which were evacuated and filled with hot PCBs. Once the capacitors were impregnated (several hours) they were removed and transported by pushcarts to the final assembly area. The longest impregnation cycle was 125 hours. There was a great deal of residual PCBs left on the shell of the capacitor, which could

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contaminate the cart. The residue PCB in the impregnation chamber was then pumped out of the chamber, filtered, and reused.

7. After impregnation, the trays of capacitors were put in the "hot room" or the fill-hole soldering department where the impregnation hole was sealed by hand (Personal Communication). The holes were soldered shut. The workers in this area handled the units which remained covered with the oil.
8. Once the capacitors were closed they were conveyed through a trichloroethylene degreaser to remove the excess oil.

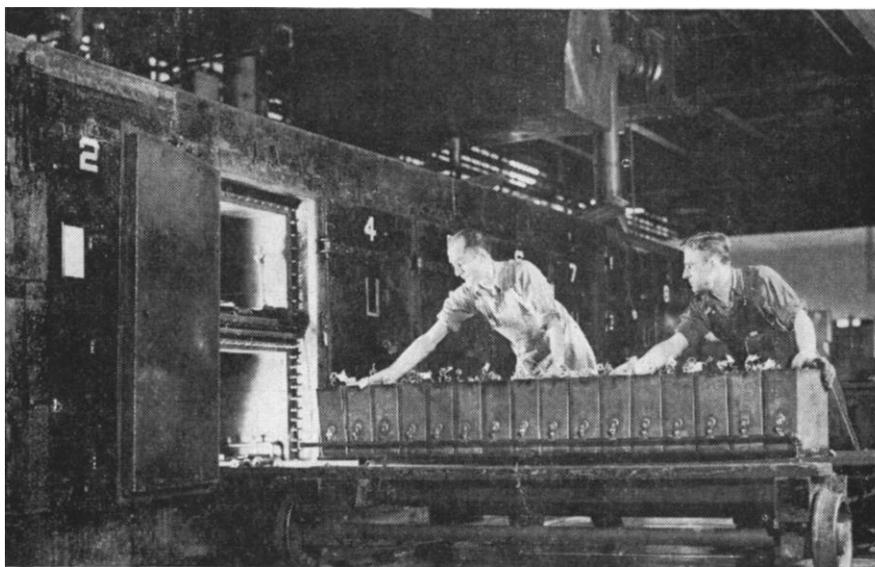


FIG. 22. Loading units for drying and impregnating.

9. Next, the capacitor was heated to find any leaks. The workers doing testing operations were all called testers, and this leak tester was not singled out with a separate job code.
10. If there were no leaks, the capacitor was tested for performance. During the heat test operation possible cracks were spotted, and each capacitor was inspected individually. In the final test the capacitor was tested for capacitance, and when they passed they were hand stamped in the past but later an ink jet machine was used (no dates). A portion of the capacitors was painted. Large units were hand sprayed and small units were only hand sprayed at the top.
11. Finally, the capacitors were packed for shipment.

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Some oils were received in 55 gallon drums but mainly the oil was transported by tankers to the plant. It is not known whether or not the way of transporting the PCB was determined by time or amount ordered. The oil was gravity-fed through pipes from the outside. They were fed into tanks at an ambient temperature but kept heated to reduce viscosity. The process oil was filtered with Fullers earth before filling the storage tank. A top filling procedure was used. The oil was pumped to the impregnation station. After impregnation the superfluous PCB oil was brought downstairs to used storage tanks for re-processing. When PCBs were used as the impregnation oil no stabilizers were added. Later when other oils were being used stabilizers were put in the mixing tank. Large power capacitors were also manufactured at this plant but in the later era were filled with mineral or castor oils rather than PCB (NIOSH 1976).

The Massachusetts Department of Labor and Industry conducted a survey at Aerovox in 1976, and described the impregnation process (step 6 above) in their report accordingly: “The impregnation room houses thirty tanks (approximately 200-gallon capacity) into which assembled capacitors are introduced. The tanks are locked, heated to about 150° F, and brought under vacuum to remove all moisture from the capacitors. Arochlor 1016 is then pumped into the tanks (26 contained Arochlor and 4 were filled with mineral oil at the time of this visit), and the impregnation process is carried on for 24 to 60 hours. At the end of this period, the Arochlor is pumped out, passed through a filtering system located in the basement of the plant and returned to storage until re-used. The impregnating tanks are then opened, unloaded, cleaned, and reloaded. The production cycle is arranged so that one or two impregnating tanks are opened on each shift (the department usually operates on three shifts).”(Personal Communication).

Other chemicals were also used during the capacitor manufacturing that could be a potential hazard. The chemical hazards observed during the NIOSH November 1977 survey were as follows (NIOSH 1977):

Table 2 Potential hazards observed during the NIOSH 1977 survey

Hazard	Location	N²
Polychlorinated biphenyls	Impregnation, final test, pump room, maintenance	104
Solder fumes	Soldering	10

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Trichloroethylene	Degreasers	5
Welding fumes ¹	Welding	
Spray painting ¹	Finishing	
Dust ¹	Winding	

-
- 1. Not recorded in the NIOSH trip report but possible chemical hazards as well.**
 - 2. # of workers exposed**

2.2 PCB composition over time

According to NIOSH trip report from 1975, the PCBs used was Monsanto's Aroclor 1016, but Aroclors 1254 and 1252 had also been used in the past. Even though Aroclor 1242 is not mentioned in this report, it is likely that Aerovox also used Aroclor 1242 for a period between the usage of 1254 and 1016 due to the fact that Aroclor 1242 was introduced to the capacitor manufacturing market around 1960 and preceded the use of Aroclor 1016. There are no definitive dates for when each of the Aroclors were used at Aerovox, or information on when the changes occurred. Mineral and castor oils were also used at the plant but mainly for large power capacitors.

From ATSDR's Public Health assessment of New Bedford, Mass it is stated:

"Both the Aerovox Corporation and CDE manufactured electrical components used PCBs in the production of capacitors. More specifically, Aroclor 1242 was predominantly used from 1947 to 1971 after which both companies used Aroclor 1016 until 1977 when usage of PCBs in the manufacturing process ceased entirely. Both companies also used Aroclors 1252 and 1254 in smaller quantities. ([EBASCO, 1989](#))"

2.3 Changes in the production process

The Aerovox corporation was split up in 1973 when many of the subdivisions were sold. AVX owned Aerovox during the PCB era and Belleville Industries bought the part known as Aerovox since 1973. PCB discontinued at Aerovox in 1978. Oil-impregnated high energy and high voltage capacitors were still manufactured after 1978 but the oil used was castor oil, a mineral oil. Another change at that time was that metalized polypropylene was used rather than paper.

2.4 Ventilation

From the NIOSH walk through survey it is only known that ventilation in the impregnation room was provided by nine 2 feet and 4 feet ceiling fans. In addition, 8 inch-exhaust trunk lines were provided to each of the thirty impregnation tanks (Personal Communication).

In addition to general ventilation, local exhaust ventilation was provided to six soldering stations in the fill-hole soldering department and to the open area of impregnation tanks (Personal Communication, NIOSH 1977).

2.5 Industrial Hygiene

The manager of industrial engineering was responsible for the safety and health program. Some safety equipment was supplied to the workers, however NIOSH observed very few people wearing gloves, aprons, or safety glasses; no one was wearing masks or respirators (NIOSH 1976). Ordinary street clothes were worn to work and no clothes washing facilities were available at the plant.

Only the maintenance workers were organized (n=25) in the International Brotherhood of Electrical Workers (IBEW). The remaining workers were not represented by a labor union (NIOSH 1976).

A local physician was retained part time and performed all physical examinations. Also, a nurse was on duty at the plant during the day shift. All employees were given pre-employment examinations, which include pulmonary function evaluation. At the time of the NIOSH survey in 1976, no periodic examinations were given but they had been given in the past (NIOSH 1976).

Previous to the NIOSH survey there had been no air samples taken of PCBs at the plant. However, air samples had been taken for trichloroethylene. Detector tubes were used to sample for trichloroethylene and it was reported that seldom were the samples in excess of 100 ppm (NIOSH 1976).

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Safety glasses, rubber clothing, and partial payment for safety shows were provided for the employees. Respirators were also provided if an employee must enter the “hot room”. The potential health hazards observed were exposure to PCBs and TCE (NIOSH 1976).

The Kemper Insurance Company and the State of Massachusetts have collected air samples for evaluating polychlorinated biphenyls exposures (NIOSH 1977). These results are given in chapter 4 Exposure measures.

2.6 Housekeeping

There were PCB oil spills throughout the plant because the 1976 NIOSH trip report reads: “Excess oil should be cleaned up with some form of absorbent material.” (NIOSH 1977)

2.7 Building and layout

A rough layout of the plant was made by Brown (see figure below). On the first floor, tops were prepared in an assembly-line fashion. Also on this floor, but separate from the top makers, were the PCB storage tanks, pumps, and some impregnation chambers.

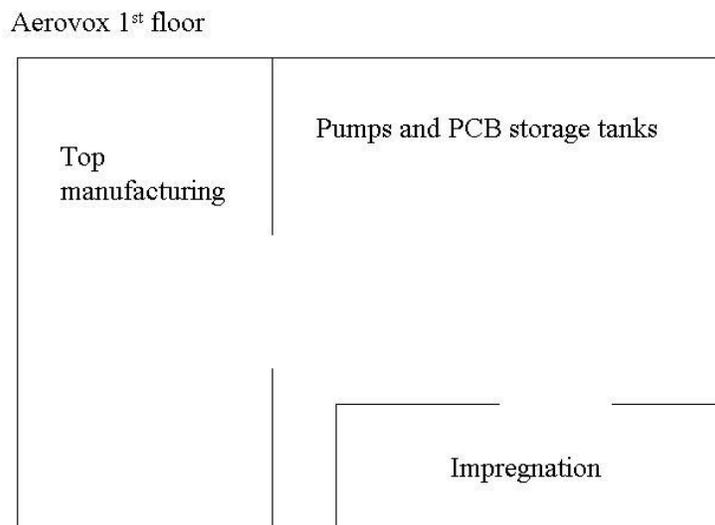


Figure 1 Aerovox 1st floor

The second floor houses sub-assembly impregnation and final assembly of the small capacitors.

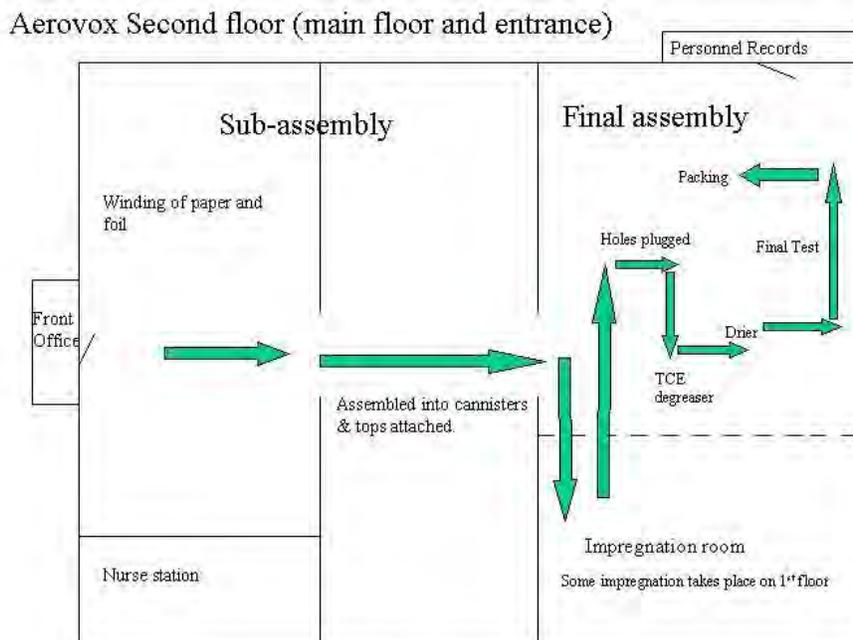


Figure 2 Aerovox 2nd floor

The large power capacitors are manufactured on the top floor with the exception of the impregnation operation. This work requires much more manual labor but only mineral or castor oils are used in these capacitors (NIOSH 1976).

2.8 Reference:

NIOSH trip report from a visit to Aerovox Industries in New Bedford, Massachusetts, January 6 1976 by Brown.

NIOSH Walk-through survey of Aerovox Industries, Inc. New Bedford, Massachusetts January 5 1976 (report date February 23 1976). Brown.

NIOSH Industrial hygiene survey of Aerovox Industries Inc. New Bedford, Massachusetts. Survey date March 21-23, 1977. Report by Jones et al. dated November 29, 1977.

Personal Communication Letter from the Commonwealth of Massachusetts Executive Office of Manpower Affairs Department of Labor and Industries, Division of Occupational Hygiene to Aerovox Industries dated December 17, 1976.

3 Background for use of PCB

Commercial production of PCBs in the USA began in 1929 at the Swan Chemical Company; in 1935 this company was purchased by Monsanto Industrial Chemicals Company. A series of chlorinated biphenyl mixtures were produced under the name of Aroclor. The initial production was mainly applied as dielectric fluids in transformers. After World War II, utilization in capacitors and open systems increased steadily, and somewhat later the use in heat-transfer systems began (Voogt and Brinkman 1989). More than 95% of all power capacitors contain PCBs. Among their applications were: use on electric utility lines, in air conditioners, and in the ballast of fluorescent lamp fixtures. PCBs were employed for safety, reliability, and long life, as well as to achieve size compatibility with equipment and installation requirements. However, non-PCB power capacitors were being manufactured (e.g., General Electric's Econol line and Sprague's Eccol line) which may serve as alternatives (Personal Communication 1975).

Beginning in 1971, Monsanto voluntarily restricted its domestic sales of PCBs to closed system dielectric applications in capacitors and transformers (Monsanto 1974). Current domestic applications of PCBs include use in investment casting processes, as heat exchange fluids, and as hydraulic fluids. Imports of PCBs have been estimated to exceed 375,000 pounds for 1974. Reclaimed PCBs also were reported to be available (Schweitzer 1975).

3.1 Chemical composition

Polychlorinated biphenyls (PCBs) describe a group, of synthetic chlorinated organic compounds having the following formula: $C_{12}H_{10-n}Cl_n$ with $n=1-10$.

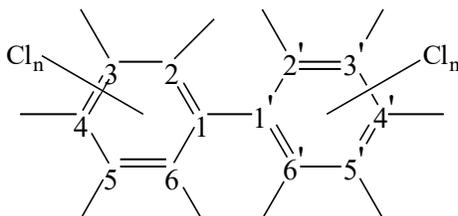


Figure 3 The chemical formula of PCB presented as $C_{12}H_{10-n}Cl_n$, where n , the number of chlorine atoms in the molecule can range from 1 to 10

3.2 Synthesis of PCB

PCBs are generally prepared industrially by chlorination of biphenyl with anhydrous chlorine in the presence of iron filings or a ferric chloride catalyst. Trace quantities of chlorinated naphthalenes and chlorinated dibenzofurans have been reported in some commercial samples of PCBs and it has been suggested that the presence of these impurities may be of toxicological significance (Hutzinger et al (1974), Bowes *et al.* 1975, Curley *et al.* 1975). Commercial PCBs are generally mixtures of many different chlorinated biphenyls, as shown in Table 2, manufactured to meet operational specifications (such as dielectric constant, flash point, fire point, density, percent chlorine, and color); these commercial mixtures may vary chemically from batch to batch.

3.3 Biphenylrings

Unlike dioxins or dibenzofuranes, the phenyl rings of a PCB are not constrained through ring fusions and have relatively unconstrained rotational freedom. Chlorines at the *ortho* (2,2',6,6') positions introduce constraints on rotational freedom that can hinder coplanarity of the phenyl rings. The preferred conformation for all PCBs, including those without *ortho*-substituents, is non-coplanar. PCBs without *ortho*-substitution are often referred to in the biological literature as the planar (or coplanar) PCBs and all others as the nonplanar (or noncoplanar) PCBs. There are 209 different chlorinated biphenyls and they are collectively referred to as PCBs although many are not actually polychlorinated. Approximately half of these compounds have been synthesized and characterized.

3.4 Physical and chemical properties

Mixtures of polychlorinated biphenyls are very resistant to degradation, are thermally stable, and resistant to oxidation, acids, bases, and other chemical agents. They are soluble in most of the common organic solvents and lipids, but only slightly soluble in water, glycerol, and glycols. PCBs are good electrical insulators. Although most individual polychlorinated biphenyls are solids at room temperatures, the mixtures vary in consistency from mobile oils to viscous liquids or sticky resins.

Vapor pressures calculated from the product of solubility (mol/m^3) and HLC ($\text{atm}\cdot\text{m}^3/\text{mol}$) data, generally decreased with relative molecular mass and increased with increasing degree of *ortho*-chlorine substitution.

Table 3 Physical and chemical properties of a number of Aroclors

Aroclor	Vapor pressure	Density	Appearance	Bp. 1atm °C
1016	4.0*10 ⁻⁴	1.33	Clear, mobile oil	325-356
1242	4.1*10 ⁻³	1.35	Clear, mobile oil	325-366
1254	7.7*10 ⁻⁵	1.50	Light yellow viscous oil	365-390

The PCBs are chlorinated hydrocarbons, manufactured commercially by the progressive chlorination of biphenyl in the presence of a suitable catalyst (e.g., iron chloride). Depending on the reaction conditions, the degree of chlorination can vary between 21 and 68% (w/w). Only about 130 of the 209 congeners are likely to occur in commercial products or mixtures of such compounds (Safe 1990).

Commercial PCBs are generally mixtures of many different chlorinated biphenyls, manufactured to meet operational specifications (such as dielectric constant, flash point, fire point, density, percent chlorine, and color); these commercial mixtures may vary chemically from batch to batch.

3.4.1 Conversion factors

Aroclor 1016 1 mg/m³ = 0.095 ppm

Aroclor 1242 1 mg/m³ = 0.092 ppm

Aroclor 1254 1 mg/m³ = 0.075 ppm

Conversion factors from Toxicological Profile 2000

3.4.2 Decomposition of PCB

Individual pure PCB congeners are colorless, often crystalline compounds, but commercial PCBs are mixtures of these congeners with a clear (Aroclor 1242 and 1016) or yellow (Aroclor 1254) color. They form vapors heavier than air, but do not form any explosive mixtures with air. They possess very low electrical conductivity and an extremely high resistance to thermal breakdown, and it is on the basis of these properties that they are used as cooling liquids in electrical equipment. According to laboratory tests, they stay chemically unchanged, even at high temperatures (up to 170 °C).

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

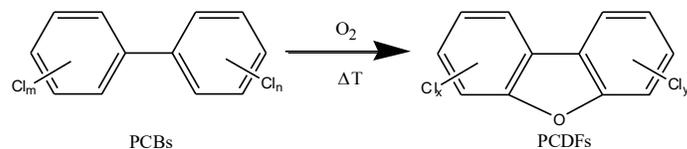


Figure 4 The PCB isomers can be transformed to PCDFs via intramolecular cyclizations.

PCBs are known for their chemical stability. Brown et al. (1988) found that the electrical use of PCB dielectric fluids in capacitors did not increase the PCDFs content significantly.

In commercially prepared PCB mixtures, the weight-percent of chlorine has varied from 21 to 68%. In some preparations, there has also been some degree of contamination by chlorodibenzofurans (Hutzinger et al. 1974, Brown and Jones 1981). The primary use of PCBs has been as a liquid insulating material in electrical capacitors and transformers, therefore, the greatest potential for occupational exposure has been in the manufacture and repair of these components.

PCBs have found wide use in industry and have been manufactured in the United States since 1929. The major domestic manufacturer (the sole U.S. producer of PCBs (Kimbrough 1995)), Monsanto Chemical Company, produced PCBs at Sauget, Illinois, and Anniston, Alabama. They reported to have manufactured 40 million pounds of PCBs in the United States during 1974 (down from 85 million pounds in 1970). Monsanto voluntarily stopped open-ended uses of PCBs in 1971. Subsequently, the lower chlorinated biphenyls, Aroclor 1016, 1242, and some 1254 were produced. Prior to 1971, other more highly chlorinated biphenyl mixtures such as Aroclor 1248, 1254, and 1260 were also marketed. In 1977 Monsanto Chemical Company ceased production of PCBs entirely (Kimbrough 1995). Monsanto's domestic production and sales of PCBs by grade and category from 1957 through the first quarter of 1975 are shown in Table 3 (Monsanto 1975).

Since 1971, PCBs were sold in the United States only for use in closed systems. According to the Toxic Substances Control Act of 1976, rules and regulations were promulgated to limit the manufacture and use of PCBs. This Act stipulated that all U.S. production of PCBs end January 1, 1979, and that all U.S. sale and distribution of PCBs end July 1, 1979 (Brown and Jones 1981).

Table 4 PCB Manufacture and Sales Monsanto Industrial Chemicals Company 1957 Through 1964(Thousands of Pounds) U.S. Export Sales figures unavailable during year indicated. Source: Monsanto Industrial Chemicals Company, St. Louis, Missouri, September, 1975.

	1957	1958	1959	1960	1961	1962	1963	1964
U.S. Production				37919	36515	38353	44734	50833
Domestic Sales	32299	26061	31310	35214	37538	38043	38132	44869
Domestic Sales by Category								
Transformer	12955	5719	5984	7921	6281	7984	7290	7997
Capacitor	17028	14099	16499	16967	15935	15382	15606	19540
Domestic Sales by PCB Grade								
Aroclor 1221	23	16	254	103	94	140	361	596
Aroclor 1232	196	113	240	155	241	224	13	13
Aroclor 1242	18222	10444	13598	18196	19827	20654	18510	23571
Aroclor 1248	1779	2559	3384	2827	4023	3463	5013	5238
Aroclor 1254	4461	6691	6754	6088	6294	6325	5911	6280
Aroclor 1260	7587	5982	6619	7330	6540	6595	7626	8535
Aroclor 1262	31	184	359	326	361	432	414	446
Aroclor 1268	--	72	102	189	158	210	284	190
Aroclor 1016	--	--	--	--	--	--	--	--

Table 5 PCB Manufacture and Sales Monsanto Industrial Chemicals Company 1965 Through 1970 (Thousands of Pounds)

	1965	1966	1967	1968	1969	1970
U.S. Production	60480	65849	75309	82854	76389	85054
Domestic Sales	51796	59078	62466	65116	67194	73061
Domestic Sales by Category						
Transformer	8657	8910	11071	11585	12105	13828
Capacitor	23749	28884	29703	29550	25022	26708
Domestic Sales by PCB Grade						
Aroclor 1221	369	528	442	136	507	1476
Aroclor 1232	7	16	25	90	273	260
Aroclor 1242	31533	39557	43055	44853	45491	48588
Aroclor 1248	5565	5015	4704	4894	5650	4073
Aroclor 1254	7737	7035	6696	8891	9822	12421
Aroclor 1260	5831	5875	6417	5252	4439	4890
Aroclor 1262	558	768	840	720	712	1023
Aroclor 1268	196	284	287	280	300	330
Aroclor 1016	0	0	0	0	0	0

Table 6 PCB Manufacture and Sales Monsanto Industrial Chemicals Company 1971 Through 1975 (Thousands of Pounds)

	1971	1972	1973	1974	(1 st quarter) 1975
U.S. Production	34994	38600	42178	40466	8532
Domestic Sales	34301	26408	37742	34406	7986
Domestic Sales by Category					
Transformer	11134	>25656	37742	34406	7986
Capacitor	14141				

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

Domestic Sales by PCB Grade					
Aroclor 1221	2215	171	35	57	10*
Aroclor 1232	171	0	0	0	0
Aroclor 1242	21981	728	6200	6207	2201**
Aroclor 1248	213	807	0	0	0
Aroclor 1254	4661	3495	7979	6185	2115**
Aroclor 1260	1725	305	0	0	0
Aroclor 1262	1	0	0	0	0
Aroclor 1268	0	0	0	0	0
Aroclor 1016	3334	20902	23531	21955	3660*

* Used Primarily in capacitors

** Used Primarily in transformers but were also still used in capacitors

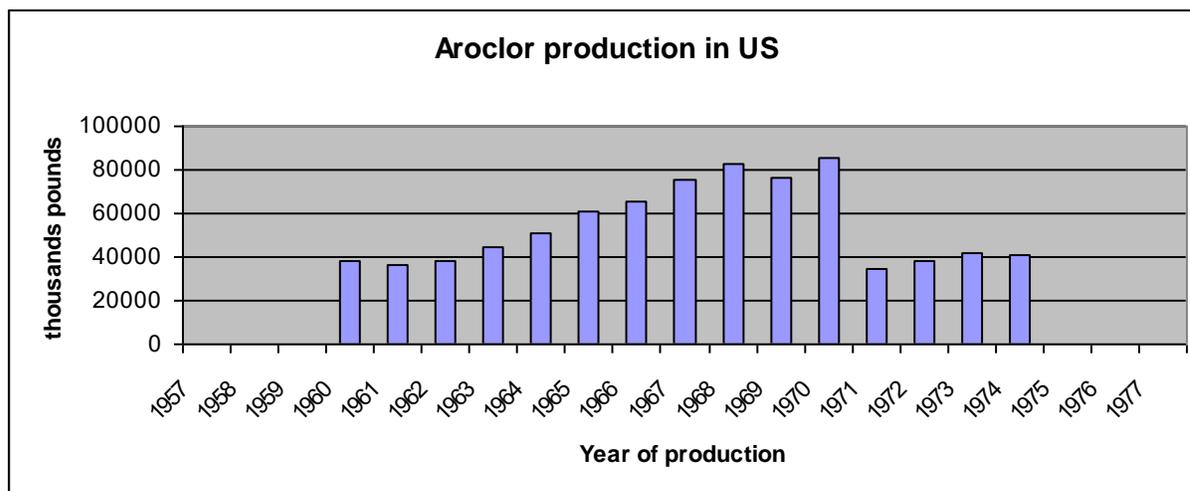


Figure 5 Aroclor production in the US. Production data before 1960 not available.

Table 7 de Voogt and Brinkman (1989) number for U.S. sales (in 10⁶ lbs of PCBs) by Aroclor grade and use category.

Year	AROCLOR						Use Category	
	1016	1242	1248	1254	1260	Others	Closed systems	Other uses
1957	0	18.2	1.8	4.5	7.6	0.3	30.0	2.3
1958	0	10.4	2.6	6.7	6.0	0.4	19.8	6.2
1959	0	13.6	3.4	6.8	6.6	1.0	22.4	8.9
1960	0	18.2	2.8	6.1	7.3	0.8	24.9	10.3
1961	0	19.8	4.0	6.3	6.5	0.9	22.2	15.3
1962	0	20.7	3.5	6.3	6.6	1.0	23.3	14.7
1963	0	18.5	5.0	5.9	7.6	1.1	22.9	15.2

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

1964	0	23.6	5.2	6.3	8.5	1.2	27.5	17.4
1965	0	31.5	5.6	7.7	5.8	1.1	32.4	19.4
1966	0	39.6	5.0	7.0	5.9	1.6	37.8	21.3
1967	0	43.1	4.7	6.7	6.4	1.6	40.8	21.7
1968	0	44.9	4.9	8.9	5.3	1.2	41.1	24.0
1969	0	45.5	5.7	9.8	4.4	1.8	37.1	30.1
1970	0	48.6	4.1	12.4	4.9	3.1	40.5	32.6
1971	3.3	22.0	0.2	4.7	1.7	2.4	25.2	9.1
1972	20.9	0.7	0.8	3.5	0.3	0.2	25.7	0.7
1973	23.5	6.2	0	8.0	0	<0.1	37.7	0
1974	22.0	6.2	0	6.2	0	<0.1	34.4	0
1975	14.6	8.8	0	8.5	0	<0.1	31.9	0

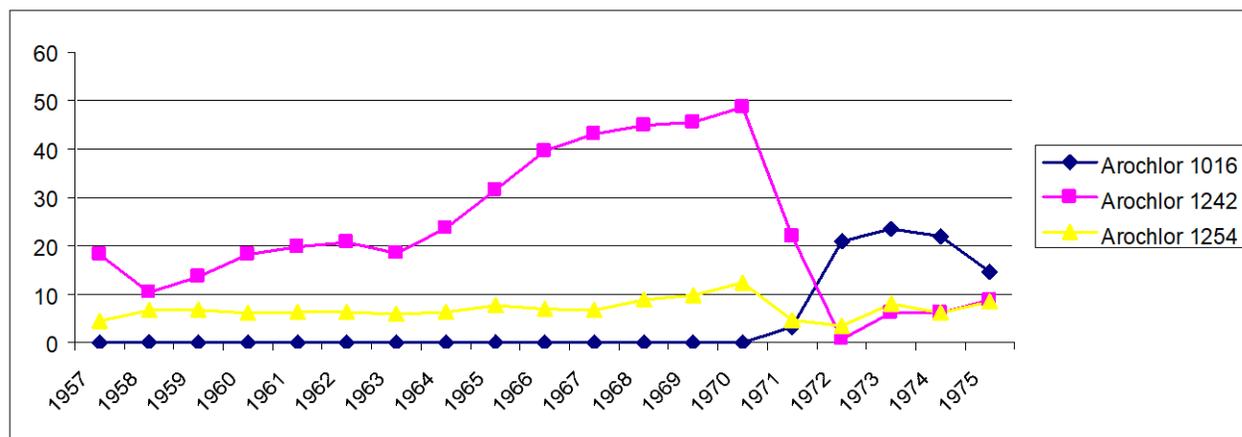


Figure 6 Overview of Aroclors used over time

3.5 Impurities with synthesis

Trace quantities of chlorinated naphthalenes and chlorinated dibenzofurans have been reported in some commercial samples of PCBs and it has been suggested that the presence of these impurities may be of toxicological significance (Hutzinger et al. 1974, Bowes et al. 1975, Curley et al. 1975). In the commercial mixtures of PCBs produced by Monsanto Chemical Company, polychlorinated dibenzofurans (PCDFs) only occurred in trace amounts or were not detected at all (Kimbrough 1995).

3.6 Additives

It is not known if additives were used in PCBs at Aerovox.

3.7 Commercial use of PCB

Mixtures of polychlorinated biphenyls are important industrial products. The most common trade names for these mixtures are Aroclor, Inerteen, Kanechlor, and Pyranol. See table below. Production of PCBs in the U.S. began in 1929 and 85 million pounds were produced under the trade name Aroclor in 1970. Since 1970 production has decreased considerably; in 1976, annual production was around 40 million pounds (Jones et al. 1986). PCB production in the US ended in 1977. Monsanto was the sole producer of PCB in the United States during this time (de Voogt and Brinkman 1989).

PCBs are employed in capacitors and transformers because they combine: dielectric properties with chemical stability and fire resistance. Approximately twice as many pounds of PCBs are used in the manufacture of capacitors as in the manufacture of transformers. PCB-containing dielectrics (electrical insulators) are generally referred to as "askarels" in the electrical industry.

Table 8 Trade names for Known PCB Containing Products.

Trade name	Trade name Owner
Aroclor	Monsanto Company St. Louis, MO
Chlorextol	Allis-Chalmers Milwaukee, WI
Clophen	Farbenfabricken Bayer GmbH Germany
Dykanol	Federal Pacific Electric Co. Newark, NJ
Fenclor	Caffaro S.P.A. Italy
Inerteen	Westinghouse Electric Corp. Pittsburgh, PA
Kanechlor	Kanegafuchi Chemical Industry Co., Ltd. Japan
Noflamol	Wagner Electric Corporation Newark, NJ
Phenoclor	Prodelec France
Pyralene	Prodelec France
Pyranol	General Electric Co. Schenectady, NY
Santotherm	Mitsubishi-Monsanto Japan
Therminol*	Monsanto Co. St. Louis, MO

PCBs are employed in transformers at locations where their proximity to people and/or property demand a fire resistant dielectric. Approximately 5% of transformers are PCB filled and each of the transformers so filled contains between 40 and 500 gallons of PCBs (about 235 gallons is average). Possible alternatives to PCB filled transformers may include dry transformers (which are larger) as well as transformers filled with silicone fluids or other materials under evaluation (Dow Corning Company 1975).¹

¹ Dow Corning Dielectric Liquids for Power Transformers, Dow Corning Corporation, Midland, Michigan, received September, 1975 (booklet not dated).

3.8 PCB in Aroclor

3.8.1 Naming

The industrial trade name Aroclor is accompanied with four digits. The two first digits number 12 in Aroclor are the numbers of carbon atoms that makes up the biphenyls. The two last digits are the amount of chlorine by weight percent. Aroclor 1254 contains approximately 54% chlorine by weight (second 2 digits). This holds true for most of the Aroclors except for 1016, which is a distillate from Aroclor 1242, both containing ca. 42% chlorine w/w.

3.8.2 Composition

Table 9 The average molecular composition (wt% chlorine) of some Aroclors

n^1	Aroclor						
	1221	1232	1016	1242	1248	1254	1260
0	10						
1	50	26	2	1			
2	35	29	19	13	1		
3	4	24	57	45	21	1	
4	1	15	22	31	49	15	
5				10	27	53	12
6					2	26	42
7						4	38
8							7
9							1

n in $C_{12}H_{10-n}Cl_n$

Table 10 Approximate chlorine content of Aroclor Mixtures.

Aroclor® 1221*	Aroclor 1242*	Aroclor 1016	Aroclor 1254*	Aroclor 1260†
21%	42%	41-42%	54%	60%

Table 2 Notes: a particular product may vary in chemical composition from batch to batch.

* Weight-weight percent.

† Percent. Source of component compositions, A., PCB Newsletter, No. 3, July 1971, quoted in Hutzinger, O. et al. op. cit., p. 23

Table 11 The chemical composition of the different Aroclors

PCB Congeners	Mol. % in		
	1254	1242	1016
BP		0.01	0.50
2		0.68	0.80
3		0.04	0.10

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

4		0.22	1.00
2,6		0.13	0.20
2,2'		3.99	4.36
2,5		0.31	0.34
2,4		1.04	1.16
2,3'	0.07	1.24	1.37
2,4'	-	8.97	10.30
3,5		0.35	0.37
3,4		0.09	0.11
3,4'		0.12	0.12
4,4'		0.99	1.07
2,6,2		0.97	1.08
2,5,2'	0.07	9.36	10.87
2,4,2'	-	2.92	3.14
2,3,2'	-	3.25	3.50
2,6,3'		0.54	0.58
2,6,4'	-	2.15	2.31
2,5,3'	-	0.55	0.62
2,5,4'	0.72	4.53	4.72
2,4,3'		1.68	1.79
2,4,4'	-	13.30	14.48
2,3,3'		3.64	3.99
2,3,4'	Trace	2.64	2.80
3,4,2'		2.83	3.08
3,4,3'		0.66	0.38
3,4,4'	0.20	1.62	1.89
3,5,4'		1.03	1.08
2,6,2',6'		0.17	0.19
2,3,6,2'	0.15	0.90	1.00
2,5,2',6'	0.13	0.97	1.07
2,5,2',5' (BZ 52)	4.36	4.08	4.35
2,5,2',4'	1.63		
2,4,6,4'		2.18	2.40
2,3,4,3'	0.43		
2,3,5,2'		0.44	0.47
2,3,2',6'		0.31	0.33
2,4,5,2'		1.33	1.41
2,4,2',5' (BZ 49)		3.28	3.48
2,3,2',5' (BZ 44)		1.06	1.14
2,3,4,2'		1.67	2.00
2,3,2',3'	0.26	0.15	0.18

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

2,3,3',4'	0.18	0.60	-
2,4,2',4'	0.52	1.65	1.81
2,4,2',3'	2.18		
2,4,5,4' (BZ 74)	0.30	2.02	1.35
2,5,3',4'	4.75	1.11	-
2,6,3',4'	-		
3,4,5,2'	0.18	Trace	-
3,4,5,3'		0.52	-
3,4,5,4'		0.28	-
3,4,3',4' (BZ 77)	0.12	0.34	-
2,5,3',5'	1.01	0.33	-
2,4,3',4'	2.24	0.81	0.14
3,4,3',5'	0.23	0.24	-
3,5,3',5'	Trace		
2,3,4,4'		0.21	-
2,4,5,2',3'	2.59		
2,4,6,3',5'	3.51	0.92	-
2,4,6,2',5'	0.29		
2,4,6,2',3'		0.13	0.04
2,3,6,2',5'		0.53	0.18
2,3,6,3',5'	Trace	0.39	0.01
2,3,6,2',4'	5.00	Trace	-
2,3,6,2',3'	1.72	0.38	0.01
2,3,4,3',5'		0.46	0.16
2,3,4,2',4'	2.15	0.40	-
2,3,4,2',5'	3.81	0.09	-
2,3,4,3',4' (BZ 105)	Trace	0.25	-
2,3,4,5,3'	0.40		
2,3,4,5,4'	0.25		
2,3,5,2',3'	0.32		
2,3,5,2',5'	0.63	0.12	-
2,3,6,3',4'	8.51		
2,4,5,2',4' (BZ 99)	6.10	0.55	-
2,4,5,2',5' (BZ 101)	6.98	0.27	-
2,4,5,2',6'	Trace		
2,4,5,3',4' (BZ 118)	8.09		
2,4,5,3',5'	0.15	0.31	-
3,4,5,2',3'	0.76		
3,4,5,2',4'		0.36	-
3,4,5,3',5'		0.05	-
3,4,5,3',4'	0.16	0.03	-

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

2,3,4,2',3',4' (BZ 128)	1.31		
2,3,4,5,2',6'		0.07	-
2,3,4,6,3',4'	0.46		
2,3,4,2',3',6'	2.00		
2,3,4,2',4',5' (BZ 138)	4.17	0.08	-
2,3,4,6,2',3'	0.14		
2,3,5,2',3',5'	0.03		
2,3,5,2',3',6'	0.20		
2,3,5,6,2',5'	0.33		
2,3,5,6,2',3'	0.38		
2,3,5,6,3',4'	-		
2,3,6,2',3',6'	0.34		
2,4,5,2',4',5' (BZ 153)	3.32	0.02	-
2,4,5,2',4',6'	-		
2,4,5,2',3',5'	0.75		
2,4,5,2',3',6'	3.59		
2,4,6,3',4',5'	4.23		
2,3,4,6,2',3',6'	Trace		
2,3,5,2',4',6'	Trace		
2,3,4,5,2',4',5' (BZ 180)	0.76		
2,3,4,5,6,2',4'	0.28		
2,3,4,5,6,2',6'	Trace		
2,3,5,6,2',3',6'	0.56		
2,3,4,6,2',4',5'	1.16		
2,3,4,5,6,2',5'	1.11		
2,3,4,6,2',3',4'	0.30		
2,3,5,6,2',4',5' (BZ 187)	0.48		
2,3,5,6,2',4',6'	0.07		
2,3,5,6,2',3',5',6'	Trace		
Unknown	0.31		
Monochloro (%)	0	0.94	2.40
Dichloro (%)	0.07	17.23	19.40
Trichloro (%)	1.02	51.67	56.31
Tetrachloro (%)	19.22	24.65	21.32
Pentachloro (%)	52.94	5.24	0.40
Hexachloro (%)	21.88	0.17	-
Heptachloro (%)	4.86		

3.8.3 Impurities in Aroclors

PCDFs have been found as contaminants in virtually all commercial PCB mixtures, both North American and European. However, there has been very little effort to determine if these levels increase during the operation of PCB-filled electrical equipment and, if they do, what factors are responsible. Table below shows an overview of PCDFs found in Aroclor (Hutzinger et al 1985).

PCB	PCDF s, ppm			
	Cl ₄	Cl ₅	Cl ₆	Total
Aroclor 1248 (1969)	0.5	1.2	0.3	2.0
Aroclor 1254 (1969)	0.1	0.2	1.4	1.7
Aroclor 1254 (1970)	0.2	0.4	0.9	1.5
Aroclor 1260 (1959)	0.1	0.4	0.5	1.0
Aroclor 1260 (lot AK3)	0.2	0.3	0.3	0.8
Aroclor 1016 (1972)	ND	ND	ND	-

Table 12 Impurities in Aroclors

3.8.4 Stabilizers

It is not known whether Aerovox used these or other stabilizers, or none.

3.8.5 Aroclor 1242 / Aroclor 1016

3.8.5.1 Impurities

Aroclor 1242 contained less than 0.05 mol % chloronaphthalenes, while Aroclor 1016 contained less than 0.06 mol.% of these compounds. Aroclor 1242 had approximately 150 ppb of chlorinated dibenzofuranes, of which 43% was the toxic 2,3,7,8-tetrachloro isomer. In the Albro and Parker paper (1979) they compare the American PCB mixture Aroclor 1242 with its more modern replacement, Aroclor 1016, in terms of their PCB, chlorinated naphthalene and chlorinated dibenzofurane compositions.

Chlorinated dibenzofuranes were detected in Aroclor 1242; 2,3,6-trichloro- (47 ng/g), 1,3,6,7-tetrachloro (7 ng/g), 2,3,7,8-tetrachloro (64 ng/g), 2,3,4,7,8-pentachloro (28 ng/g), and 1,2,3,6,7,8-hexachlorodibenzofurans (<3 ng/g). These compounds were not seen in Aroclor 1016. This Albro and Parker study indicates the presence of two presumably toxic PCB isomers; 3,4,3',4'-tetrachlorobiphenyl and 2,3,4,3',4'-pentachlorobiphenyl, and of a series of chlorinated dibenzofuranes including the extremely toxic 2,3,7,8-tetrachloro isomer in Aroclor 1242 but absent or in greatly reduced concentrations in Aroclor 1016 (Albro and Parker 1979).

Aroclor 1242 and 1016 differ from Aroclor 1248, 1254, and 1260 in the higher chlorinated PCB isomers. The three latter have higher concentrations of higher chlorinated PCBs. Aroclors 1242 and 1016 have similar PCB compositions up to tetrachloro isomers. Aroclor 1016 lacks the more polar tetrachloro, most of the pentachloro, and essentially all of the hexachloro isomers present in Aroclor 1242. Nothing can be said at this point about the possible effects of lot-to-lot variations on these analytical results.

3.9 Reference:

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4 Exposure measures

4.1.1 Introduction

Three exposure measurement surveys by three different investigators were performed at Aerovox from August 1976 to May 1977. Kemper insurance agency measured Aroclor 1016 in air in August 25, 1976. The Commonwealth of Massachusetts evaluated the potential health hazard from Aroclor 1016 based on their air measurements survey in December 2, 1976. NIOSH collected air samples in the plant in May 1977 for evaluating exposure to polychlorinated biphenyls (Aroclor 1016), trichloroethylene, lead, tin and zinc (NIOSH, 1977).

4.2 Air

NIOSH and Kemper Insurance Company sampled both personal and area air samples throughout the facility. The Commonwealth of Massachusetts sampled in eth impregnation room, fill-hole soldering department, and assembly area.

4.2.1 Measurement methods

Sipin SP1 pumps were used to collect the air samples in tubes containing Florisil which is a magnesium silicate adsorbent. The tubes have a 100 mg primary section and a 50 mg backup section. Samples were collected from two to seven hours at a flow rate of approximately 200 cc/min. The PCBs were desorbed from the Florisil with benzene and analyzed by using a gas chromatograph with an electron capture detector. (NIOSH, 1977)

Several PCB sampling methods have been developed over the years. Impingers were used frequently before being replaced by the Florisil method. NIOSH performed a comparison of two sampling methods for PCB: impingers and Florisil. There were seven locations that were sampled: Final test, leak test, impregnation, winding, pump room, assembly, and heat soak. The results were paired and the concentrations of the area air samples collected at Aerovox Industries, New Bedford, Massachusetts on May 12, 1976 are given in the table below (Jones, 1976):

Table 13 Area air concentrations collected at Aerovox Industries, New Bedford, Massachusetts on May 12, 1976 with two methods; impinger and Florisil (Jones, 1976)

Location	Concentration µg/L Impinger	Concentration µg/L Florisil
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Final test	0.95	0.51
Final test	0.03	-
Final test	0.72	0.58
Leak test	0.94	0.76
Leak test	0.53	1.13
Leak test	0.02	-
Impregnation	0.55	0.43
Impregnation	0.56	0.81
Impregnation	0.03	-
Impregnation	1.16	0.84
Impregnation	0.49	0.55
Impregnation	0.58	0.74
Winding	0.16	0.12
Winding	0.24	0.14
Pump room	0.60	0.65
Pump room	0.62	0.81
Pump room	2.67	0.86
Pump room	0.67	0.71
Assembly	0.57	0.55
Assembly	0.37	0.42
Assembly	0.67	0.64
Assembly	0.16	0.21
Heat soak	1.78	1.15
Heat soak	0.44	1.49

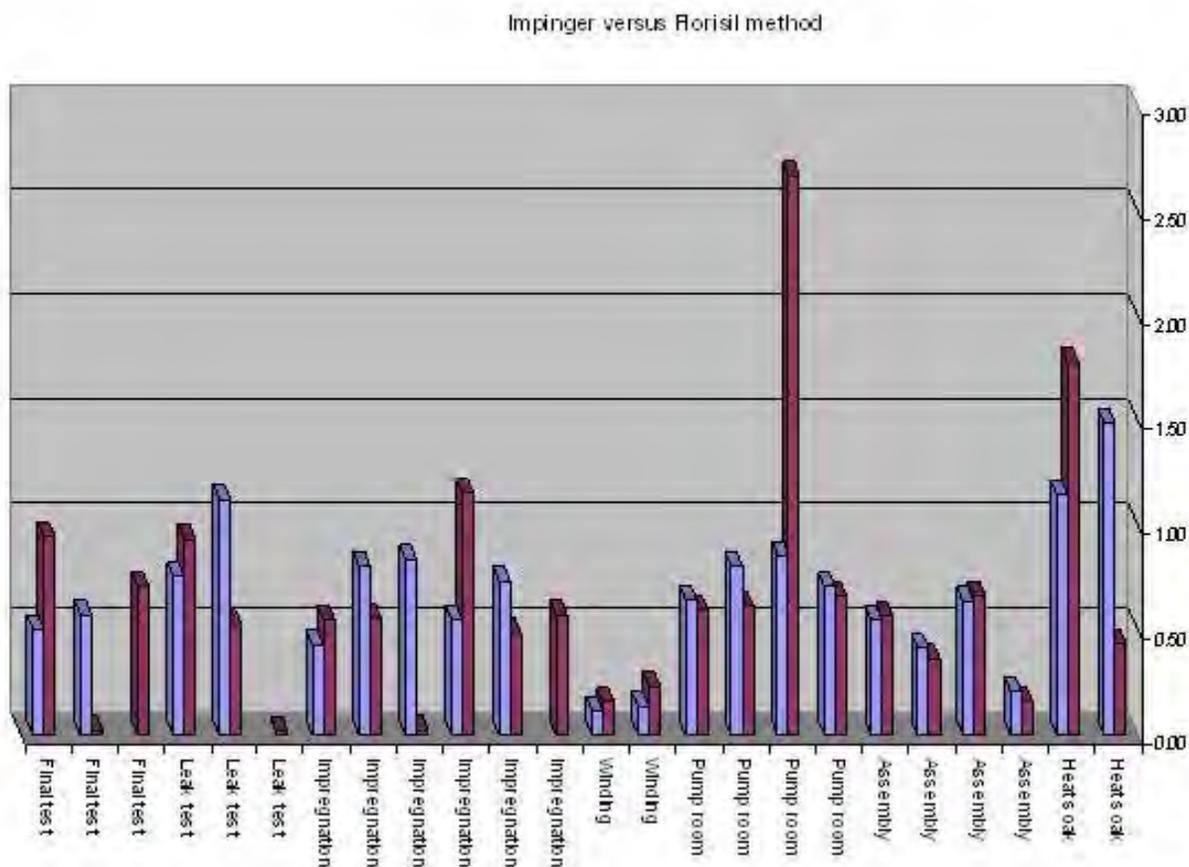


Figure 7 Overview of side-by-side measurements taken with Florisil (blue) and Impinger (red) in the same seven locations at the Aerovox plant

Jones concluded: “The results of the sampling data indicate that the Florisil tube correlates with the impinger and therefore will be used in the future sample for polychlorinated biphenyl.” (Jones, 1976).

4.3 Correlation

Two sampling methods for measuring concentrations of polychlorinated biphenyl, impinger and Florisil, were compared using air samples collected on May 12, 1976. (Jones, 1976) A total of 21 paired concentrations ($\mu\text{g/l}$) were observed at seven different locations: final test ($n = 2$), leak test ($n = 2$), impregnation ($n = 5$), winding ($n = 2$), pump room ($n = 4$), assembly ($n = 4$), and heat soak ($n = 2$). Impingers at three locations were connected in series and the resulting concentrations summed. Problems were noted with nine of the paired concentrations: Sipin pump did not operate properly ($n = 4$); MSA

Model G pump did not operate properly (n = 3); impinger solution dropped below bubbler (n = 2). These concentrations were omitted from analysis. Florisil concentrations ranged from 0.12 to 0.76 µg/l (median 0.57 µg/l) and impinger concentrations ranged from 0.16 to 0.98 µg/l (median 0.59 µg/l). A scatterplot of impinger concentration versus Florisil concentration appears in Figure 8 for valid paired concentrations.

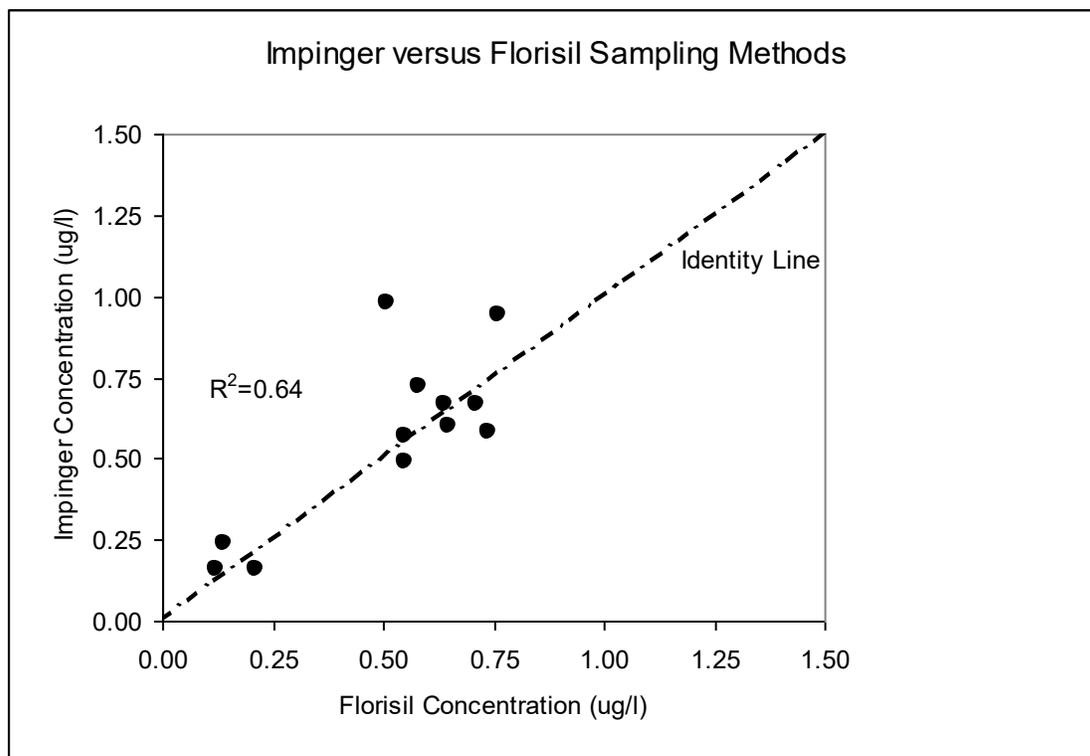


Figure 8 Correlation between impinger versus Florisil sampling methods

Points at lower concentrations tend to lie close to the identity line, while there is more variability at higher concentrations. Most of the problem samples occurred at higher concentrations. Overall, the Pearson correlation between the two sampling methods is $r = 0.42$ (n = 21, p-value = 0.0603); however, excluding paired samples with noted sampling problems resulted in a correlation coefficient of $r = 0.80$ (n = 12, p-value = 0.0018). (Hein, 2002)

4.3.1 Measurements in the plant

As mention earlier there were three surveys performed at Aerovox in 1976-77 by three independent investigators. The three investigators; Kemper insurance company, the Commonwealth of Massachusetts,

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and NIOSH, all had different purposes and hence different strategies for their PCB surveys. The table below shows all measurements obtained from the three investigators.

Table 14 Kemper, the Commonwealth of Massachusetts, and NIOSH survey results

		Kemper mg/m3	Comm.Mass mg/m3	NIOSH mg/m3	Personal	Area air	Comments
1	Soldering operation	0.46			x		1 h
2	Soldering operation	0.33			x		1 h
3	Moveman-soldering			1.01	x		265min, 33.2L
4	Moveman-soldering			0.42	x		384 min, 71.3 L
5	Moveman-soldering			1.11	x		103 min, 22 L
6	Solder			1.05	x		384 min, 76.2 L
7	Solder			0.98	x		105 min, 23.6 L
8	Solder			1.09	x		395 min, 74.5 L
9	Heat Soak			0.50	x		387 min, 81.1 L
10	Heat Soak			0.87	x		86 min, 16.4 L
11	Heat Soak			0.71	x		399 min, 83.1 L
12	Loading baskets	0.26			x		1 h
13	Tanker			0.56	x		385 min, 66.8 L
14	Tanker			0.80	x		93 min, 6.3 L
15	Tanker			1.26	x		384 min, 72.9 L
16	Tanker			0.51	x		87 min, 17.6 L
17	Tanker			1.01	x		385 min, 77.5 L
18	Tanker			0.54	x		262 min, 35.5 L
19	Tanker			0.78	x		287 min, 56.7 L
20	Tanker			0.94	x		93 min, 15.8 L
21	Tanker			0.97	x		144 min, 14.3 L
22	Tank room worker	0.76			x		1h 47min
23	Tank room worker	0.67			x		1h 47min
24	Impregnation room		0.60		x		3 L/min, 105 min
25	Impregnation room		0.82		x		3 L/min, 85 min
26	Impregnation room		0.50			x	1.5 L/min, 81 min
27	Impregnation room		0.36			x	1.3 L/min, 65 min
28	Impregnation room			0.55		x	Impinger
29	Impregnation room			0.81		x	Florisil
30	Impregnation room			0.59		x	Impinger
31	Impregnation room			0.84		x	Florisil
32	Impregnation room			1.16		x	Impinger
33	Impregnation room			0.55		x	Florisil
34	Impregnation room			0.49		x	Impinger
35	Impregnation room			0.74		x	Florisil
36	Impregnation room			0.58		x	Impinger
37	Impregnation room			1.01		x	85 min, 17.3 L
38	Impregnation room			0.61		x	91 min, 21 L
39	Fill-hole soldering		0.40		x		3 L/min, 64 min
40	Fill-hole soldering		0.41		x		3 L/min, 72 min
41	Fill-hole soldering		0.27			x	1 L/min, 59 min
42	Fill-hole soldering		0.52		x		3 L/min, 60 min
43	Fill-hole soldering		0.74		x		3 L/min, 53 min
44	Heat soak / fill hole			1.15		x	Florisil
45	Heat soak / fill hole			1.78		x	Impinger
46	Heat soak / fill hole			1.49		x	Florisil
47	Heat soak / fill hole			0.44		x	Impinger
48	Assembly office		0.10			x	3 L/min, 71 min
49	Assembly area			0.55		x	Florisil

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50	Assembly area		0.57		x	Impinger
51	Assembly area		0.42		x	Florisil
52	Assembly area		0.37		x	Impinger
53	Assembly area		0.64		x	Florisil
54	Assembly area		0.67		x	Impinger
55	Assembly area		0.21		x	Florisil
56	Assembly area		0.16		x	Impinger
57	Assembly area	0.30			x	3 L/min, 140 min
58	Pre-Assembly		0.04		x	379 min, 60.9 L
59	Pre-Assembly		0.22		x	80 min, 16.2 L
60	Pre-Assembly		0.17		x	376 min, 84.1 L
61	Pre-Assembly		0.14		x	378 min, 76.3 L
62	Floorman – Pre-assembly		0.23	x		380 min, 65.9 L
63	Floorman – Pre-assembly		0.19	x		83 min, 12.9 L
64	Floorman – Pre-assembly		0.14	x		380 min, 76.4 L
65	Floorman – Pre-assembly		0.20	x		82 min, 16.8 L
66	Floorman – Pre-assembly		0.14	x		380 min, 82.4 L
67	Floorman – Pre-assembly		0.15	x		378 min, 73.4 L
68	Pump mechanic		0.28	x		377 min, 73 L
69	B-5B pump room	0.39			x	4 L/min, 132 min
70	Pump room		0.81		x	Florisil
71	Pump room		0.62		x	Impinger
72	Pump room		0.86		x	Florisil
73	Pump room		2.67		x	Impinger
74	Pump room		0.71		x	Florisil
75	Pump room		0.67		x	Impinger
76	Pump room		0.65		x	Florisil
77	Pump room		0.60		x	Impinger
78	Pump room		0.47		x	362 min, 70 L
79	Pump room		0.48		x	368 min, 68.7 L
80	Pump room		0.53		x	359 min, 74.2 L
81	Winding		0.12		x	Florisil
82	Winding		0.16		x	Impinger
83	Winding		0.14		x	Florisil
84	Winding		0.24		x	Impinger
85	Winding		1.56		x	80 min, 16.2 L
86	Winding		0.03		x	72 min, 26.2 L
87	Winding		0.08		x	375 min, 79.8 L
88	Winding		0.10		x	110 min, 15.5 L
89	Leak test		0.76		x	Florisil
90	Leak test		0.94		x	Impinger
91	Leak test		1.13		x	Florisil
92	Leak test		0.55		x	Impinger
93	Final test		0.51		x	Florisil
94	Final test		0.97		x	Impinger
95	Final test		0.58		x	Florisil
96	Final test		0.72		x	Impinger
97	Testing		0.31		x	401 min, 78.6 L
98	Testing		0.37		x	106 min, 23.8 L
99	Testing		0.33		x	105 min, 21.8 L
100	Testing		0.21		x	405 min, 86.4 L
101	Testing		0.36		x	407 min, 77.7 L
102	Tester		0.25	x		402 min, 80.6 L
103	Tester		0.31	x		107 min, 21.2 L
104	Tester		0.32	x		408 min, 83.5 L
105	Degreaser		1.26	x		381 min, 72.9 L
106	Shipping		0.08		x	373 min, 75.7 L

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107	Shipping	0.10	x	368 min, 77.8 L
108	Cover Mfg.	0.07	x	357 min, 40.6 L
109	Cover Mfg.	0.05	x	358 min, 73.8 L
110	Cover Mfg.	0.06	x	374 min, 75.3 L
111	Office	0.05	x	370 min, 51.9 L
112	Office	0.05	x	371 min, 83.7 L
		n = 5	n = 12	n = 95

The purpose for the Kemper insurance survey (Kemper 1976) was to evaluate potential employee exposures to Aroclor 1016 during various plant operations. The plant operations surveyed were soldering operation, loading baskets, and tank room worker. Kemper commented on their personal measurements henceforth: “With these relatively short sample times, a proper evaluation of an 8-hour time-weighted average cannot be made. However, it appears that the employees loading the basket are exposed to aroclor vapors within the allowable limit of 1 milligram per cubic meter. The two employees working in the tank room who were sampled indicate somewhat higher exposures, but still below the allowable limit of 1 milligram per cubic meter.” (Company Comm. 1, 1976)

The sampling and analytical method used in the Kemper survey was MSA model G pumps in conjunction with pre-weighed filters. The pumps were worn by the employees, and the filters were positioned at the breathing zone of the workers during sampling. The Brooks No.5 Rotometer was used in order to calibrate the flow rate on the pumps. Upon completion of sampling, the Millepore filters were sent to an industrial hygiene laboratory for accurate weighing. (Company Comm. 1, 1976)

In the Kemper report to Aerovox some recommendations were made (Company Comm. 1, 1976):

- I. “Since many of the employees have been working with aroclor for a period of 15 years or more, it is recommended that all employees working with aroclors be given a complete physical which would include appropriate tests in order to determine if any of these employees have developed any liver disorders’
- II. “Since the unloading of tanks in the tank room is an intermittent operation, it is recommended that strict supervision be maintained to see to it that employees wear the approved type respirators available during these unloading operations.”

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- III. “The employees performing soldering operations many times position the parts in such a manner that it causes the local exhaust ventilation to be ineffective because the parts are located too far from the exhaust hood. Strict supervision should be maintained to see to it that employees perform the soldering operations directly in line with an under-the-exhaust hood so that any smoke given off during the soldering operations will be properly exhausted.”

Recommendations were usually made to improve the workers work-conditions and to preserve the employees' health. From the Kemper recommendations it is clear that they were worried about PCBs effect on the body in particular liver disorders (I), peak exposures to PCBs (II), and break-down products from soldering where PCBs were present (III).

In the Kemper report, they commented on the sampling method used: “This type of sampling is not specific for the aroclor vapors, as it is quite possible that other dust could be involved on the filter weights.” In the report there was also a mark about peak exposures: “There is a definite odor of the aroclor in the areas where it is used. However, it is not offensive, nor does it produce any irritation of the eyes or upper respiratory passages.” (Company Comm. 1, 1976)

The Commonwealth of Massachusetts performed a survey December 2, 1976, where the purpose was to compare Aroclor 1242 air levels with the occupational exposure standard. They found that all samples were below the 1976 maximum allowable concentration for PCB containing 42% chlorine. (Company Comm. 2, 1976)

In this study air samples were collected on silica gel and bubblers (two in series) containing iso-octane. The iso-octane samples were analyzed directly by gas chromatography; the silica gel samples were first extracted with a 20% ethyl ether-petroleum ether solution. The analytical procedure used was a Perkin-Elmer 3920B Gas Chromatograph, equipped with an electron capture Ni⁶⁰ detector, and a 180 cm by 4 mm Pyrex 1.5% OV-17, 1.95% QF1 column under the following operating conditions:

- Oven temperature 200°C
- Injector temperature 195°C
- Detector temperature 295°C
- Chart speed 1 cm/minute

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- Nitrogen flow 60 ml/minute

For quantitation the heights of five pronounced peaks were measured. The results from this study, are found in table 3 above which comprises all air measurements results for Aerovox. (Company Comm. 2, 1976)

In the report from The Commonwealth of Massachusetts to Aerovox there were additional information on the different samples. Four samples were collected in the impregnation room; two personal samples and two area air samples. The area air samples were taken over one of the impregnation tanks and 30-40 feet away from tank while opened for unloading. The personal samples were collected while the workers were unloading the oven, which lasted for 30 minutes. The rest of the time the workers performed other duties. The personal sample levels (0.60 and 0.82 mg/m³) were higher than the two area air sample levels (0.36 and 0.50 mg/m³). (Company Comm. 2, 1976)

At Aerovox the newly impregnated capacitors were transported to the solder station in baskets. The Commonwealth of Massachusetts surveyed four workers; one worker removed capacitors from baskets, one worker was soldering, one worker was operating a silicone bun machine, and the fourth sample was on a worker who was soldering. One area air sample was also collected in the Fill-hole soldering department. The personal samples ranged from 0.40-0.74 (average measured concentration 0.52 mg/m³) where the lowest was the sample on the worker removing capacitors from basket and the highest from the worker who was soldering. The lowest concentration found was the area air sample (0.27 mg/m³).

Three additional area air samples were sampled in places where PCB were not used. These places in the plant were; in the assembly office, in the assembly area, and in the pump room, and resulted in the following PCB concentrations; 0.10, 0.30, and 0.39 mg/m³, respectively. This indicates that the PCBs were not just found in the vicinity of the sources but throughout the plant.

NIOSH sampled at Aerovox twice. The first survey with the purpose of testing two sampling methods; impinger and Florisil was performed in May 12, 1976. The results from the comparison of the two methods were discussed previously. The sampling results are included in table 3 that encompasses all measurements

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from Aerovox. The second survey NIOSH performed at Aerovox was in March 21-23, 1977. This was an industrial hygiene survey with the purpose to measure PCB levels where PCBs were used. A total of 29 personal and 54 area air samples were sampled. These results are also included in the overview table, table 3 above. (NIOSH, 1977)

Twenty-nine personal air samples were collected in eight locations. These were mainly areas where higher PCB air levels were expected. The eight work tasks performed and sampled were; moveman (n=3), floorman (n=6), tester (n=3), pump mechanic (n=1), degreaser (n=1), tanker (n=9), solder (n=3), and heat soak operator (n=3). The time-weighted averages (TWA) were calculated for these operations; 0.72, 0.17, 0.29, 0.28, 1.26, 0.82, 1.06, 0.63 mg/m³, respectively. The TWA for the personal samples ranged from 0.17 mg/m³ for the floorman in the pre-assembly area to 1.26 mg/m³ for the person operating the degreaser after the soldering operations. (NIOSH, 1977)

Twenty-five area air samples were also sampled during the NIOSH 1977 industrial hygiene survey. Eight locations were chosen; impregnation (n=2), shipping (n=2), pre-assembly (n=4), winding (n=4), testing (n=5), pump room (n=3), top or cover manufacturing (n=3), and office (n=2). The average concentrations for each location was calculated: Impregnation 0.81 mg/m³, Shipping 0.09 mg/m³, Pre-Assembly 0.14 mg/m³, Winding 0.44 mg/m³, Testing 0.32 mg/m³, Pump room 0.49 mg/m³, Cover Mfg. 0.06 mg/m³, and Office 0.05 mg/m³. The highest concentration measured was sampled in the impregnation area, 1.01 mg/m³. The lowest level of Aroclor 1016 was recorded in the winding area; 0.03 mg/m³.

Table 15 Vital air concentration statistics for operation code sampled

	Operation/ department	Personal	Area air	Time sampled min	Range of sampling time min	n	IH data mg/m ³	Average		Range
								Personal air mg/m ³	Area air mg/m ³	
1	Soldering operation	x		60	60-60	2	0.46	0.40		0.33-0.46
2	Soldering operation	x		60			0.33			
3	Moveman-soldering	x		265	103-384	3	1.01	0.85		0.42-1.11
4	Moveman-soldering	x		384			0.42			
5	Moveman-soldering	x		103			1.11			
6	Solder	x		384	105-395	3	1.05	1.04		0.98-1.09
7	Solder	x		105			0.98			

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8	Solder	x	395			1.09		
9	Heat Soak	x	387	86-399	3	0.50	0.69	0.50-0.71
10	Heat Soak	x	86			0.87		
11	Heat Soak	x	399			0.71		
12	Loading baskets	x	60		1	0.26	0.26	
13	Tanker	x	385	87-385	9	0.56	0.82	0.51-1.26
14	Tanker	x	93			0.80		
15	Tanker	x	384			1.26		
16	Tanker	x	87			0.51		
17	Tanker	x	385			1.01		
18	Tanker	x	262			0.54		
19	Tanker	x	287			0.78		
20	Tanker	x	93			0.94		
21	Tanker	x	144			0.97		
22	Tank room worker	x	107	107-107	2	0.76	0.72	0.67-0.76
23	Tank room worker	x	107			0.67		
24	Impregnation room	x	105	85-105	2	0.60	0.71	0.60-0.82
25	Impregnation room	x	85			0.82		
26	Impregnation room	x	81	65-91	11	0.50	0.72	0.36-1.16
27	Impregnation room	x	65			0.36		
28	Impregnation room	x				0.55		
29	Impregnation room	x				0.81		
30	Impregnation room	x				0.59		
31	Impregnation room	x				0.84		
32	Impregnation room	x				1.16		
33	Impregnation room	x				0.55		
34	Impregnation room	x				0.49		
35	Impregnation room	x				0.74		
36	Impregnation room	x				0.58		
37	Impregnation room	x	85			1.01		
38	Impregnation room	x	91			0.61		
39	Fill-hole soldering	x	64	53-72	4	0.40	0.52	0.40-0.74
40	Fill-hole soldering	x	72			0.41		
41	Fill-hole soldering	x	59			0.27		
42	Fill-hole soldering	x	60			0.52		
43	Fill-hole soldering	x	53			0.74		
44	Heat soak / fill hole	x		120-420	4	1.15	1.22	0.44-1.78
45	Heat soak / fill hole	x				1.78		
46	Heat soak / fill hole	x				1.49		
47	Heat soak / fill hole	x				0.44		
48	Assembly office	x	71		1	0.10		
49	Assembly area	x		120-420	9	0.55	0.55	0.16-0.67
50	Assembly area	x				0.57		
51	Assembly area	x				0.42		
52	Assembly area	x				0.37		
53	Assembly area	x				0.64		
54	Assembly area	x				0.67		

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55	Assembly area	x				0.21		
56	Assembly area	x				0.16		
57	Assembly area	x	140			0.30		
58	Pre-Assembly	x	379	80-379	4	0.04	0.14	0.04-0.22
59	Pre-Assembly	x	80			0.22		
60	Pre-Assembly	x	376			0.17		
61	Pre-Assembly	x	378			0.14		
62	Floorman – Pre-assembly	x	380	82-380	6	0.23	0.15	0.14-0.23
63	Floorman – Pre-assembly	x	83			0.19		
64	Floorman – Pre-assembly	x	380			0.14		
65	Floorman – Pre-assembly	x	82			0.20		
66	Floorman – Pre-assembly	x	380			0.14		
67	Floorman – Pre-assembly	x	378			0.15		
68	Pump mechanic	x	377		1	0.28	0.28	
69	B-5B pump room	x	132		1	0.39	0.39	
70	Pump room	x		120-420	11	0.81	0.82	0.47-2.67
71	Pump room	x				0.62		
72	Pump room	x				0.86		
73	Pump room	x				2.67		
74	Pump room	x				0.71		
75	Pump room	x				0.67		
76	Pump room	x				0.65		
77	Pump room	x				0.60		
78	Pump room	x	362			0.47		
79	Pump room	x	368			0.48		
80	Pump room	x	359			0.53		
81	Winding	x		72-420	8	0.12	0.30	0.03-1.56
82	Winding	x				0.16		
83	Winding	x				0.14		
84	Winding	x				0.24		
85	Winding	x	80			1.56		
86	Winding	x	72			0.03		
87	Winding	x	375			0.08		
88	Winding	x	110			0.10		
89	Leak test	x		120-420	4	0.76	0.85	0.55-1.13
90	Leak test	x				0.94		
91	Leak test	x				1.13		
92	Leak test	x				0.55		
93	Final test	x		120-420	4	0.51	0.70	0.51-0.97
94	Final test	x				0.97		
95	Final test	x				0.58		
96	Final test	x				0.72		
97	Testing	x	401	105-408	5	0.31	0.32	0.21-0.37
98	Testing	x	106			0.37		

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99	Testing	x	105			0.33		
100	Testing	x	405			0.21		
101	Testing	x	407			0.36		
102	Tester	x	402		3	0.25	0.29	0.25-0.32
103	Tester	x	107			0.31		
104	Tester	x	408			0.32		
105	Degreaser	x	381		1	1.26	1.26	
106	Shipping	x	373	368-373	2	0.08	0.09	0.08-0.10
107	Shipping	x	368			0.10		
108	Cover Mfg.	x	357	357-374	3	0.07	0.06	0.05-0.07
109	Cover Mfg.	x	358			0.05		
110	Cover Mfg.	x	374			0.06		
111	Office	x	370	370-371	2	0.05	0.05	0.05-0.05
112	Office	x	371			0.05		

n = 111

4.4 Other sampling data

In addition to PCB personal and area air measurements, air samples were collected for soldering fumes and trichloroethylene as well. Detector tubes were used to determine air concentrations of trichloroethylene.

The plant reported that these samples very seldom exceeded 100 ppm. (NIOSH, 1977)

4.4.1 Trichloroethylene

Area air samples were collected near the degreaser using trichloroethylene. Sipin SP1 pumps were used to collect the air samples in tubes containing activated coconut charcoal absorbent. The tubes have a 100 mg primary section and a 50 mg backup section. The samples were collected for approximately six hours at a flow rate of 200 cc/min. The tubes were desorbed with carbon disulfide, which was analyzed using GC. (NIOSH, 1977)

4.4.2 Lead, Tin and Zinc

Area air samples were collected for lead, tin, and zinc near the soldering operation. MSA Model G pumps were used to collect the air samples on 37-mm/0.8 micrometer mixed cellulose ester membrane filter. They were collected from two to three hours at a flow rate of 1.5 pm. The samples were digested in nitric acid and analyzed by atomic absorption. (NIOSH, 1977)

4.4.3 TCE

Three samples were collected which ranged from 53.4 to 77.5 ppm. However, it should be noted that all of the samples were saturated, therefore these concentrations would be considered to be minimum concentrations. (NIOSH, 1977)

4.4.4 Pb, Sn, and Zn

The results of the area air samples are given in table. Eight samples were collected for evaluation of exposure to tin and 15 for evaluation of exposure to lead and zinc. No detectable levels (15 µg/tube) of tin were found. A lead concentration of 41.2 µg/m³ was found on one sample while six samples had concentrations of zinc ranging from 2.3-94.1 µg/m³. (NIOSH, 1977)

4.5 Reference

Company communication 1 (1976): Letter of September 14, 1976, from Ernest Neukuckatz, Senior Industrial Hygienist, Kemper Insurance Companies, North Quincy, MA, to Norman Butterworth, Manager of Industrial Engineering, Aerovox Industries Inc., New Bedford, MA.

Company communication 2 (1976): Letter of December 17, 1976, from Harold Bavley, Director, The Commonwealth of Massachusetts Executive Office of Manpower Affairs, Department of Labor and Industry, Division of Occupational Health, to Norman Butterworth, Manager of Industrial Engineering, Aerovox Industries Inc., New Bedford, MA.

Kemper Insurance Agencies (1976): Aerovox Industries Inc. Survey of August 25, 1976.

Hein, M. (2002): NIOSH internal communication, Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH).

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Jones, M. (1976): Memorandum of June 28, 1976, from Mark Jones, Industry Wide Studies Branch, Division of Surveillance, Hazard Evaluations and Field Studies, to Chief Industrial Hygiene Section. Cincinnati, OH: U.S. Department of Health, Education, and Welfare, Public Health Service, Center for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHEW (NIOSH)

NIOSH (1977) survey report of November 29, 1975 by Jones, M., Phillips, R., Smith, L., Cincinnati, OH: U.S. Department of Health, Education, and Welfare, Public Health Service, Center for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHEW (NIOSH)

The Commonwealth of Massachusetts (1976): Survey of Aerovox Industries Inc. of December 2, 1976.

5 Development of the Aerovox JEM

The rationale for developing a job exposure matrix for Aerovox was to develop exposure estimates to be used to further explore the relationship between mortality and workers' PCB exposures. The job exposure matrix was developed based on the process description (chapter 2), chemical knowledge about Aroclor (chapter 3), air measurements (chapter 4), operation description and qualitative dermal assessment (Brown & Jones, 1981). A flow chart of the process for developing the JEM is given below.

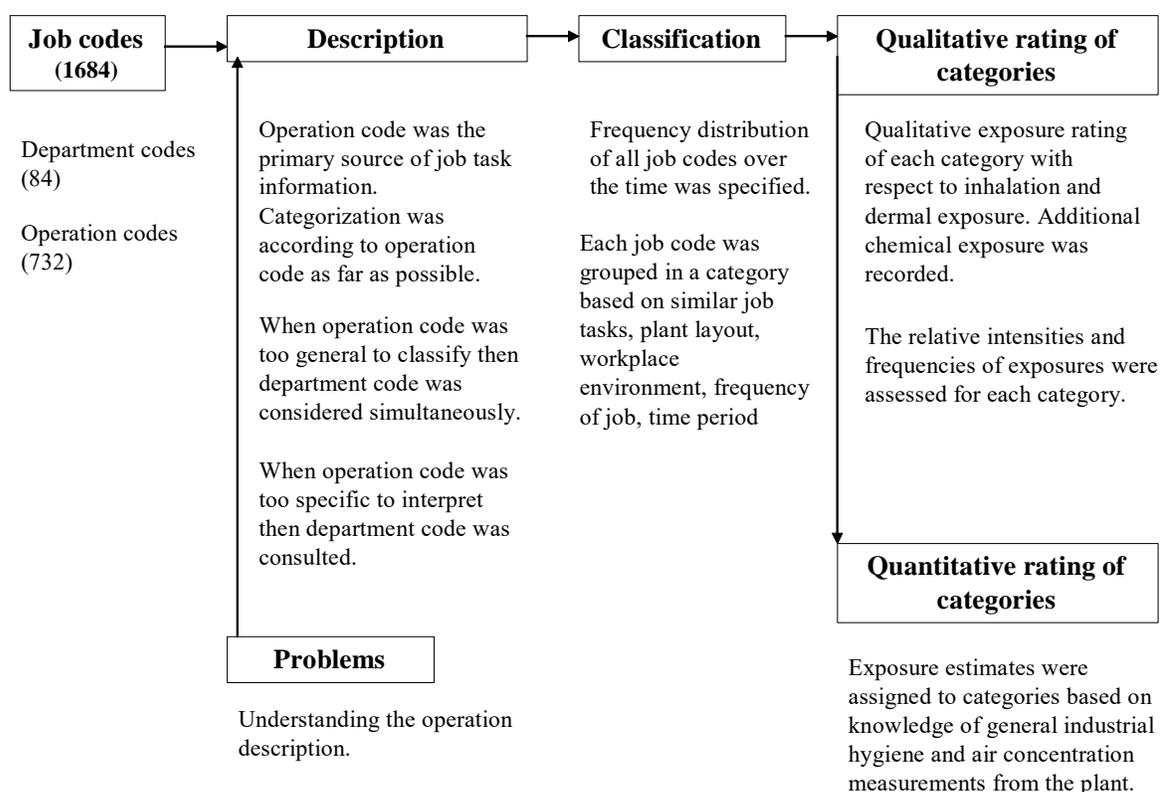


Figure 9 A flow chart of the process for developing the JEM is given below

5.1 Work Histories

Microfilming of work histories for the Brown and Jones study (1981) and the Brown follow-up study (1987) was done in March of 1975. Job operation codes up to this date were assessed. Several implications were encountered especially are they severe when departments and /or operation codes are labeled

‘unknown’ or when information was lacking, either due to unreadable work histories or missing entries.

The work histories from Aerovox dated back to before 1938 but these are of no interest because the PCB capacitor manufacturing plant started in 1939.

5.2 Department codes

Department codes were labeled with a two-digit number or one letter. Department codes were entered with operation codes when the workers first were employed. When the workers changed operation the department code was not always updated. The original Aerovox department codes were converted to NIOSH department codes. Initially Brown *et al.* (1981) was only interested in workers in three departments, which were regarded as having the highest levels of PCBs and workers could potentially be exposed to PCBs. These three departments were: tank room, paper II assembly and final test. The table below depicts the departments of interest to these authors.

Table 16 Departments with PCB use

Aerovox original department code	Description	Brown code	NIOSH code
12	Tank room	01	12
21	Paper II assembly and final test	02	21
22	Paper II assembly and final test	03	21
I	Tank room	04	12
F	Paper II assembly and final test	05	21
	All others	10	

NIOSH microfilmed the work histories in March 8-18 1975. The only codes Brown *et al.* were interested in were tank room and paper II assembly and final test.

For the mortality follow-up study, Brown (1982) decided to expand the cohort to include all workers at the plant for a time period when PCB capacitors were manufactured 1939-78. In the protocol for this mortality study update; 26 department codes with descriptions were given new NIOSH codes. The original Aerovox two-digit department codes were mainly kept but several original Aerovox department codes were collapsed in to one NIOSH department code, which was also designated a two-digit number.

Table 17 Department Codes for Aerovox Industries

Original Department Code	NIOSH department code	Description of department
10- 11 or D	10	Paper I Winding
12- or I	12	Tank Room - Impregnation and Pump Mech.
13- 14- 28- or G	13	Paper I Assembly
20 - or E	20	Paper II Winding
21, 22 or F	21	Paper II Assembly & Final test

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23-	23	Supervisor, plant area
24-	24	Spec. Products
25- 26- or N	25	Sub-Assembly
27-	27	Met. P.P.
29- 30- 31- 41- or A	29	Preform and Anodes
32 or B-	32	Electrical Impregnation and Winding
33- 39- or C	33	Electrical Assembly and Final testing
43- or H	43	Mica
50- or U	50	Shipping
50-8000 or 50-9000	51	Manuf. Admin.
52- 53 - 55- or R	52	Materials, Stock Rooms
54-*	62	Personnel and First Aid
55	55	Receiving & Storage room
57- 58-*	56	Engineers - Industrial or Product
58- 76- or T	58	Guards, Security
60- 62- 63- or P	60	Machine Shop
61	61	QC (Quality Control)
65- or V	65	Maintenance
67- 68- or L	66	Firemen and Porters
8000, 82-* 90-* 91-92-93-94 or W	62	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative
95-or S	67	Jobber Stock

The frequency of the department codes are given in the chart below for departments with more than 100 occurrences of frequency from 1939 to 1977.

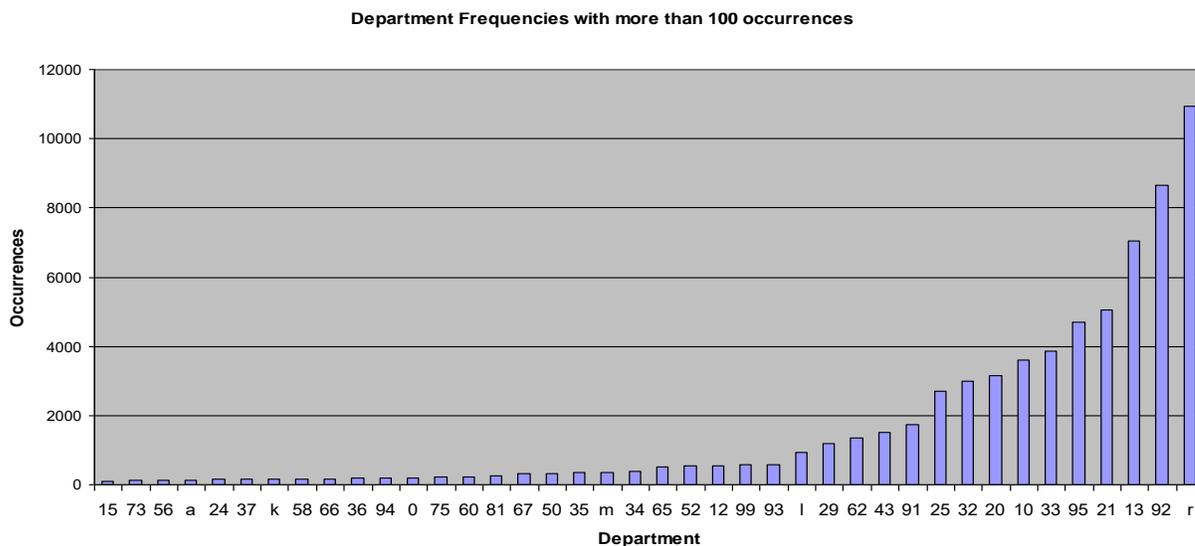


Figure 10 Frequency of department codes with >100 occurrences; 1939 - 1977.

The department frequency graph (fig. 6) shows that department R which should have been recorded to 52 Materials and stock room is the department with the highest frequencies. The frequency of occurrence is a count for what departments the worker was recorded to work in for every year. The worker was not counted if he/she had less than 60 days worked in one year. The worker was assigned to the department the worker

held the longest for that particular year. There were several complications with the department data entry in the master file. Some of the old department codes were collapsed in with another, or with several other original Aerovox department codes, but their two-digit department code would be used again for a new NIOSH department code (Prince et al). This complicates the scene by not knowing if the two-digit department code was an old original Aerovox code or a new NIOSH department code. In the table below, the department with more than 100 recorded occurrences are given with their department description where this above mentioned problem is seen clearly.

Table 18 Department codes where frequency of occurrence is larger than 100 with department description

Dept code	Frequency	Dept. description
15	101	Old Aerovox code for shipping or stock room
73	115	Old Aerovox code for QC
56	121	Unidentified old Aerovox code or a NIOSH code for Engineers
A	124	Preform and Anodes
24	153	Specialty products
37	156	?
K	157	?
58	162	Guards, security
66	173	Firemen and porters
36	184	?
94	203	Old Aerovox code for Office or a NIOSH code for spill at plant and oil poisoning fumes
0	208	?
75	215	Maintenance
60	222	Machine shop
81	268	?
67	306	Old Aerovox code for Fireman and porters or a NIOSH code for jobber stock
50	310	Old Aerovox code for Manufacturing administration or NIOSH code for Shipping
35	338	Electrolysis
M	353	Tantalum
34	391	Electrolysis
65	512	Maintenance
52	534	Materials, stock room
12	552	Tank room
99	584	NIOSH code for missing handedness
93	587	Old Aerovox code for Office or a NIOSH code for Accident at plant
L	940	Old Aerovox code for firemen and porters
29	1183	Preform and Anodes
62	1351	Old Aerovox code for Machine shop or a NIOSH code for office, personnel, first aid
43	1497	Mica
91	1751	Old Aerovox code for Office or a NIOSH code for pregnancy/miscarriage
25	2710	Sub assembly

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32	2996	Electrical impregnation and winding
20	3168	Paper II Winding (possibly a tank room before 1962)
10	3592	Paper I Winding
33	3860	Electrical assembly and final testing
95	4697	Old Aerovox code for Jobber stock or a NIOSH code for illness greater than 1 month
21	5055	Paper II Assembly & Final test
13	7037	Paper I Assembly
92	8651	Old Aerovox code for Office or a NIOSH code for leave
R	10935	Old Aerovox code for Material stockroom

This was especially pertinent to old Aerovox codes: 50 Manufacturing administration, 62 Machine shop, and 67 Firemen and porters. The NIOSH departments having these two-digit codes are 50 Shipping, 62 Personnel and First Aid, and Office/Office services, Sales*, Data Processing* Accounting and Finance, General Administrative, and 67 Jobber Stock, respectively. It is therefore important when classifying these workers, to know if they were an old machine shop (62), or a NIOSH office worker. There are 1,967 occurrences of these codes e.g. department code 50, 62, and 67. To address this issue the department codes and the operation codes were looked at simultaneously to assess if a worker could have had this operation in a particular department, e.g. a tool and dye maker would not be in personnel and a typist would not be in machine shop. This was done instead of pulling all these work histories for re-coding which may or may not have given information on this subject.

The department codes were not always recorded in the work history file, e.g. the department code was missing. The master file includes 208 occurrences where departments are listed as unknowns with code 00. Out of the 208 occurrences of unknown departments 168 occurrences have unknown operation codes as well.

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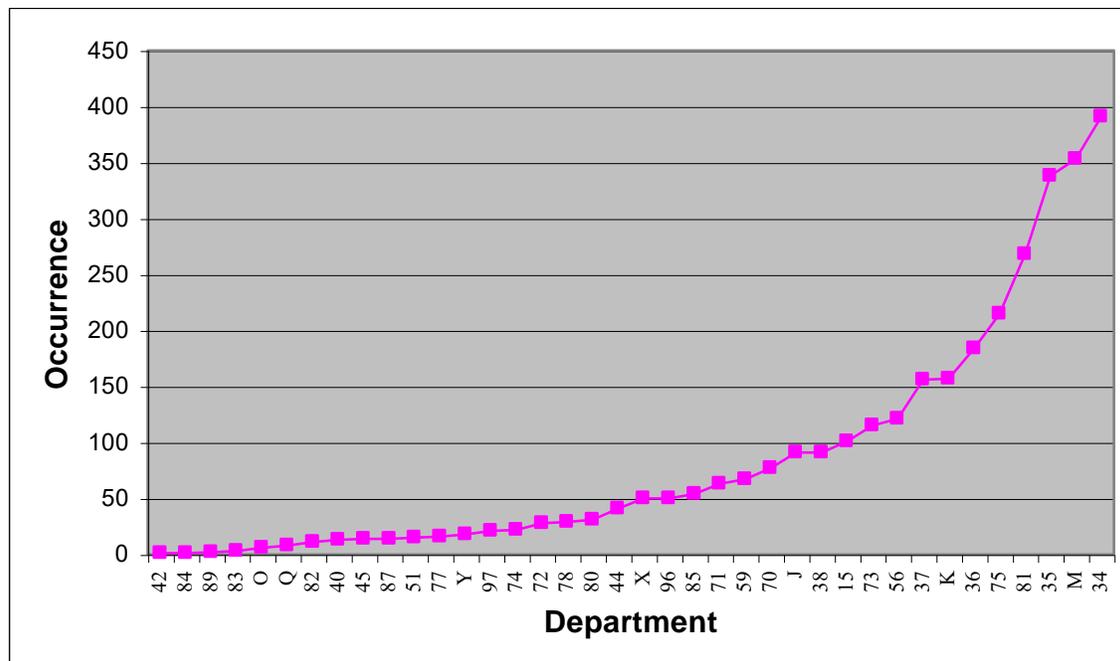


Figure 11 Number of occurrences with non-identified department codes

In addition there were department codes that had an identification code but no description. The work histories for workers recorded with these descriptionless department codes were pulled, and operation code and time were recorded. The results are given below.

Table 19 Department descriptions, year and # of occurrences found in the work histories¹

Dep. code	n	Department codes with missing descriptions with year and department description given in work histories									
J	91	1945									
		Mica									
M	353	1957		1962	1962	1963					
		Tantalum	Liquefied	Tantalum	Tantalum	Closing					
X	50	1961									
		Accounting & personnel									
15	101	1964		1967	1970						
		Shipping		Paper 1	Prod. control						
				Stockroom							
34	391	1965		1966	1969						
		Electrolysis	Electrolysis	Electrolysis	Electrolysis						
35	338	1964		1965							
		Electrolysis	Electrolysis								
40	13	1967									
		Electrolysis									
45	14	1963									
		Closing									
59	67	1966	1967	1967	1968	1969	1971				
		Office	QC	Manufacturin	QC	QC	QC				
				g			engineering				
70	77	1966	1967	1967	1967	1971	1971	1971	1971	1972	
		CTL	Shipping	Shipping	Shipping	Shipping	Electric lab	Shipping	Shipping	Shipping	

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71	63	1962 Test lab	1962-64 Test lab	1963 QC process control	1964 Environmental lab	1965 Test lab	1966 Central test lab
72	28	Process control					
73	115	1963 QC	1964 QC	1967 QA	Machine shop		
74	22	1963 Closed tantalum					
75	215	1966 Engineering	1967 Maintenance	1967 Maintenance	1968 Maintenance		
78	29	1973 Fireman	Fireman				
82	11	1966 Distribution & sales					
85	54	1970 Sales					
96	50	1970 Corporate	1970 Corporate	1970 Engineering			
97	21	1972 Central parts					

1. Department code (# of occurrences in work histories) without descriptions: K (157), O (6), Q (8), Y (18), 36 (184), 37 (156), 38 (91), 42 (1), 44 (41), 51 (15), 56 (121), 77 (16), 80 (31), 81 (268), 83 (3), 84 (1), 87 (14), and 89 (2)

The operation descriptions ascribed to the missing department descriptions did not always match, see table above. The most frequent description of the department was assigned as the description of the department code in question.

Another issue regarding the coding of the departments was that a large number of operation and department codes changes occurred in the time interval 2/1/62 and 11/5/62. This is especially evident for NIOSH department 20, Paper II Winding department. At one time department 20 must have been a tank area because the work histories show operations labeled 'tankmen' in department 20. Tankmen would only work in the tank department. The NIOSH code for the tank room was department 12. The work histories for workers with tankman operation in department 20 were reviewed and the findings revealed that there were indeed tankmen in department 20 but only before November of 1962. After this date no tankmen were found, and mostly paper and winding operations were present in department 20. It is likely that the tank room changed codes. It is not likely that the tank room became a paper winding room because previous spills would have polluted the room which again could potentially be released and pollute the paper which would have a negative influence on the performance of the capacitor.

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NIOSH department code 52 a stock room was also one department that had a number of descriptions that did not reflect a stock room, for example chemical lab, purchasing, engineers, and test lab. Aerovox department L which was coded as NIOSH department 66 was a department for firemen and porters. Judging from the operation codes found in this department, the code might have been used for a machine shop or a mica department earlier.

In other instances the initial department code with operation code was given, but when the operation code changed it was not known whether or not the worker stayed in the same department or moved to another. Another possibility that usually would not be recorded would be if the department merged with another department, or ceased entirely and another new was created.

In the work histories spills, accidents, pregnancies/miscarriages, leave, and illness are recorded, and these events were assigned their own NIOSH codes (see table below).

Table 20 Additional NIOSH department codes for Aerovox Industries

Original Aerovox code	NIOSH dept. code	DESCRIPTION OF DEPARTMENT
N/A: Additional code	91	Pregnancy/Miscarriage
N/A: Additional code	92	layoff, leave, quit (terminal end of employment), school, marriage, etc.
N/A: Additional code	93	Accident at plant
N/A: Additional code	94	Spill at plant and oil poisoning fumes (Rashes and problems with fumes were coded as dept 94.)
N/A: Additional code	95	Illness, greater than 1 month
N/A: Additional code	99	Missing Handedness
N/A: Additional code	00	NO department given

- It was difficult to differentiate between accidents and spills because the record referred to an Industrial Accident Reports for certain dates but these accident reports were not obtained/found.

The accidents and spills are recorded for individuals. If the accident was a fire, workers could potentially be exposed to pyrolysis products of PCBs (chapter 3). An accident could also mean that a worker had a fall or was caught in a machine while operating it. It does not necessarily mean an exposure to PCB or their derivatives occurred.

Spill was another department code created by NIOSH. Automatically an association to PCB and a spill of PCB would be portrayed, but the Aerovox plant also used other oils to fill their capacitors, for example

castor oil. Other insulating oils of unknown type could have potentially been used for their specialty products. Spills could refer to other chemicals such as trichloroethylene (TCE). The spills were recorded for individuals in their work histories. These events would be expected to modify exposures.

5.3 Operation codes

The number of unique operation codes / job titles combinations for Aerovox was 732. The operation codes were given a two-digit code or a letter and one number. If the work histories did not have a job title recorded then these were coded as missing job titles with code 00. All the operation codes are listed in Appendix A.

The unidentified department codes with suggestive descriptions and the result after assigning descriptions to the departments are listed in table 15. The number of non-described department codes was now reduced from 38 unknown departments to 20 unknown departments. The total frequency of occurrence of department codes was 1434 but given the now assigned department codes the frequency of occurrence in unknown departments was reduced to 922. This resulted in 18 departments without description in the cohort and these will be treated as unknowns.

Table 21 Assigned descriptions to departments

Dep. code	Department
J	Mica
M	Tantalum
74	Closed tantalum
70	Shipping
15	Shipping
34	Electrolysis
40	Electrolysis
59	QC
73	QC
71	Test lab
72	Process control
75	Maintenance
78	Fireman
82	Distribution & sales (office)
85	Sales
96	Corporate
X	Accounting & personnel
97	Central parts

There were 1434 occurrences of department codes without descriptions, or 2.1% of total occurrences of these departments in the coding of the workers in the cohort (67,509 occurrences including the non-

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descriptive department codes). Assigning descriptions to formerly unknown departments give only 572 unknown occurrences of department codes lacking descriptions, or 0.84%.

Another problem with the operation codes was the broad scope. One operation code incorporated several job titles. Some of these job titles described the same job operation for example ‘freight handler’ and ‘handler, freight’, and do not conflict. However, conflicts were encountered when job titles of non-similar jobs were grouped together in one operation code. Not only were the job tasks very different but they were carried out in different parts of the plant giving rise to different levels of PCB exposure, both direct and indirect contact with PCBs. The job codes were partially categorized by having given several job tasks the same job code. Especially was this troublesome for job code 11, 35, 36, 51, 60, 62, 76, and 84.

It was obvious from the job titles that operation code 11 was meant for office workers (see list of job titles in table below).

Table 22 Operation code 11 with all job titles listed

Job title	Operation code
assistant, administrative	11
assistant, executive	11
barcode labeler	11
Bookkeeper	11
clerk/typist/posting	11
credit union	11
customer contact	11
Documentation technician	11
executive assistant	11
incentive verifier	11
ink jet operator	11
labeler, barcode	11
office worker (incl. secretary/ admin. asst) QC	11
operator, ink jet	11
operator, telephone	11
payroll	11
posting clerk	11
QC inspector	11
QC, office worker	11
quality control / inspector	11
receptionist	11
sales clerk	11
secretary	11
stenographer	11
technician, documentation	11

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telephone operator	11
timekeeper, accounting	11
typist	11
worker, office	11

There was no documentation specifying where the various types of office workers worked. Two of the job titles: *operator ink jet* and *labeler bar code*, were recorded with the same job code, code 11, as the office workers but these jobs were not office workers. These functions were upgrades of the stamping job task which was to label the finished capacitors with a serial number for quality assurances and control purposes. Later Aerovox updated the stamping machine with an ink jet machine, probably to make bar code labels. These workers were in the manufacturing area of the plant and hence had different background exposures to PCBs than that of the rest of operation code 11.

Engineers were all given the same operation code: 35. Engineers were located where their use of skills would be maximized, namely in the different departments of the plant. A filter engineer would work with filters, either in ventilation systems or with Fullers earth filtering PCB oil. The manufacturing/ industrial engineer would likely have their workplaces in the impregnation area. Foil engineers would presumably be working in the paper II winding department where foil was being made, cut, and wound together with the paper to a coil. Engineers would experience a range of different PCB exposures, assuming our assumption of engineers' work was performed in their respective departments.

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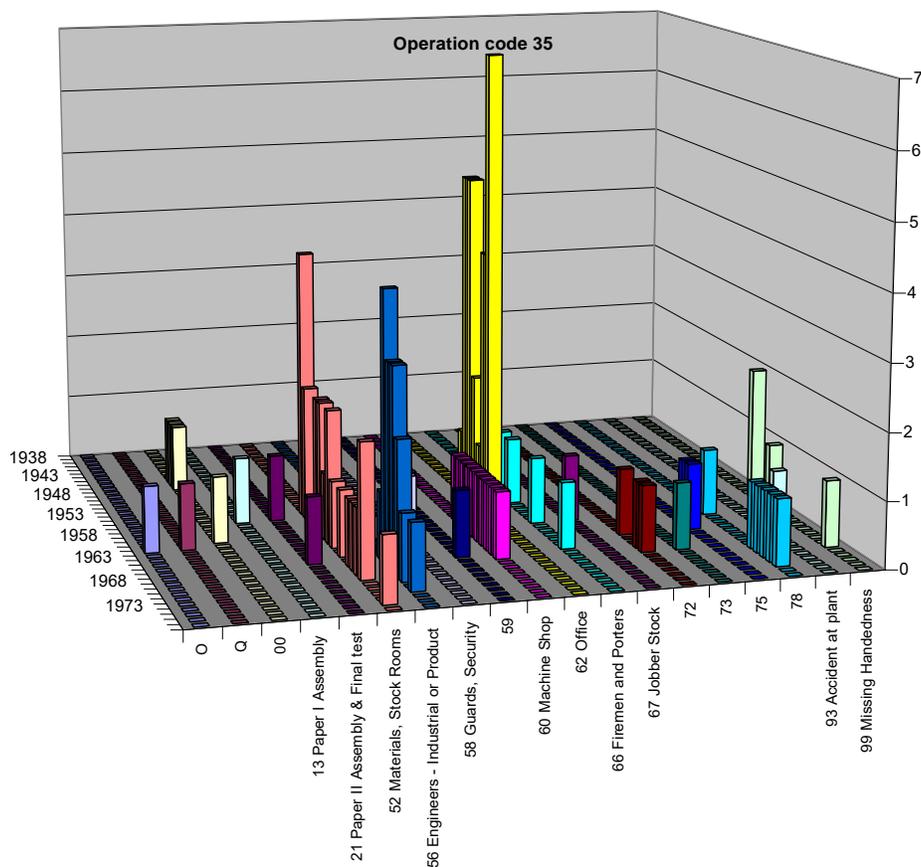


Figure 12 Operation code 35 engineers and their distribution in departments

Table 23 Job titles and operation codes for engineers and technicians

Job title	Operation code	Job title	Operation code
engineer technician (all types)	35	environment technician	36
engineer, filter	35	flex technician	36
engineer, foil	35	lab technician	36
engineer, mfg/industrial	35	technician	36
filter engineer	35	technician, environment	36
foil engineer	35	technician, flex	36
industrial engineer	35	technician, lab	36
mfg. engineer	35		
technician, engineer	35		

All technician job codes (code 36)) were grouped together into one code, and the same concerns as with the engineers arose. The technicians' job tasks were very specific and individually different, and gave rise to a

range of different potential PCB exposures. See table above for job titles in the operation code 36 and for the distribution of the code in the different departments see figure below

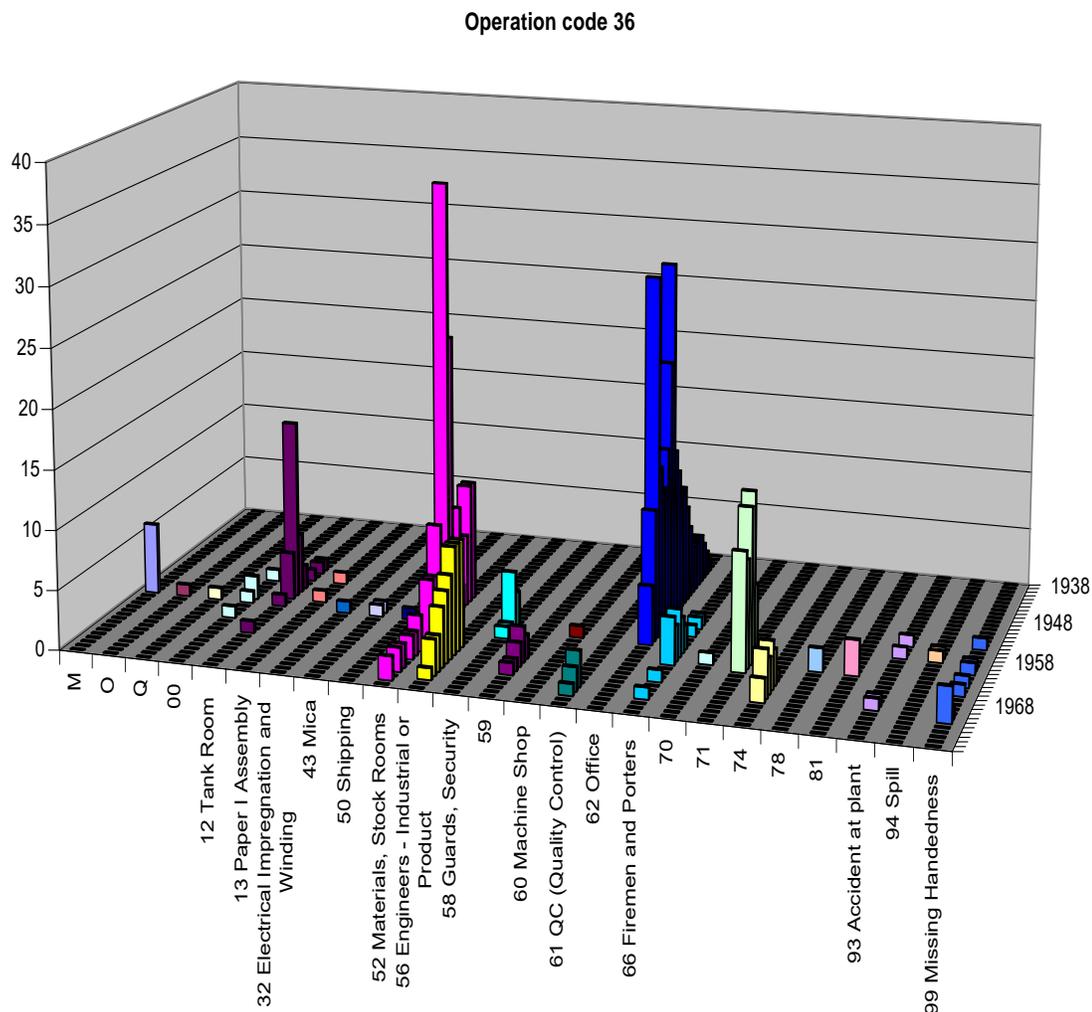


Figure 13 Operation code 36 technicians distributed across departments

Operation code 51 was very wide and included titles such as salvage handler and leaders of sub-assembly. There were at least six identifiable job functions visible for this group. Job titles indicated purchasing, stock work, shipping, and leaders among workers who worked with tools and materials including salvaged material. Needless to say, all of these workers had different job descriptions but also their level of PCB exposures would be very different: from salvage of wet PCB materials to an order typist who worked in an

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office environment. The table below lists all job titles for operation code 51 and the job functions mentioned above.

Table 24 Operation code 51 with job titles and trends

Job titles	Operation	
	code	Job function
leader, sub-assembly	51	Leader
sub-assembly leader	51	Leader
handler, material	51	Material handler
handler, salvage	51	Material handler
material handler	51	Material handler
salvage handler	51	Material handler
buyer	51	Purchasing
car muler	51	Purchasing
dispenser, order	51	Purchasing
material supplier coordinator	51	Purchasing
order clerk or order typist	51	Purchasing
order dispenser	51	Purchasing
storekeeper	51	Purchasing
supplier material coordinator	51	Purchasing
clerk, stock or inventory	51	Stock
coordinator, supplier material	51	Stock
inventory clerk	51	Stock
jobber stock/ material stockroom/ material handler	51	Stock
lead storekeeper	51	Stock
material stockroom	51	Stock
stock clerk	51	Stock
stock jobber	51	Stock
stocker, material	51	Stock
storekeeper - driver	51	Stock
storekeeper lead	51	Stock
freight handler	51	Shipping
handler, freight	51	Shipping
packing, shipping and receiving/ packer	51	Shipping
receiving, shipping, packing	51	Shipping
shipper	51	Shipping
shipping, receiving, packing	51	Shipping
crib attendant	51	Tools
tool crib attendant	51	Tools

Operation code 51

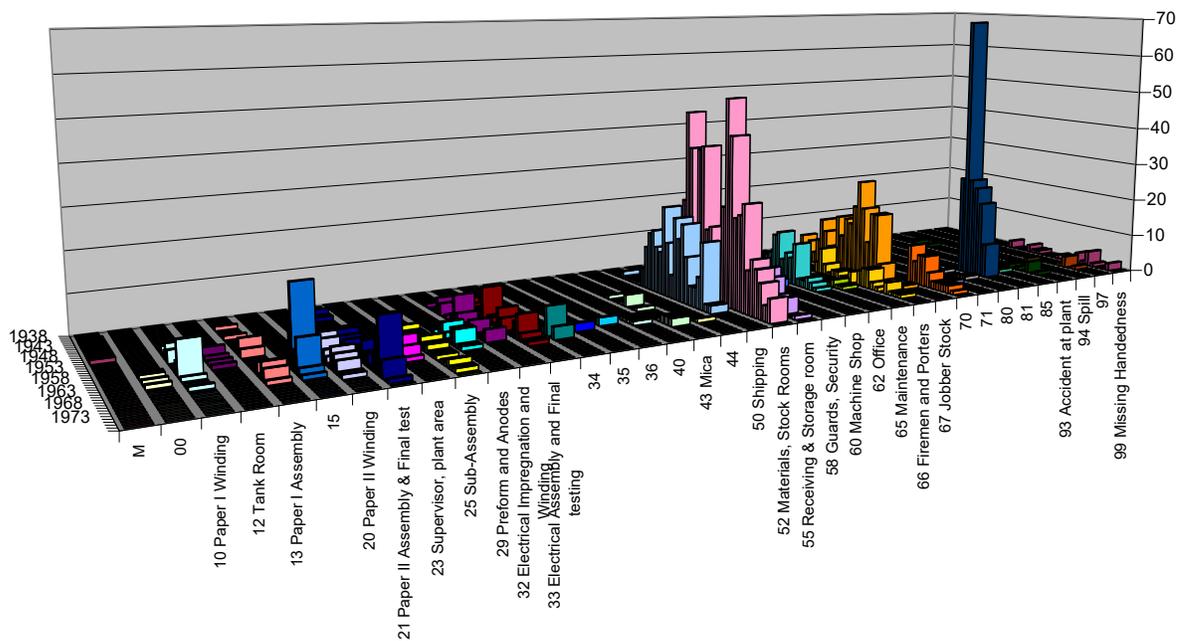


Figure 9 Operation code 51 and its distribution over departments.

Operation code 60 was used as an example to show the extent of variability of PCB exposure due to the disregard of similarity of exposure patterns, and other chemical exposure for some of the operation codes that were grouped together.

Table 19 Operation code 60 with job titles listed

Job title	Operation code
coordinator, training	60
metalizer	60
nurse	60
operator, service	60
service	60
service department	60
service operator	60
service operator winder	60
training coordinator	60
winder service operator	60

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It is hard to understand what a nurse has in common with a service operator or a metalizer, or what a training co-coordinator have in common with a winder service operator.

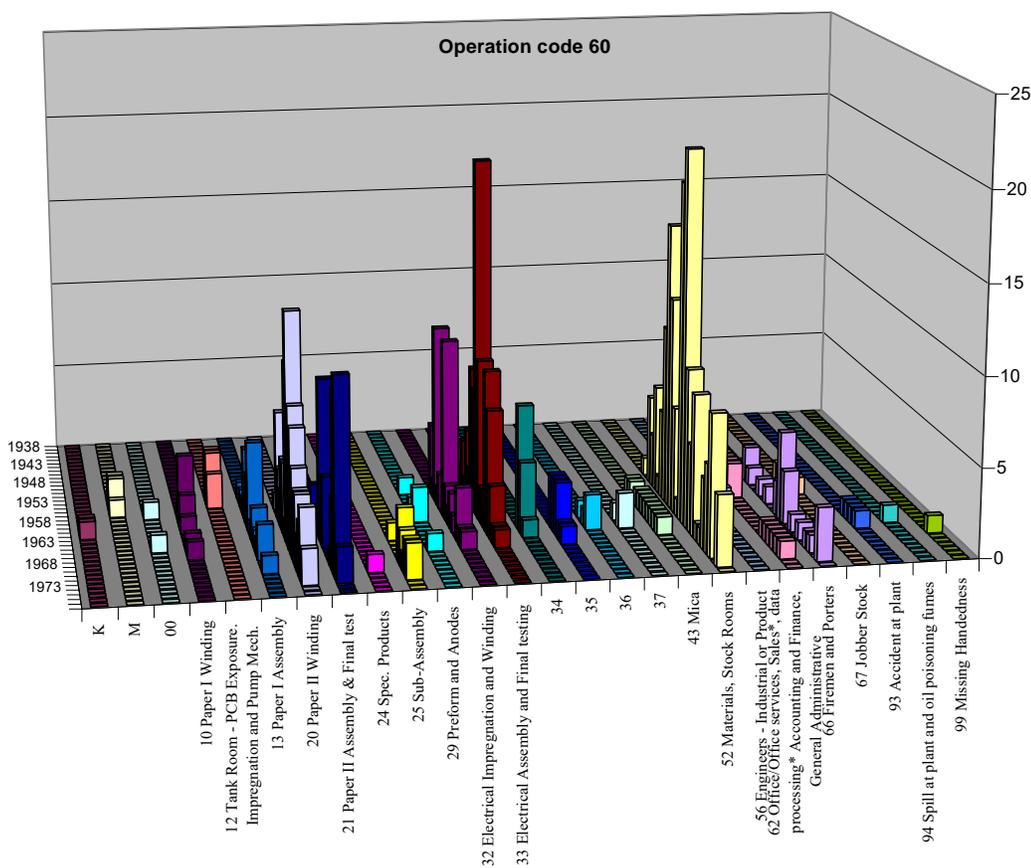


Figure 10 Operation code 60 and its distribution among the departments.

From an exposure assessment point of view it is of convenience to group the machine operator task according to type of machines operated. A “wet” operator was one who operated machines which handled PCBs or other oily chemicals, and would be considered as an exposed group of workers. A “dry” operator would be one that operated machines with dry material such as winding machines for paper or foil. These workers were regarded as non-exposed or lower exposed to PCBs. It was not possible to divide these operators, operation code 62, by the type of machines operated but were grouped in wet or dry machining. The job titles for this operation code are listed in the table below.

Table 20 Operation code 62 with wet and dryness indicated (type)

Job title	Operation code	Type
cut & punch operator	62	dry

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cycle rel operator	62	wet
electrostatic spray operator	62	wet
foot press operator	62	dry
manufacturing operator	62	wet
operator	62	?
operator (multi-operator)	62	?
operator, cycle rel.	62	wet
operator, electrostatic spray	62	wet
operator, foot press	62	dry
operator, manufacturing	62	wet
operator, pump	62	wet
operator, transmitting	62	dry
operator, cut & punch	62	dry
pump operator	62	wet
punch & cut operator	62	dry
spray, electrostatic, operator	62	wet
transmitting operator	62	dry

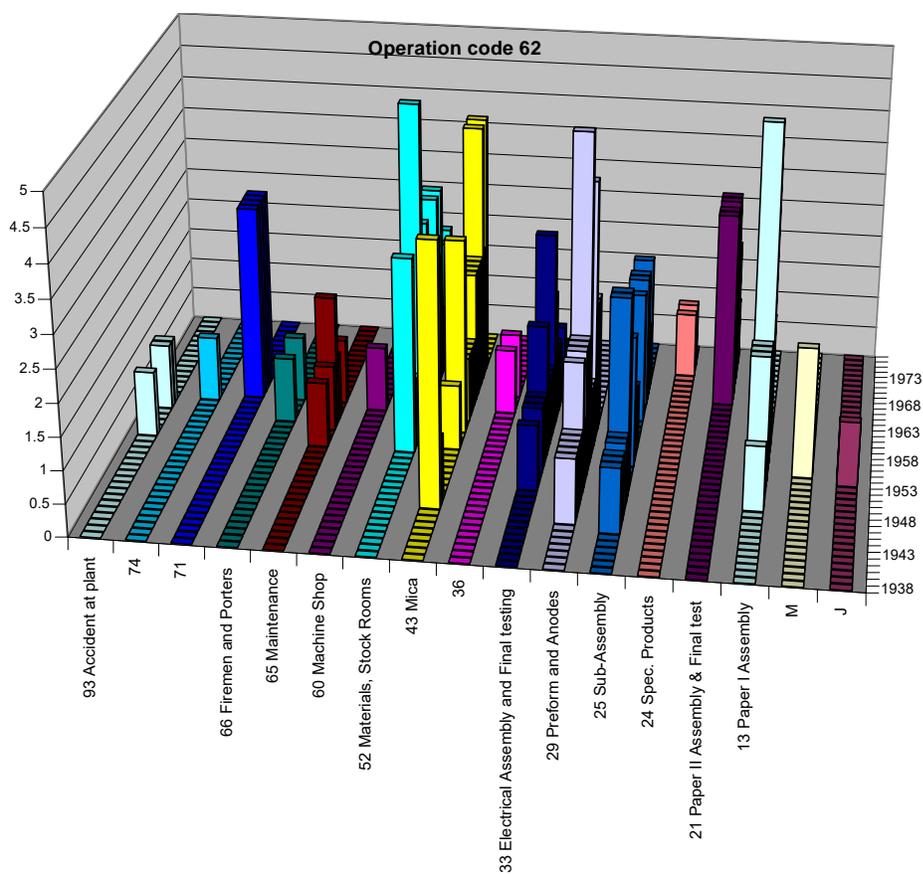


Figure 14 Operation code 62 operators and their distribution among the departments.

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Solderers and welders were exposed to toxic fumes which can cause health effects with or without PCB exposure, and hence were separated out from other operations. Operation code 76 represented solderers and welders. However, it is important to distinguish between welders and solderers in the capacitor manufacturing process with regard to their PCB exposure. PCB exposure patterns for solderers and welders were different because the welders were welding the cans used for enclosing the capacitors, and were usually found in the pre-assembly area, and the solderers were found mainly in the sub-assembly area where the newly impregnated capacitors were soldered shut before they were sent to the degreasing station. The different welder and solder titles are given in the table below

Table 25 Welder and solder titles at Aerovox

Job title	Operation code	
base solderer	76	solder
cover welder	76	welder
fill hole solderer	76	solder
rotary welder	76	welder
solderer	76	solder
solderer, base	76	solder
solderer, fill hole	76	solder
solderer, welder	76	?
T-line welder	76	welder
tab welder	76	welder
welder	76	welder
welder, T-line	76	welder
welder, rotary	76	welder
welder-tab/cover	76	welder
welder/solderer	76	?

Similar to the welders and solderers, the testers were not distinguished from each other based on the capacitor manufacturing process set-up. There were several tests being performed on the capacitor manufacturing assembly line. Two tests which required manual labor was the test for can/coil air tightness where the pre-manufactured non-filled cans were tested in water baths for leaks, and test two where electric conductivity was performed after impregnating, also called final testing. From the operation code, see table below, it is not known whether or not the worker had testing job 1 or 2 above.

Table 26 Operation code 84 for testers

Job title	Operation code
------------------	-----------------------

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administrative team leader	84
HV/EDC tester	84
HV/PF tester	84
leader, team, administrative	84
preselect tester	84
rework, wax	84
team leader, administrative	84
tester	84
tester HV/PF	84
tester/HV/EDC	84
tester, preselect	84

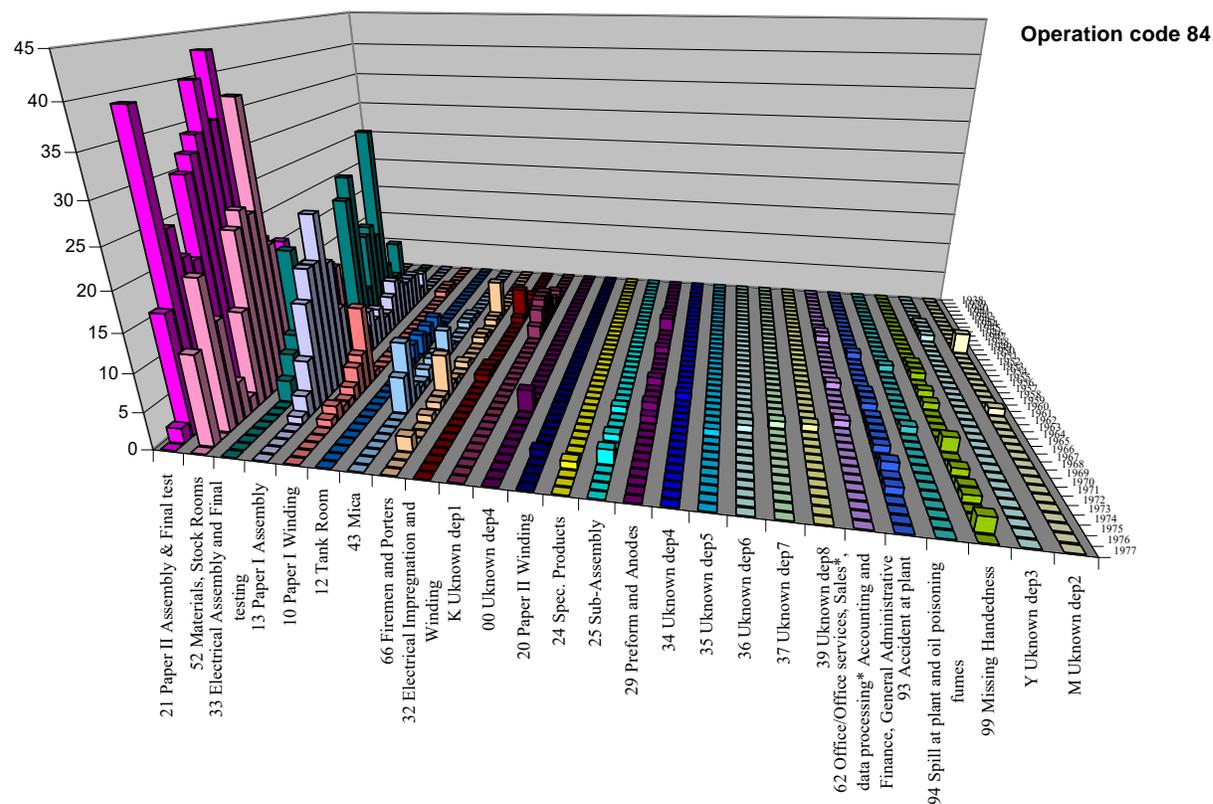


Figure 15 Operation code 84

At Aerovox an impregnator had different definitions. A worker who impregnated the electrical material especially paper being rolled into coils for insertion into the metal cans in the pre-assembly had the operation code “impregnator”. Also, the worker who flood-filled the capacitors with PCBs in the oven area were also labeled “impregnator”. The work-histories do list departments with these operations. However,

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Aerovox did not update the department field as often as the worker changed jobs. The solution was to find impregnators who belonged to category 5 Electrical work and category 26 treat room.

of operation codes including the word "impregnation": 8

impregnation/filter * filter/impregnation / operator
filterman? grade 8
packer and impregnator [ONLY FOR ASSEMBLY DEPTS] * impreg. & packer
impregnator
tester & impregnator
impregnator & dispatcher & degreaser
impregnator & kettle op
impregnator, tester & stamper

of department codes listed for the impregnation operation codes: 10

Paper I Assembly
Paper II Winding
Paper II Assembly & Final test - PCB exposure
Sub-Assembly
Preform and Anodes
Electrical Impregnation and Winding
Electrical Assembly and Final testing
Mica
Materials, Stock Rooms
Firemen and Porters
Electrolysis (35)
Unknown (37)

Seen from the listing of department code descriptions above there are several departments that would not have had an impregnator present. These were *Preform and Anodes, Mica, Materials and Stock Rooms, Electrolysis, Firemen and Porters.*

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There were one unknown category that we cannot assess. This left 6 possible departments for which impregnators could be found: Paper I Winding, Paper I Assembly, Sub-Assembly, Electrical Impregnation and Winding, and Electrical Assembly and Final testing all had operation codes involving electrical testing. This was deduced from other operation codes listed within these department codes. Henceforth these department codes were categorized together in Category 5 Electrical work (marked **yellow**).

Paper II Assembly & Final test must have been the flood-filling of capacitors with PCBs. These workers were far more exposed to PCBs than electrical workers, and belong to another category – Category 26 Treat room (marked **green**).

Paper I Assembly (13)

Paper I Winding (20)

Paper II Assembly & Final test - PCB exposure (21)

Sub-Assembly (25)

~~Preform and Anodes (29)~~

Electrical Impregnation and Winding (32)

Electrical Assembly and Final testing (33)

Mica (43)

~~Materials, Stock Rooms (52)~~

~~Firemen and Porters (66)~~

~~Electrolysis (35)~~

~~Unknown (37)~~

Operation code 39 “impregnation/filter * filter/impregnation / operator” were listed in 8 different departments (12,13, 20, 25, 29, 32, 52, and 66). The department codes were contradictory. The chart below shows the distribution of occurrences in different departments over time.

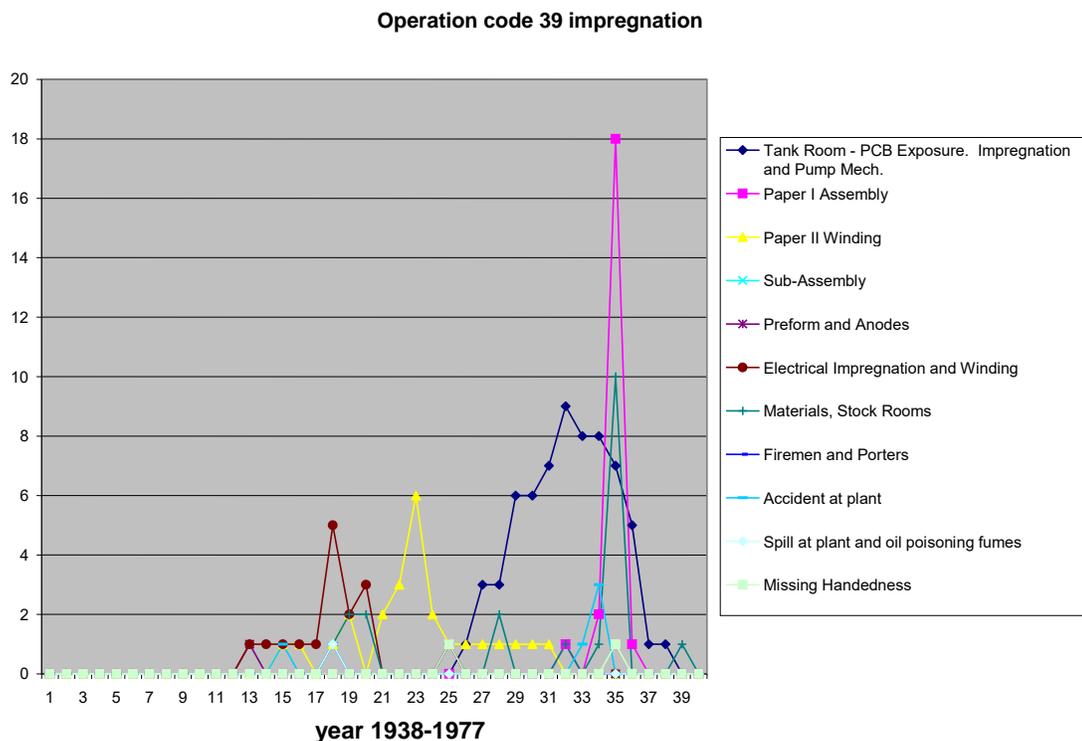


Figure 16 operation code 39

From the chart above we know that the following department code: missing handedness, spill, accident, firemen & porters, and materials & stock room did not have an impregnator present. Paper one assembly had one year with 18 occurrences which could be a data entry (likelihood of employing 18 people to the same department for only one year 1972) was considered low. Electrical impregnation and paper II winding had occurrences of impregnation code in two different time periods, 1955-1957 and 1959-1960, respectively. The occurrence of impregnators in the Tank room occurred over several years 1963-1975. Operation codes were more reliable than the department codes, hence operation code 39 were assigned category 26 – Kettle & oven operators (formerly named tank room).

Operation code 48 “Packer & impregnator” was given a comment in the work histories: “only for assembly departments” from previous investigators. This comment was interpreted as for pre-assembly before flood-filling with PCBs because they usually appeared in the pre-assembly departments. From the chart below, notice that department 21 is mentioned which was the paper II assembly and Final test (PCB exposure).

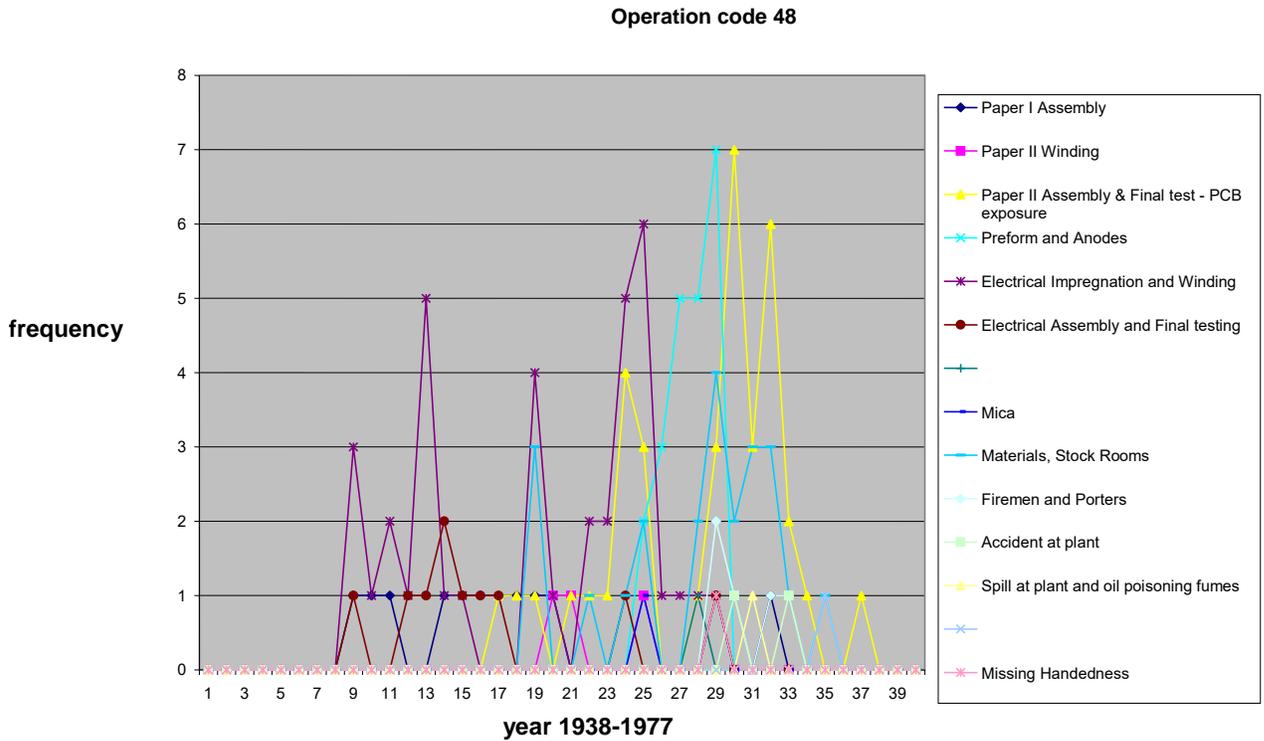


Figure 17 operation code 48 packer and impregnator (only for assembly departments).

There were 14 departments listed with operation code 48 where 8 departments were dismissed as not plausible for an impregnator to have worked. This left 5 plausible department codes for operation code 48; 13-paper I assembly, 21-paper II assembly and final test, 29-preform and anodes, 32-electrical impregnation and winding, and 33- electrical assembly and final testing. Four of the five departments with frequencies ranging over several years were in the electrical department. The conclusion for operation code 48 was that all unique job codes with operation code 48 was categorized in category 5.

Operation code 9C impregnator was listed in 10 department codes for which a very distinct frequency pattern could be seen, see chart below. The frequency of occurrences for department 32 Electrical Impregnation and winding was dominating. The C9 operation code was categorized in category 5. (Again as a reminder the operation code was more reliable than the department code and hence all the operation codes were categorized together.)

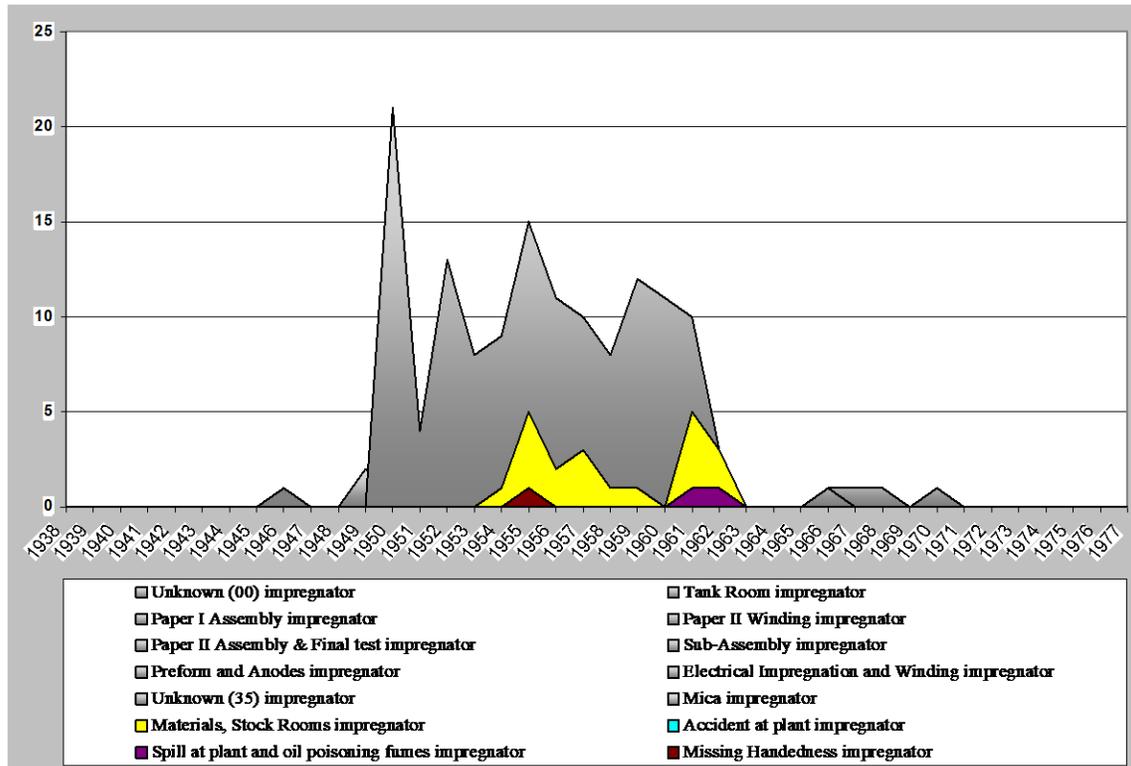


Figure 18 Operation code C9. Notice the dominating department electrical impregnation and winding.

Operation code P1 tester & impregnator occurred in three department whereas one was not likely. The two departments were contradictory; paper I assembly (13) (low exposure) and paper II assembly (21) (high exposure). The frequency occurrence recorded for these two jobs were once in 1947 for department 13, and twice in 1966. The work histories were pulled and three workers were identified. The worker with the 13P1 job code was 7 months in this job code and moved to 3304 electric assembly final testing as a wax assembler. This person left and came back three years later in 1304 Paper 1 assembly wax assembler which was believed the first entry should have read (instead of 13P1). For the two workers recorded with the job code 21P1; one was recorded in this job code for 2 ½ months and nothing prior or post this code, the second worker was recoded in this job code the exact same dates and timeframes, but came back about 3 years later as 2184 team leader/ high voltage tester but strangely enough in the PCB exposure area Paper II assembly which was unlikely since most of the high voltage testers were mainly located in the electrical testing area. Conclusion drawn: the P1 operation code was categorized in category 5.

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Operation code P4 impregnator & dispatcher & degreaser was only recorded in one department paper II assembly as expected, and categorized in category 26.

Operation code Q9 impregnator & kettle operator were recorded in three different departments but all three departments were electrical departments, hence Q9 was categorized in category 5.

Operation code T8 impregnator, tester and stamper were recorded in two departments whereas one department (materials and stock room) was not plausible for an impregnator. The other occurrence was in department paper II assembly. The work histories for this one worker was pulled and showed 5 weeks in this job code nothing prior nor post this job code. This category was categorized in category 5 due to the stamping on capacitors was thought to be done in the pre-assembly. This job code could potentially have been put in category 26. This change would not have had an impact on the cumulative dose exposure estimates.

Table 27 Operation code Impregnator

job code	dept	oper	dept desc	oper desc	Category
1339	13	39	Paper I Assembly	impregnation/filter * filter/impregnation / operator	26
2039	20	39	Paper II Winding	impregnation/filter * filter/impregnation / operator	26
2539	25	39	Sub-Assembly	impregnation/filter * filter/impregnation / operator	26
2939	29	39	Preform and Anodes	impregnation/filter * filter/impregnation / operator	26
3239	32	39	Electrical Impregnation and Winding	impregnation/filter * filter/impregnation / operator	26
5239	52	39	Materials, Stock Rooms	impregnation/filter * filter/impregnation / operator	26
6639	66	39	Firemen and Porters	impregnation/filter * filter/impregnation / operator	26
1341	13	41	Paper I Assembly	filterman? grade 8	26
5241	52	41	Materials, Stock Rooms	filterman? grade 8	26
1348	13	48	Paper I Assembly	packer and impregnator [ONLY FOR ASSEMBLY DEPTS] * impreg. & packer	5
2048	20	48	Paper II Winding	packer and impregnator [ONLY FOR ASSEMBLY DEPTS] * impreg. & packer	5
2148	21	48	Paper II Assembly & Final test - PCB exposure	packer and impregnator [ONLY FOR ASSEMBLY DEPTS] * impreg. & packer	5
2948	29	48	Preform and Anodes	packer and impregnator [ONLY FOR ASSEMBLY DEPTS] * impreg. & packer	5
3248	32	48	Electrical Impregnation and Winding	packer and impregnator [ONLY FOR ASSEMBLY DEPTS] * impreg. & packer	5
3348	33	48	Electrical Assembly and Final testing	packer and impregnator [ONLY FOR ASSEMBLY DEPTS] * impreg. & packer	5
3748	37	48		packer and impregnator [ONLY FOR ASSEMBLY DEPTS] * impreg. & packer	5
4348	43	48	Mica	packer and impregnator [ONLY FOR ASSEMBLY DEPTS] * impreg. & packer	5

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5248	52	48	Materials, Stock Rooms	packer and impregnator [ONLY FOR ASSEMBLY DEPTS] * impreg. & packer	5
6648	66	48	Firemen and Porters	packer and impregnator [ONLY FOR ASSEMBLY DEPTS] * impreg. & packer	5
13C9	13	C9	Paper I Assembly	impregnator	5
20C9	20	C9	Paper II Winding	impregnator	5
21C9	21	C9	Paper II Assembly & Final test - PCB exposure	impregnator	5
25C9	25	C9	Sub-Assembly	impregnator	5
29C9	29	C9	Preform and Anodes	impregnator	5
32C9	32	C9	Electrical Impregnation and Winding	impregnator	5
35C9	35	C9	Electrolysis	impregnator	5
43C9	43	C9	Mica	impregnator	5
52C9	52	C9	Materials, Stock Rooms	impregnator	5
13P1	13	P1	Paper I Assembly	tester & impregnator	5
21P1	21	P1	Paper II Assembly & Final test - PCB exposure	tester & impregnator	5
52P1	52	P1	Materials, Stock Rooms	tester & impregnator	5
21P4	21	P4	Paper II Assembly & Final test - PCB exposure	impregnator & dispatcher & degreaser	26
29Q9	29	Q9	Preform and Anodes	impregnator & kettle op	5
32Q9	32	Q9	Electrical Impregnation and Winding	impregnator & kettle op	5
33Q9	33	Q9	Electrical Assembly and Final testing	impregnator & kettle op	5
21T8	21	T8	Paper II Assembly & Final test - PCB exposure	impregnator, tester & stamper	5
52T8	52	T8	Materials, Stock Rooms	impregnator, tester & stamper	5

5.4 Manufacturing process

The descriptions of the manufacturing process at Aerovox provided in correspondence with the company, published papers, and surveys show that the process do not differ significantly from the process performed in other capacitor plants in the same time period. The simplest description of capacitor manufacturing is a three-step process; pre-assembly, impregnation, and sub-assembly. From correspondence with Aerovox and from surveys performed at the plant more site specific information was given. Hence, the steps involved in the manufacturing can be sub divided into 11 steps, see table below. In the same table the air measurement results from Kemper and NIOSH (chapter 4) were associated with the corresponding manufacturing steps. It is obvious that both Kemper and NIOSH identified the areas with concerns for high PCB exposure, steps 6-8. The winders, step 1, was probably chosen to obtain a background exposure or non-exposed workers area.

Table 28 The process of making PCB filled capacitors broken down to seven steps.

Process description	Air samples mg/m ³		
	Kemper	NIOSH personal	NIOSH area
1. First, bales of foil and paper were wound automatically. During this operation, connectors were automatically inserted into the bales of smaller capacitors.	0.30	0.17	0.07
2. On another floor the tops for the capacitors were assembled.			0.1 (n=2) [0.06-0.14]
3. Next the connectors were welded to the terminals of the capacitor tops.			
4. The assembled bale and capacitor top is then put into the capacitor can and unit sealed.			
5. Trays of capacitors were then placed into an impregnation chamber. The chamber is heated to approximately 150C and brought under vacuum to remove all moisture from the capacitor.			
6. Next, PCB is pumped into the heated chamber and impregnation of the capacitors takes place. The residual PCB is then pumped out of the chamber, filtered, and reused.	0.5 (n=5) [0.36-0.82]	0.6 (n=3) [0.28-0.85]	0.6 (n=2) [0.49-0.81]
7. Next, the trays of capacitors were put in the "hot room" and the impregnation hole is sealed either by soldering or inserting a rubber plug.	0.5 (n=5) [0.27-0.74]	0.8 (n=2) [0.63-1.06]	
8. The capacitors were then conveyed through a trichloroethylene degreaser to remove any excess oil.		1.26 (n=1)	
9. Next, the capacitor is heated to find any leaks.			
10. If there were no leaks, the capacitor is tested for performance and		0.29 (n=1)	0.32 (n=1)
11. finally packed for shipment. ²			0.09 (n=1)

The air concentration measurements obtained from three different sources and assigned to the 11 steps in the table above cannot be directly compared. There were two different air concentration measurements obtained: area and personal air samples. Also the area air samples were not necessarily sampled from the same spot in the area, more likely they were not. The number of measurements was small, and from this follows that the errors are large. The air concentration measurements were done in identified high exposure areas and only a few in the lowest identified area in the manufacturing areas. The air measurements do not cover departments elsewhere in the plant e.g. shipping, packing, storage room, maintenance, etc.

At Aerovox the large power capacitors were manufactured on the top floor (3rd) with the exception of the impregnation operation. According to NIOSH's walk through survey, this work required much more

² Walk-through survey of Aerovox Industries, Inc. New Bedford, Massachusetts January 5 1976 (report date February 23 1976). Brown.

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manual labor but only mineral or castor oils were used in these capacitors.³ Whether or not castor or mineral oil was used at all times is not clear.

A qualitative dermal exposure assessment was done by Brown and Jones (1981) after their walk-through survey. They assessed dermal exposure for the workers in their three explored departments. They used a grading scale where the workers had a direct contact with PCB, no direct contact with PCB, some direct contact, or indirect and occasional contact. Their dermal assignment can be viewed in the table below which is just a copy from their IH survey report.

Table 29 Qualitative dermal exposure by Brown and Jones (1981)

Work Area	Number of workers	Possible Exposure to PCBs (subjective)
Pump room	3	Direct contact
Impregnation	14	Direct contact
Final testing	60	Some Direct contact
Maintenance	25	Indirect and occasional contact
Winding paper and foil	15-20	No Direct contact
Sub-assembly	40	No Direct contact
Large (power) capacitors	15	No Direct contact
Top making	?	No Direct contact
Packing and shipping	?	No Direct contact

5.5 Industrial hygiene

An IH survey is usually followed by a report with suggestions on how to improve the working environment. Recommendations found in NIOSH's survey report⁴ from Aerovox were interpreted and our inferences from these recommendations are given after the recommendations.

- I. Survey recommendations: "Because of the greater potential for occupational exposure the impregnation, heat soak, sealing and degreasing operations should be located in one enclosed area or separate enclosed areas. This area or areas should be equipped with a negative ventilation system and PCB recovery systems to prevent air contamination of other areas."⁵

³ Walk-through survey of Aerovox Industries, Inc. New Bedford, Massachusetts January 5 1976 (report date February 23 1976). Brown.

⁴ Industrial hygiene survey of Aerovox Industries Inc. New Bedford, Massachusetts. Survey date March 21-23, 1977. Report by Jones et al. dated November 29, 1977.

⁵ Industrial hygiene survey of Aerovox Industries Inc. New Bedford, Massachusetts.

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- ❖ Our inferences: These very PCB polluted areas (heat soak, sealing, and degreasing operations) were open areas, permitting a wide spread of PCBs in the vicinity of these operations. A ventilation system could have been in place but not working properly, or of poor design, or entirely missing in this area. No PCB recovery system was in place.
- II. Survey recommendations “The local exhaust system used in the sealing operation (soldering) would be more efficient if it was extended down closer to the soldering operation. This will prevent air contaminated with PCBs from flowing past the workers breathing zone when the worker bends over. An example of a system could be used is enclosed. However, the specifications needed for your operation would have to e determined.”⁶
- ❖ Our inferences: Obviously the soldering was done manually. Bearing in mind that the soldering was usually done right after impregnation when the capacitors were covered in PCB. The sealing workers had a high dermal exposure but their PCB exposure was increased unnecessarily due to an inadequate ventilation system.
- III. Survey recommendations: “A more efficient method to vent the impregnation chamber would be to pull a vacuum on each chamber before opening the chamber up to remove the impregnated capacitors.”⁷
- ❖ Our inferences: This suggests that the ventilation method for the impregnation chambers was to open the doors after the excess PCB had been drained out of the chambers. The workers working in this area would experience a higher concentration of PCB every time a impregnation cycle was completed.
- IV. Survey recommendations: “The degreaser should be checked for leaks since high concentrations of trichloroethylene were found around the area of the degreaser. After sealing all leaks the ventilation system should be checked to make sure it is properly functioning. If there are faults in the degreaser or ventilation system, engineering measures should be taken to correct the problems.”⁸
- ❖ Our inferences: The degreasing was done by spraying the newly impregnated and sealed PCB capacitors with trichloroethylene (TCE). The PCB would then be dissolved in the TCE. The leaks found could potentially be TCE with dissolved PCB. The ventilation system was probably not working properly when the suggestion of testing its function, giving the workers a false safety.

Survey date March 21-23, 1977. Report by Jones et al. dated November 29, 1977.

⁶ Industrial hygiene survey of Aerovox Industries Inc. New Bedford, Massachusetts.

Survey date March 21-23, 1977. Report by Jones et al. dated November 29, 1977.

⁷ Industrial hygiene survey of Aerovox Industries Inc. New Bedford, Massachusetts.

Survey date March 21-23, 1977. Report by Jones et al. dated November 29, 1977.

⁸ Industrial hygiene survey of Aerovox Industries Inc. New Bedford, Massachusetts.

Survey date March 21-23, 1977. Report by Jones et al. dated November 29, 1977.

There are no data on when ventilation systems were installed in processing areas or how often they were maintained or checked.

5.6 PCB era at Aerovox

Aerovox made few changes in the production process between 1947 and 1977 of their PCB capacitor processing, so exposure levels measured in 1975 may be a good indication of exposure levels in the past. However, the types of Aroclors being used for impregnation over the years changed. In 1975, Aroclor 1016 was used, but Aroclor 1254 and 1242 had also been used in the past although dates are unknown.⁹

5.7 Study population

From a internal NIOSH report by Brown, he specifies: "It appears, from the walk through survey, that Aerovox Industries would provide a good worker population to study the health effects from exposure to PCBs. The plant has a large population, varying exposure levels, and good personnel records going back to 1939. Several problems maybe encountered with this population, as some of the workers who were involved in production of mica, electrolytic, or tubular capacitors may have had exposure to toxic substances. There may be difficulties, however, can be dealt with."¹⁰ "There are presently approximately 104 employees who have direct contact with PCB, while another 40 employees may have some exposure to PCBs but not direct contact."¹¹

The cohort was mainly Caucasian (98%) and hourly workers. Number of employees increased from 1939 and had its peak in 1955 through 1957 with more than 3,600 employees. From 1958 through 1969 the number of workers employed fluctuated between 1,707 to 2,713 workers. Starting in 1970 the number of workers decreased through 1976, from 1,264 to 390 workers. The gender distribution was dominated by the number of female workers which ranged from 64-78% of the cohort except during World War 2 when it peaked to 85%.

⁹ NIOSH trip report from a visit to Aerovox Industries in New Bedford, Massachusetts, January 6 1976 by Brown.

¹⁰ NIOSH trip report from a visit to Aerovox Industries in New Bedford, Massachusetts, January 6 1976 by Brown.

¹¹ Walk-through survey of Aerovox Industries, Inc. New Bedford, Massachusetts January 5 1976 (report date February 23 1976). Brown.

5.8 Layout

A rough layout of the plant was made by Brown (see figure below). The flow of the process as well as the source of PCBs was extremely important during the classification of job codes.

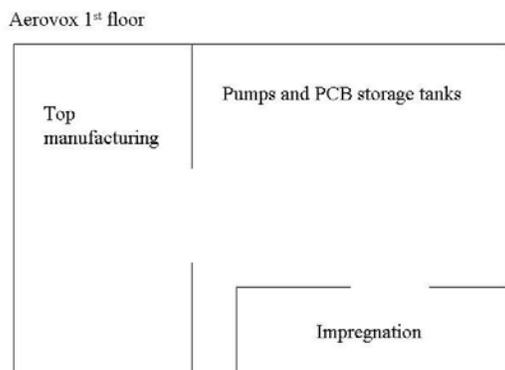


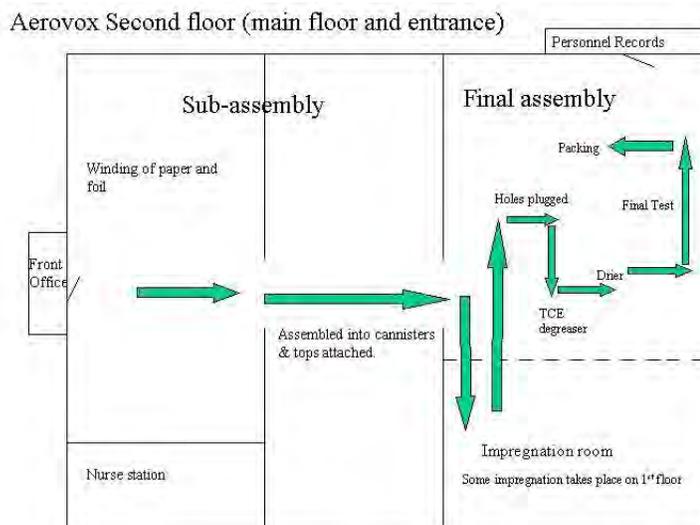
Figure 19 Aerovox 1st floor

On the first floor, tops were prepared in an assembly-line fashion. Also on this floor, but separate from the top makers were the PCB storage tanks, pumps, and some impregnation chambers. The second floor houses sub-assembly impregnation and

final assembly of the small capacitors.

Figure 20 Aerovox 2nd floor

The large power capacitors are manufactured on the top floor (3rd) with the exception of the impregnation operation. This work required much more manual labor but only mineral or castor oils were used in these capacitors.¹²



5.9 Other classification schemes

Brown and Jones (1981) calculated the mortality rate based a classification scheme with workers either in a PCB exposed and non-PCB exposed group. Their criterion for entry into the study was a minimum of three months of employment.

¹² Walk-through survey of Aerovox Industries, Inc. New Bedford, Massachusetts January 5 1976 (report date February 23 1976). Brown.

5.10 Salaried workers

Salaried workers were separated out as far as these job codes could be identified. The main titles identified were: managers, statistician, chemists, and advertising jobs. Exposure for workers in these jobs were expected to be background levels of PCBs.

5.11 Additional chemical exposure

Additional chemical exposure were encountered in the degreasing, soldering, and welding areas. The soldering and welding fumes were sampled for metals, and the following recommendations were made. The OSHA standard for TCE in 1975 was 100 ppm based on an 8 hour TWA. The NIOSH recommended standard and ACGIH TLV were also set at this level.

Pb: The OSHA standard for lead was 200 $\mu\text{g}/\text{m}^3$. There was a proposed OSHA standard of 100 $\mu\text{g}/\text{m}^3$. The NIOSH recommended standard is 100 $\mu\text{g}/\text{m}^3$ and the ACGIH TLV is 150 $\mu\text{g}/\text{m}^3$.¹³ Today the lead (CAS 7439-92-1) NIOSH REL is TWA 50 $\mu\text{g}/\text{m}^3$, and OSHA PEL is TWA 50 $\mu\text{g}/\text{m}^3$.

Zn: The OSHA standard for zinc oxide (reported as zinc) was 5 mg/m^3 (5000 $\mu\text{g}/\text{m}^3$). The NIOSH recommended standard and the ACGIH TLV was also 5 mg/m^3 .¹⁴ Today the zinc is regulated differently according to type of zinc with derivatives and aggregate.

Sn: The OSHA standard for tin was 2 mg/m^3 . The AIHA recommended TLV was also 2 mg/m^3 .¹⁵ Today the NIOSH REL for tin (CAS 7440-31-5) is TWA 2000 $\mu\text{g}/\text{m}^3$ and the OSHA PEL is TWA of 2000 $\mu\text{g}/\text{m}^3$ which is the same as it was in 1975.

It is not known if metals have any synergistic or anti-synergistic effects on PCB body burden. Mixed exposures are difficult to study, and the lack of knowledge in this metal/PCB mixed exposure was carried forward by separating job tasks involving metal and PCB exposure into separate categories.

5.12 Categorization of job codes

The development of the job exposure matrix (JEM) for Aerovox started out by going through all the different job codes that existed for Aerovox. In the work history records there were 64 different department

¹³ Industrial hygiene survey of Aerovox Industries Inc. New Bedford, Massachusetts. Survey date March 21-23, 1977. Report by Jones et al. dated November 29, 1977.

¹⁴ Industrial hygiene survey of Aerovox Industries Inc. New Bedford, Massachusetts. Survey date March 21-23, 1977. Report by Jones et al. dated November 29, 1977.

¹⁵ Industrial hygiene survey of Aerovox Industries Inc. New Bedford, Massachusetts. Survey date March 21-23, 1977. Report by Jones et al. dated November 29, 1977.

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codes not including the fictive ones e.g. pregnancy, leave, laid off, spill and accident, and 732 different operation codes. Combining these two sets information gave unique job codes, a four-digit number, or a three-digit number and a letter which totals to 1684 job codes including the NIOSH assigned department codes.

The frequencies of occurrences these job codes were of interest in order to focus on the more important job code. All job codes are listed with their frequency of occurrences for the Aerovox time period 1939-1977 (see appendix D). This was done to avoid spending time on job codes that did not have any workers. Some of the job codes that did not have any workers – empty job codes – were the result of a worker whom had transferred from other plants to Aerovox which did not have these job codes. If job codes were recorded between 1975 through 1977 then these were not considered because the work histories were microfilmed in April of 1975.

To be able to assess the level of exposure for the individual job code it is essential to know the capacitor manufacturing process in detail because different jobs will entail different exposures. The typical capacitor manufacturing operations with high exposure levels were identified by Brown and Jones (1981), and described in their survey report¹⁶:

Floorman (pre-assembly)	moves parts to areas where they are needed
Solderer	solders impregnation hole
Tanker	loads and unloads impregnation tanks
Tester	tests capacitor to insure it workers properly
Heat soak	takes capacitors in and out of heat soak room
Pump mechanic	operates the pumps, which transfer PCBs throughout the plant

Additional light was shed on these specialized tasks after a NIOSH meeting with Aerovox representatives. Notes from this meeting (1993) described the 'Tank room department' as mainly occupied by the *tank workers, impregnators, and filtering workers*. The tank worker loaded and unloaded the tanks with PCB

¹⁶ Industrial hygiene survey of Aerovox Industries Inc. New Bedford, Massachusetts. Survey date March 21-23, 1977. Report by Jones et al. dated November 29, 1977.

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and the impregnator ran the impregnating cycles. The impregnating job and the filtering job was combined in 1977-78.¹⁷ The tank room was re-named to Kettle & oven operator area.

In 'the testing department' the heat test operator loaded and unloaded oven for testing, racked the ovens, and collected the baskets from the assembly departments. The *fill hole solderer* soldered the filled capacitors in this department and the *dispatcher* coordinated the paperwork between assembly and oven room.¹⁸

If equipment leaks occurred the '*piper*' in the maintenance department would repair the equipment. These '*pipers*' dealt with liquid systems. There were no records of when automation, or other engineering changes were made.¹⁹

When going through the work histories it was discovered that the department codes were not always updated for the worker but the operation codes were frequently updated. The operation code was henceforth used as the benchmark when assessing the category for the job code.

Example. Operation code 'tankman' was found in the winding department. The tankmen were also called tankers. The job description was to load and unload the PCB impregnation ovens. The workers with this operation code would never be found in the winding department.

One of the first problems that arose was when the operation code description was undecipherable. So far, the floorman, fill hole solderer, tanker, tester, heat soak, pump mechanic, impregnators, filtering workers, dispatcher, and piper were identified relative to the capacitor manufacturing process. Other specific job operation identified for this process were a soak cycle operator; who operated the impregnation cycle but not the impregnation itself, a 'bridge tester' who would test the electrical current, and a racker who stacked the capacitors in racks for impregnation and moved them to the degreasing station.

Other operation codes were harder to construe because they were too specific to interpret.

¹⁷ Karen Davis-King Notes 1993

¹⁸ Karen Davis-King Notes 1993

¹⁹ Karen Davis-King Notes 1993

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Examples were pig teller, T-line, Callahan roller/set-up, Heliane seamer, Mullilith operator, clincher, FT slant Bd operator, FF assistant, Final pert, DPH operator, car muler, and auto PF facate. Other operation codes were so general in their description and possibly belonged to several departments.

Examples were technician, engineers and dipp operators.

When the operation codes were too specific or too general then the department code was used simultaneously to determine what category the job code should be assigned. The general operation codes would usually be assigned to their department code. The specific operation codes were reviewed in conjunction with the department code but also with the frequency of occurrence in the department.

Example the Callahan set-up occurred in four departments (disregarding the NIOSH created department codes); Paper II Assembly & Final test, Sub-Assembly, Preform and Anodes, Materials, Stock Rooms, and Firemen and Porters. Their frequency of occurrence is depicted in the graph below.

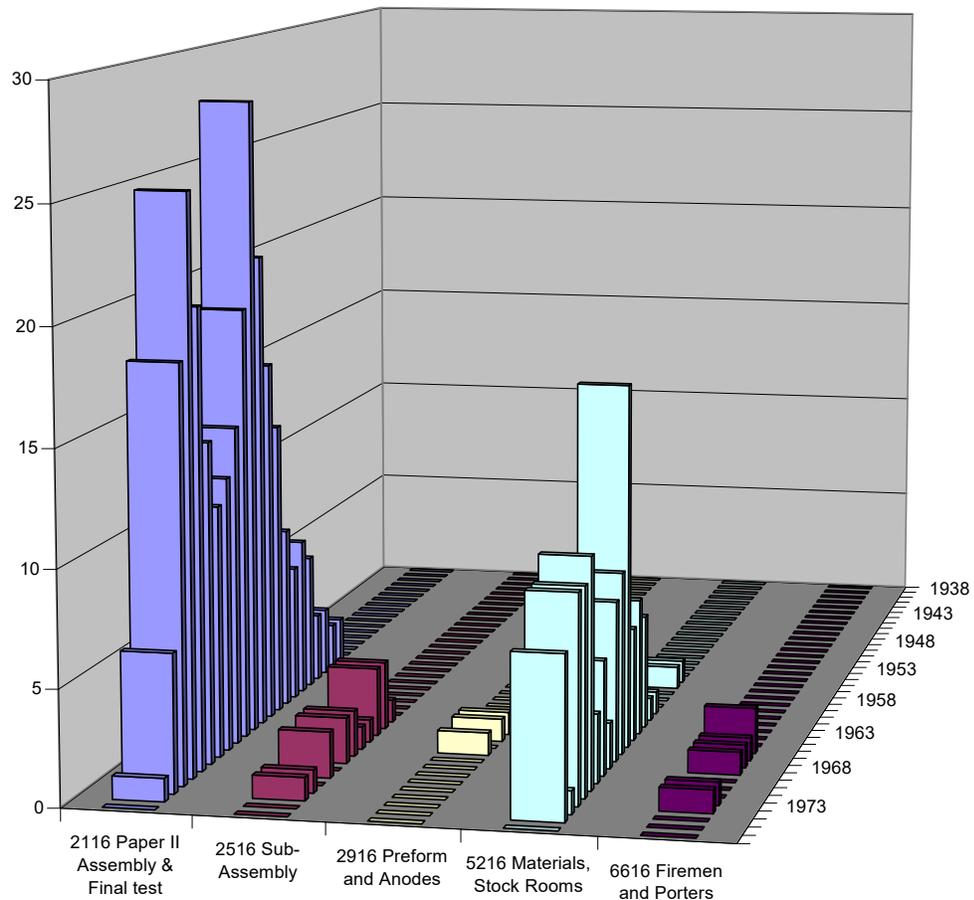


Figure 21 The frequencies of occurrence for Callahan set-up operators.

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From this it was deduced that the Callahan operator performed the work in the Paper II Assembly and final test, Sub-assembly, and in the Materials and Stock room. It is not likely that the Firemen and porters were set-up operators for this machine.

When indefinable operation codes appeared in one of the 17 department codes that did not have any description e.g. 00, K, O, Q, Y, 36, 37, 38, 44, 51, 56, 77, 80, 81, 83, 84, and 87, then they were classified as unknowns.

When assigning each of the job codes an exposure level and a category it is pertinent to remember the layout of the plant, the manufacturing process, the results from the industrial hygiene surveys, and Aroclor use.

Examples:

- ✚ If the job code involved heat soak, sealing and degreasing, it is known that these processes occurred in open areas. The heat soak preceded the sealing station which was found right before the degreasing station according to the layout provided. The job tasks were quite different for these three areas and the inhalation and dermal contact with PCBs were different and hence these job codes did not belong in the same category.
- ✚ If the job code involved soldering, it is known that it was a manual process with insufficient ventilation and with heavy dermal contact. Soldering was done immediately after impregnation and the capacitors were wet with PCB when the solderers handled them. They were in the vicinity from the degreaser and could also experience aerosols of PCB from this station in addition to their own soldering fumes. These solderers could potentially have been exposed to the break down products of PCBs which are known to more potential toxic than the mother compound.
- ✚ If the job code involved impregnation, it is known from the IH survey that the ventilation method for the impregnation chambers was to simply open the doors to the chambers and hence all the workers that had a job in this area were effected.
- ✚ If the job code involved degreasing, it was known from the IH survey that the degreasing machine was very polluted, and at times probably leaking. Additional chemical exposure was the rationale for not grouping these job codes with other job codes.

In addition, the frequencies of occurrence of the job codes enabled us to adjust for Aroclor use which changed over time. If the job code died out sometime in the early years, it was not classified with a new job

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code when Aroclor 1016 were known to be used. However, the level of details did not result in a separation based on solely Aroclor use.

Table 30 gives an example of how the categorization of department 10 Paper I Winding was performed. The job code is given with the description of the operation code that appeared in the work histories. There is a suggestion for what category the particular job code could potentially belong to with arguments supporting the suggestion. It is seen that department 10 was divided into 15 different categories. A majority of these job codes ended up in the pre-assembly category which encompasses a large number of job codes – a not so specific category. Salaried workers were sorted out to their respective offices. Electrical workers and welders were separated out because of their additional chemical exposures, but not grouped together because their chemical exposure would be quite different. Maintenance workers were also separated out because of their frequent direct encounter with PCB polluted surfaces. See table below arguments for each job code (department and operation codes).

Table 30 Department 10 Paper I Winding with operation codes and their category assessment is shown as an example in the table below. For the other departments see Appendix.

Job				
code	Department	Operation code description	Category	Arguments for category placement
	Paper I			Since these non-identified operations are in the Winding department it is likely that they do some type of pre-assembly work.
1000	Winding	No listed Wax assembler * tantalum operator / assembler * oil assembler * met. misc. assembler * met. & filter assembler * inspector, assembler * filter & met. assembler * assembler/ oil * assembler/ mica * assembler/ met. Misc. * assembler/ met. & filter	Pre-assembly	
1004	Winding	Paper I * assembler / wax * assembler / inspector	Pre-assembly	This job operation code is very wide ranged. However, most of the job codes are related to the pre-assembly of the capacitor. There are no winding jobs in the operation code and hence this is put not in the winding category but in the pre-assembly category.
1005	Winding	Paper I Plastic mixer * plastic assembler * paper assembler * mixer, plastic *	Pre-assembly	Plastic took over the purpose paper used to serve in the capacitor. It is

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		Assembly/ hi voltage * assembler/ plastic/ plastic mixer * assembler/ paper ii * assembler/ paper 1		likely that these workers had a similar job in the pre-assembly area as the paper-winding workers before them.
1008	Paper I Winding	instr autoinsulate * Autolete (?) * Autoinsulat instr	Pre-assembly	This sounds like a new machine was installed for insulating the foil (either with paper or with plastic) According to meeting minutes Aerovox did not use a ball plug to cover the whole, only soldering was used. This might mean something else (only 1 person in 1955).
1010	Paper I Winding	Ball plug Worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Pre-assembly	These operators were hourly paid office workers. I do not believe these were assigned to Paper and Winding department; hence these get their own category.
1011	Paper I Winding		Office worker	
1014	Paper I Winding	Tester, bridge * bridge tester	Electrical tester	A bridge is an electrical device and the tester is checking current. This operation is somewhat 'foggy'. I believe the SO4 stems from sulfuric acid and hence to clean the metal before welding or soldering. Since these are already put in Paper and Winding department this would fit in the pre-assembly before welding cans.
1015	Paper I Winding	IMC?IMS04 burn?in * burn?in IMC?IMS04	Pre-assembly	An expediter could also be called a dispatcher.
1037	Paper I Winding	Expediter	Dispatcher	

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				The only testing done in paper and winding would be test the paper for conductivity, or the bushings mounted before sending off the prefabrication to impregnation.
1042	Paper I Winding	Testing (final pert.) * final pert." (Testing?)	Electrical tester	A non-specific job task that requires minimum of training. Since this operation is set to the paper I winding department it is categorized as a pre-assembly job.
1044	Paper I Winding	Worker, general * production * helper, general * general worker * general helper	Pre-assembly	The operation description sounds like a maintenance job. It is uncertain why HV (high voltage) repair workers are in the same operation code.
1045	Paper I Winding	Repair, HV * manager/ maintenance * maintenance, general * maintenance manager * maintenance * lugs., ground * HV repair * ground lugs. * general maintenance	Maintenance	The heat test or also called heat soak is in the impregnation department. This operator is not doing the groundwork, but only inspects the heat test. The worker might come in contact with the impregnation oil and hence is called a wet inspector.
1050	Paper I Winding	QA inspector / (AF PT inspection) * inspector, heat test * inspector * heat test inspector	Wet inspector	
		supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? Driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly *	Material	Material handler or as they are also called by Brown a floorman, are usually moving around within the whole plant. Their exposure might fluctuate with what department and job they were currently working on; hence these have their own title Material handler (operation 51).
1051	Paper I Winding	lead storekeeper * jobber stock/ material stockroom/ material handler room	handler/ stock	

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		* inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler		
		Tester, foil * slitter, foil * slitter * setup, power press * riveter * power press setup * power press * operator, machine * machinist * machine operator / ballast cover * foil tester * foil slitter * ballast cover / machine operator	Foil	The winding of the foil and paper together is usually done after the foil has been cut to size and checked for irregularities. The less regularities the better the conductivity. These operations include several metalworking jobs and hence are given the description foil. Assembling is done in several steps. This step is placed in the paper and winding department and hence belongs to pre-assembly.
1056	Paper I Winding	Motorized assembler * mechanic * assembler, motorized Training coordinator * service operator * service department * service * operator, service * nurse * metalizer * coordinator, training	Pre-assembly	
1060	Paper I Winding		Training	The operation sounds independent of the department. A racker is the worker who places the pre-fabricated capacitors on trays or baskets before impregnation. There might be a racker in the paper and winding department, but the workers job would be more similar to the racker in impregnation. This worker is an office worker scheduling the production, not necessarily in the paper and winding department.
1069	Paper I Winding	Racker	Racker/Floorm an	
1074	Paper I Winding	Scheduler / planner * planner	Planner	

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		Welder? tab/cover * welder/solderer * welder, T-line * welder, rotary * welder * T-line welder * tab welder * solderer, welder * solderer, fill hole * solderer, base * solderer * rotary welder * fill hole solderer *		These workers were likely welders because they were in the paper and winding department where boxes were welded together.
1076	Paper I Winding	cover welder * base solderer	Welder	Supervisors were usually Salaried workers assigned a department. They did not perform the same job as the rest of the department.
1078	Paper I Winding	Supervisor/ foreman * foreman/supervisor * foreman	Supervisor	Assume this operation is part of pre- assembly since it is in the paper and winding department.
1081	Paper I Winding	Worker, table * table worker * tab cutter * tab. assembler * assembly tab	Pre-assembly	
1083	Paper I Winding	Work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inspector/leader, work	Dry Inspector	The operation code indicates a leader, since the department is paper and winding, it is assumed that the inspector is working in the dry areas of the plant
1084	Paper I Winding	Tester/ HV/EDC * tester, preselect * tester HV/PF * tester * team leader, administrative * rework, wax * preselect tester * leader, team, administrative * HV/PF tester * HV/EDC tester * administrative team leader	Electrical tester	Several of the descriptions of the operation give an indication that these workers test electrical equipment.
1087	Paper I Winding	Trainee	Training	The operation sounds independent of the department.
1089	Paper I Winding	Tuber/ tube cutter * teller, pig * pig teller * cutter, tube	Pre-assembly	Cutting material to fit sounds like a pre- assembly job. Tubular capacitors were also made at Aerovox. This is just an operation for a worker working with this specific capacitor design.
1090	Paper I Winding	Tubular assembler * assembler, tubular	Pre-assembly	

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1095	Paper I Winding	Winder? all types * respooler * Hunt machine (winder) * Hilton machine (winder) * clincher	Winding	Different winding machine would give different job operation descriptions. All are winders.
10A3	Paper I Winding	Stitcher, cut * stitcher, anode * cut stitcher * cut & stitch * anode stitcher	Electrical tester	The only description part that may imply that this is an electrical worker is the anode part. Assume the stitching has some electrical relevance.
10B1	Paper I Winding	Worker, bench * bench worker	Winding	This is another operation code for the same description and hence is set to belong to the department.
10C4	Paper I Winding	Time study	Planner	It is believed that time study is just another description for planner or scheduler
10E1	Paper I Winding	FT slant bridge operator	Electrical tester	Another electrical bridge tester. Have several job duties for one operation description. Choose to go with dispatcher since there exists several of those.
10E2	Paper I Winding	Service operator & dispatcher	Dispatcher	Service is often used to refer to specialized maintenance personnel.
10E4	Paper I Winding	Service setup man	Maintenance	The capacitors are made on an assembly line. This operation is believed to be in the paper and winding department.
10F6	Paper I Winding	Assembler & tester	Pre-assembly	Description is very clear and hence this is a foil job.
10J6	Paper I Winding	Foil respooler	Foil	Maintenance would include service and waste section
10J9	Paper I Winding	Waste control	Maintenance	This operation is not connected to department.
10M6	Paper I Winding	Statistician	SAL	Such a general operation description could belong in any or all departments.
10N2	Paper I Winding	Capacity control	Winding	Therefore this capacity control is assigned to the winding department.
10N8	Paper I	Finisher	Pre-assembly	A finisher sounds like a worker that

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	Winding		gets the product out of the division. Usually this refers to when the capacitors are painted and are ready to be shipped out. Tab is something a worker hooks on and sounds like an assembly job. Since it is given to the paper and winding department it is likely a pre-assembly job.
	Paper I		
10S3	Winding	Tab reinforcement	Pre-assembly job.
	Paper I		
10S9	Winding	Machine setter	Machinist

After assessing the exposure similarities for each of the job tasks, a total of 29 categories arose:

Table 31 Aerovox categories

1	Checking/Receiving/Packer	15	Office
2	Degreaser	16	Paint /sealant
3	Driver	17	Post-assembly
4	Dry Inspector/operator	18	Pre-assembly
5	Electrical work	19	Repair/Salvage
6	Engineer	20	Research lab
7	Fireman	21	Salary
8	Stock material workers	22	Security
9	Large capacitors	23	Shipping
10	Machinist	24	Solderer
11	Maintenance	25	Kettle & oven operators
12	Process control	26	Unknown
13	Material handler & racker	27	Welder
14	Metal coating	28	Wet inspector/operator
		29	Winding

In addition there are four more categories that eventually will disappear, and those are 31 Illness, 32 Layoff, 33 Pregnancy, and 34 Leave.

5.13 Ranking of categories

After categorizing all the job codes, the rating or ranking of the categories' exposure was performed. The ranking is done based on two routes of entry to the body PCB could potentially have via inhalation and dermal contact. These exposures are rated high, medium, or low relative to background exposure of PCBs in the plant. The reference point chosen was salaried and office workers, and was set as background

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exposure level. The exposure level is based on the category arguments which again are grounded in the industrial surveys, Aerovox plant layout, air measurements, etc.

Another factor that could potentially cloud the assessment of the exposure level would be additional chemical exposure. This factor was given when appropriate. It is not known and hence not indicated whether the additional exposure will enhance or reduce the PCB uptake.

In the table below the relative qualitative assignments for each category and intensity are shown. Also the frequency of the exposure is assessed qualitatively as a continuous exposure or an intermittent exposure.

When the intermittent exposure is set then there is a second intensity and frequency that covers the rest of the work day.

Table 32 Category number, name and description

Cat	Cat.name	Cat. Description
1	Checking/Receiving/Packer	Workers in this category usually had multiple job operations listed. They were either in the front end of the line or in the last end of the production line usually handling packages which were wrapped or capacitors that were ready for shipping. Their similarity lays in the handling of dry goods and the area of the plant where they were working - e.g. not near the processing operations. The only way they could get in direct contact with PCB would be during spills or accidents.
2	Degreaser	Degreasers were separated out because there are neuropathological, and hematological issues relating to TCE exposure that could possibly interfere with findings in later epidemiological analysis, knowing PCB and TCE might have some similarities regarding their toxicological pathways. The degreasers were exposed to PCB as well due to the fact that they rinsed off PCB collected on the outside of the capacitors after PCB impregnation.
3	Driver	Truck drivers and other drivers were classified together because their PCB exposure pattern was believed quite different from other workers at the plant. They usually tanked the tanks with PCBs from cars and were likely to get PCBs on their hands which in turn was transferred to the steering wheel of the truck, and hence the PCB dermal exposure would be extensive over time due to build-up and frequent touching the contaminated area (steering wheel).
4	Dry Inspector/operator	Dry inspectors and dry operators were categorized together. The operator was a worker had a more 'hands on' type of job activity. Examples were electrostatic spray operator; operate different machines (drill press, cutting, tab, insulating, inserter, compounding), kiln operator. Dry inspectors would be found in the same general area but would not necessarily operate the machine, just set it up and/or inspect the machine performance.

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5 Electrical work	<p>There were several steps in the manufacture of capacitors where new electrical equipment would be assembled and the electric performance would be tested. The electrical components were attached when the paper and foil were wound together, after the coil had been assembled to the metal box, and after impregnation. The final electrical test was when the capacitors were fully assembled. The electrical equipment was assembled at the plant - several operation codes were bridge testers or HV/PF testers, anode sticher, and electricians. There were two different impregnation procedures involved in the manufacture of capacitors; one was impregnating the paper and foil to avoid disruption in the electrical current. Obstacles in the paper and the foil would increase the resistance, and hence decrease the performance of the capacitors. The other impregnation procedure was when the capacitors were filled with PCBs - one of the most exposed jobs at the plant. The operation code in conjunction with the department code gave away type of impregnation job, and most of the classifications were done this way. However, the department codes did not always reflect the operation code and hence the classification of impregnation was not known but classified as a category 5 if it was believed to be a pre-impregnation, and a category 25 if it was believed being a post-impregnation.</p>
6 Engineer	<p>Engineers were found in very many departments, obviously different types of engineers. All engineers had the same operation code (35) and hence were grouped together. The engineer was likely a salaried worker and did not spend most of their time in the plant manufacturing area but had other duties as well that kept him/her away from this area and to an office.</p>
7 Fireman	<p>Firemen had their own job code and had nothing to do with the manufacturing of capacitors itself. The firemen and porter had their own department codes (66), and firemen had in addition their own operation code (43). Since most of the chemicals in the plant were non-flammable, the number of workers in this category was likely porters rather than firemen. Needless to say both operations involved low levels of PCB exposure.</p>
8 Stock materials workers	<p>There was a department called jobber stock and an operation code at Aerovox with the description jobber stock. It was assumed that this department was almost the same as a stock room. There was also a materials, stock room department which was assumed had the same type of exposure as the jobber stocker.</p>
9 Large capacitors	<p>Large capacitors were made on the 3rd floor at Aerovox and often involved other oils than PCB. These workers were therefore categorized together due to their similarities in work tasks and location.</p>
10 Machinist	<p>This category was made up of a diverse group of workers, all they were believed having in common were the fact that they were working with machines, either creating new parts, maintenance of old machines, or setting up new machines. This group of workers was initially grouped into two; machinist and tool & die, but we do not have enough information to separate the two.</p>
11 Maintenance	<p>Maintenance workers had multiple tasks. From the operation descriptions these workers were called service personnel. From what was learned from the department/operation codes the service workers were located in different departments. However, the work would probably be pretty much the same in the different departments and hence were grouped according to operation code.</p>
13 Process control	<p>This category was made up of workers located in the processing part of the plant e.g. where the impregnation took place.</p>
13 Material handler & racker	<p>Material handlers' job description was to move materials around where needed. These workers could potentially belong to one department, but would move around and not necessarily stay within one department, hence these material handler (operation code 51) were categorized into one category. In Brown's study we believe these workers were classified as floorman, but only selective workers were included in the study.</p>
14 Metal coating	<p>Sprayer, zinc/ lead /copper, general worker, hot tinner, electrostatic spray operator, and finisher were all operations where the worker had an additional exposure - metal exposure. The metal exposure could potentially be extensive because it was sprayed or heated and treated hot. These workers were found in the pre-assembly where the metal boxes or cans would be treated against rusting before they were impregnated with PCB, or in the sub-assembly department where different from mainstream capacitors were made, and in the last stages of the mainstream assembly of capacitors where the capacitors went through 'finishing'.</p>
15 Office	<p>Office; The distribution and sales would be a salaried job. At the maximum they had 10 workers, but with the job operation not listed. The distribution and sales department was defined from two WH in 1966 and 1967. A dispatcher would be a worker that sends out trucks, or cars according to a schedule. A drafter designs technical equipment. Planners would be the workers that worked out a schedule for how many capacitors can be produced over time and the storage capacity and fast they will sell according to orders coming in. The Quality Control (QC) personnel were included in the office category with the above-mentioned professions and with supervisors and training personnel. There were no job descriptions for trainers, QC, or supervisors.</p>

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16	Paint /sealant	Paint and sealant workers had additional organic chemical exposure and hence were separated out. These workers would paint the finished capacitors. It was unclear what the sealant worker would do but some of the job operations had painter, sealant combination, and based on this they were in the same area of the plant, maybe doing both operations.
17	Post-assembly	Post assembly was defined as the handling of the capacitor from impregnation with PCB to final capacitor product. Workers in the post assembly would be handling PCB contaminated capacitors of larger or lesser degree.
18	Pre-assembly	The pre-assembly category was made up of several department like mica, pre-assembly and sub-assembly. The primary link between the three was that they were combining capacitor parts - a pre-fabricate, which in turn was sent off to impregnation. Millwright operators were also put in this category.
19	Repair/Salvage	The rejected non-functional capacitors end up in the repair and salvage area. There was no department defining this area so most of the job operation with description of this kind was grouped in this category.
20	Research lab	All lab workers were grouped into this category, totally disregarding their department code which I believe was wrong. It was not likely that there would be a lab set up in different departments.
21	Salary	Salaried workers were identified in the work history by a weekly/monthly pay, not paid by the hour. These were workers in advertising, managers, statisticians, and chemists.
22	Security	Security workers will patrol the plant and call when accidents/spills would happen. They were never part of production and were singled out due to this.
23	Shipping	The shipping category includes workers who made freight possible which involves paperwork and handling forklifts, trucks etc to physically move the capacitors on trucks to be shipped out.
24	Solderer	Welders were tried separated out from the solderers. From the description of the process it was known that the solderers solder the filled capacitors shut hence it was a post-assembly job and welding was a pre-assembly job. The solderers were singled out as one category due to the additional exposure to metals.
25	Kettle & oven operators	Oven operators, rackers, floormen and tank room operators were all grouped together. Their similarities were working near or with the PCB impregnation oven which was a very wet job.
26	Unknown	Unknown category - department code and operation code missing.
27	Welder	Welders were tried separated out from the solderers. From the description of the process it was known that the solderers solder the filled capacitors shut hence it was a post-assembly job and welding was a pre-assembly job.
28	Wet inspector/operator	The inspectors and operators were grouped into dry and wet e.g. working with PCBs or not. The wet inspectors were grouped together with the wet operators. Even though inspectors will not had as much hands on as the operators.
29	Winding	The winding category includes winders but also foil spoolers. The foil and the winding department needed to be clean to avoid particles getting caught and weaken the insulation of the metal coil and hence were categorized together.

Table 33 Inhalation exposure intensity and frequency rating

Cat	Cat. name	Inhalation			
		Intensity1	Frequency1	Intensity2	Frequency2
	1 Checking/Receiving/Packer	Low; inhalation should be low since no PCB should be present other in sealed capacitors or in sealed tanks.	Continuous; The exposure is an all day exposure; the exposure is due to where the worker works not to what the worker is doing.		
	2 Degreaser	High; PCBs were rinsed off with TCE in the degreasing process. The worker would potentially inhale PCBs from the mist in the air.	Intermittent; The worker would probably not be occupied with the degreaser all day, but stacking the greasy degreasers in the degreasing machine and taking them out as well	Medium; The rest of the day would probably not involve a lot of breathing in PCBs; hence the exposure intensity is set to medium.	Intermittent; The medium exposure is set to last the rest of the day.

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3 Driver	<p>Medium; Drivers would expect an inhalation exposure when filling the tank. The inhalation intensity is therefore set to medium.</p>	<p>Intermittent; The driver would only tank intermittently between the driving.</p>	<p>Low; the inhalation intensity is considered low when the driver is not tanking the PCB.</p>	<p>Intermittent;</p>
4 or Dry Inspector/operat	<p>Low; inhalation should be low since no PCB should be present in this particular area.</p>	<p>Continuous; The exposure is an all day exposure; the exposure is due to where the worker works not to what the worker is doing.</p>		
5 Electrical work	<p>Low; inhalation should be low since no PCB should be present in this particular area. The worker could potentially do electrical work on open capacitors but most of these workers would belong to the salvage category.</p>	<p>Continuous; The exposure is an all day exposure; the exposure is due to where the worker works not to what the worker is doing.</p>		
6 Engineer	<p>Low; The inhalation intensity of PCB would vary according to where the engineers would be located, but overall the engineers would be exposed to a lesser degree than other workers, hence the inhalation intensity is set to low.</p>	<p>Continuous; The exposure is an all day exposure; the exposure is due to where the worker works not to what the worker is doing.</p>		
7 Fireman	<p>Background; Background exposure would be the same as what office workers were exposed to.</p>	<p>Continuous; Believe that the firemen did not hold other job at the same time.</p>		
8 workers Stock material	<p>Low; It is not really clear what the jobber stock worker would do, but it is assumed that the worker worked in a stockroom where the buying and selling also took place.</p>	<p>Continuous; The level the area had is what the workers would experience.</p>		
9 Large capacitors	<p>Medium; Large capacitors were made in a different location from the other capacitors making this area less prone to PCB fumes.</p>	<p>Intermittent; filling large capacitors was done manually and when it was done the fumes would be elevated but this would only affect the worker when it was filled not so much afterwards.</p>	<p>Low; In-between filling the large capacitors other chores would be done which would not involve PCB, hence inhalation of PCB is set to be low the rest of the day.</p>	<p>Intermittent</p>
10 Machinist	<p>Low; The inhalation intensity of PCB would vary according to where the machinist would be located, but overall the machinists would be almost equally exposed to the level of PCBs found in the machine shop, hence the inhalation intensity is set to low.</p>	<p>Continuous; there is no reason for believing the inhalation exposure would not last all day.</p>		

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11 Maintenance	<p>Medium; The inhalation exposure to PCB is set to medium because the maintenance workers would work throughout the plant experiencing from medium to low exposures.</p>	<p>Intermittent; The medium exposures would probably not last all of a workday and hence an intermittent exposure is set.</p>	<p>Low; When maintenance workers were not working in the highly PCB polluted areas; the inhalation exposure is set to low.</p>	Intermittent
13 Process control	<p>High; What exactly the manufacturing workers were doing is not quite clear, but they were working on the PCB impregnation process, and hence were surrounded with high air levels of PCB.</p>	<p>Continuous; The manufacture jobs were likely performed all day.</p>	<p>Low; The rest of the day was considered to be lower than the high exposure which was set to medium for these material handlers.</p>	
Material handler 13 & racker	<p>Medium; The inhalation exposure to PCB is set to medium because the material handlers workers would work throughout the plant experiencing from medium to low air levels of PCB.</p>	<p>Intermittent; The material handlers would handle everything from dry materials to PCB but on an intermittent schedule.</p>	<p>Some of these material handlers could have been working in the high exposed departments all day, but the job codes do not allow for this differentiation.</p>	Intermittent
14 Metal coating	<p>Low; the inhalation of PCB is set to be low for the metal coating workers. The inhalation of PCB would be due to area; the coating would be done after degreasing. According to plant layout there were no walls separating these departments.</p>	<p>Continuous; Assume that these workers would just do metal coating and not have other job tasks.</p>		
15 Office	<p>Background; Office workers are believed having the lowest exposure to PCB in the plant and hence this is called background level of PCB.</p>	<p>Continuous; Office workers did not usually have other jobs on the 'floor' and were exposed continuously to background levels of PCB.</p>		
16 Paint /sealant	<p>Low; paint jobs were usually performed on bushings etc. and then attached to the capacitor that were metallally treated. Sealants would probably be used to seal attachments to the capacitors. This task could have been performed before the degreasing but it would probably be easier to seal something when the surfaces were free of grease. The latter is assumed more likely and hence the inhalation exposure is set to low.</p>	<p>Continuous; The paint and sealing would probably be an all day event since this would apply to most sizes of capacitors.</p>		

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

17 Post-assembly	<p>High; Workers would handle PCB filled capacitors from the oven, and after degreasing. Their environment would contain high levels of PCB.</p>	<p>Intermittent; The ovens run in cycles, and there are several ovens, but the workers would probably have several work tasks other than move newly impregnated capacitors from ovens. Other tasks would assemble additional equipment to the capacitors after degreasing or testing.</p>	<p>Medium; The rest of the day would probably not involve a lot of breathing in PCBs; hence the exposure intensity is set to medium.</p>	Intermittent
18 Pre-assembly	<p>Low; the pre-assembly area should not contain much PCB because oil and dust could decrease the capacitors performance. The pre-assembly area is set to have a low air level of PCB.</p>	<p>Continuous; workers in the pre-assembly would not likely start working in the post-assembly where they would be all greased up to then come back t a clean place.</p>		
19 Repair/Salvage	<p>High; Salvage and repair would potentially have a high air level PCBs depending on the number of capacitors in the repair shop and how damaged and leaky they are.</p>	<p>Intermittent; The number of damaged capacitors made would determine how much time the salvage and repair worker would spend. It could be all day, hardly any of the day etc. It is set to be intermittent.</p>	<p>Medium; The rest of the day would probably not involve such high exposure intensity hence the exposure intensity is set to medium.</p>	Intermittent
20 Research lab	<p>Medium; research lab worker would not have the same job, some would have 'dirtier' job than others, some would work with PCB others would not, but this is not differentiated in the code and are therefore lumped together here. The medium inhalation intensity is a compromise between not so high as process workers and not as low as stockroom workers, something in-between.</p>	<p>Intermittent; Research personnel would probably not be exposed to the same air levels of PCB all day.</p>	<p>Low; the air levels would probably be low 50% of the time in the lab.</p>	Intermittent
21 Salary	<p>Background; The levels for salaried workers are set the same as for general office workers at the plant.</p>	<p>Continuous; The salaried workers would most likely do what they are trained to do all day.</p>		
22 Security	<p>Background; security workers were once hired to look after the plant and keep unwanted visitors out. They would probably work much outside as inside, and their overall level of PCB inhalation exposure would resemble background levels.</p>	<p>Continuous; The security workers would not do any other job so the exposure would be continuous in this respect.</p>		
23 Shipping	<p>Low; Shipping personnel would only be exposed to low levels of PCB due to a prior spill or because area of the plant.</p>	<p>Continuous; There are no operations done that involves PCB so the exposure should be continuous.</p>		

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

24 Solderer	<p>High; Solderer were located immediately after the impregnation to seal the capacitors before degreasing. The workers were exposed to high air levels of PCB.</p>	<p>Intermittent; The capacitors were in different dimensions and hence would require longer or shorter periods in the oven. The cycle at hand would determine how exposed the workers would be in one day. Hence the frequency of inhalation exposure to high air levels of PCB is set to intermittent</p>	<p>Medium; When the solderers are soldering the latter part of the batch and the other capacitors are sent off to degreasing the air levels of PCB would decrease.</p>	<p>Intermittent; The medium exposure is set to last the rest of the day.</p>
Kettle & oven 25 operators	<p>High; The surface areas would be coated with PCB, as well as the equipment, in a room where heating was done on a regular basis. All these factors added up give rise to believe that the highest estimated air levels of PCB are believed found in the tank room.</p>	<p>Continuous; The high air levels were not rapidly declining due to new cycles of impregnation would be finished.</p>		
26 Unknown				
27 Welder	<p>Low; Pre-assembly welding would be pertained to the area where other PCB required jobs would not be performed. The inhalation of PCB for welders were small.</p>	<p>Continuous; The welders are skilled workers and would rarely change to another job.</p>		
Wet inspector/operat 28 or	<p>Medium; Wet inspectors would not normally inspect or operate PCB material, but would be in rooms where spills often occurred or where leaks were discovered on a routinely basis.</p>	<p>Intermittent; Since the exposure comes from leaks and accidents, although often it is not a scheduled PCB release and hence the frequency of inhaled PCB would be intermittent.</p>	<p>Low; When inspectors and operators were not encountering leaks they would have low exposure to PCB air levels.</p>	<p>Intermittent</p>
29 Winding	<p>Low; The winding job is considered the least PCB polluted job (except office workers) in the assembly process. The winding was usually done in a clean environment to avoid particles in the wind coil which would increase resistance for the capacitors.</p>	<p>Continuous; Winders are not known for moving around to other areas of the plant, not during the day.</p>		

Table 34 Category, category name, and dermal intensity and frequency PCB exposure rating with arguments

Cat	Cat. name	Dermal			
		Intensity1	Frequency1	Intensity2	Frequency2
	Checking/ Receiving/ 1 Packer	<p>Low; Checkers, receivers, and packers would seldom come in direct contact with PCB, other than during spills and leaks. Most of the time it will be the polluted surface areas that give the low exposure.</p>	<p>Continuous; There would not be much difference of exposure during the day.</p>		

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

2 Degreaser	<p>High; Dermal intensity would be very high in the degreasing station. It is uncertain if the workers would wear gloves or not and if they were worn correctly. The degreaser worker would move the PCB-greasy capacitors from the rack on to the degreasing machine and spray off all PCB. The dermal exposure is considered high</p>	<p>Intermittent; The degreaser would be highly exposed only partly, only when the worker unloads the greasy capacitors from the rack. The number of capacitors being degreased pr day or week might also change. The high dermal exposure is therefore set to intermittent frequency.</p>	<p>Medium; The dermal intensity would not disappear when the degreasing was done, the work station itself would probably give rise to a medium dermal intensity.</p>	Intermittent
3 Driver	<p>Medium; The truck drivers unload the PCB from the tank trucks using different devices over the years. The dermal intensity would be when the nozzle was removed and PCB liquid spilled on the drivers hand which in turn was transferred to the steering wheel.</p>	<p>Intermittent; The driver would spend a short time filling the tanks, and most of the time driving the truck from A to B. The medium dermal exposure is therefore set to intermittent frequency.</p>	<p>Low; The background dermal PCB exposure the drivers experience would be the PCB that has polluted the steering wheel.</p>	Intermittent
4 Dry Inspector/ operator	<p>Low; Dry operators would seldom come in direct contact with PCB. The polluted surface areas would give rise to the low dermal exposure.</p>	<p>Continuous; There would not be much difference of exposure during the day.</p>		
Electrical 5 work	<p>Low; The electrical workers would for the most part be in the pre-assembly area and only be exposed to PCB contaminated areas spread from the PCB processes.</p>	<p>Continuous; There would not be much difference of exposure during the day.</p>		
6 Engineer	<p>Medium; The engineers were not a homogeneous group when it comes to decide dermal exposure intensity to PCB. Overall engineers would be found in the tank room, winding room, machine shop etc. But overall the average engineer would probably experiencing a medium intensity PCB exposure, seldom high due to the type of job they had nor low because they would work in highly PCB polluted areas.</p>	<p>Intermittent; The engineers were a group that would move around where their expertise was needed, hence their exposure was probably not constant.</p>	<p>Low; The engineers would probably be experiencing something between medium and low dermal exposure during the workday because they would likely not be stationary.</p>	Intermittent
7 Fireman	<p>Background; dermal intensity experienced by a firemen would probably be very low. The firemen usually wears very good protective clothing. The exposure intensity is set to the lowest possible exposure e.g. background</p>	<p>Continuous; The firemen would fight fires continuously when they existed.</p>		

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

Stock material 8 workers	<p>Low; The jobber stocks were located in the area where no production with PCB was being performed. Only with accidents would the workers be exposed directly to the skin.</p>	<p>Continuous; Assume that the jobber stock worker would keep to this department all day and hence experienced a continuous dermal exposure.</p>		
Large 9 capacitors	<p>High; The workers who worked with the large capacitors would do every step of the assembly. The impregnation with PCB would still continue on the second floor but the grease would be washed off on the 3rd floor giving rise to high direct dermal contact with PCB.</p>	<p>Intermittent; The highly exposed job tasks would be done in-between other work tasks.</p>	<p>Medium; The workers who work on the third floor also had other work tasks that required no direct dermal contact with PCB, only indirectly.</p>	Intermittent
10 Machinist	<p>Medium; Machinist not only work in the machine shop department but would move around where the machine breakdowns would occur which could be in the whole range from high exposure area or the the low exposure area.</p>	<p>Intermittent; the dermal contact with PCB the machinist would encounter would be in intermittent frequency depending on job location.</p>	<p>Low; The machinist could potentially be working with tools that have PCB residues even if the machinist was working in the tool shop</p>	Intermittent
11 Maintenance	<p>High; Maintenance workers would be working all over the plant and especially doing 'dirty' jobs which could involve direct contact with PCB.</p>	<p>Intermittent; The frequency of coming contact with PCB would be dependent on the job that was being performed.</p>	<p>Medium; maintenance tasks would probably vary in the degree of contact with PCB each worker had. It is plausible that half the day would involve medium exposure.</p>	Intermittent
Process 13 control	<p>High; The workers in the manufacturing processing, were all highly exposed dermally. The surfaces would have layers of PCB residues.</p>	<p>Continuous; The workers in manufacture would probably stay in this area all day. Do not find arguments why they would move about in the plant.</p>		
Material handler & 13 racker	<p>Medium; Material handlers would have hands on everything they were moving about. Materials such as PCB would be included.</p>	<p>Intermittent; the dermal contact with PCB the material handler would encounter would be an intermittent frequency depending on job location.</p>	<p>Low; Some of what the material handlers would move would not give rise to dermal exposure of PCB, nor the environment they moved the material to/from.</p>	Intermittent
14 Metal coating	<p>Low; Metal coating job tasks would involve very little dermal contact with PCB. The only time would be if they would be working on a capacitor that started leaking. The low intensity is set due to the build up of PCB residues on the surface over time.</p>	<p>Continuous; The metal coating workers would not need to move around in the plant. Their work station would be permanent.</p>		
15 Office	<p>background; dermal intensity office workers would experience would be lower than 'low' because they do not handle capacitors that may leak. Offices are assigned background levels, because they are not totally free of exposure to PCB.</p>	<p>Continuous; Office workers would not likely do other job tasks.</p>		

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

16 Paint /sealant	<p>Low; Paint and sealant workers job tasks should not involve direct contact with PCB. The capacitors should be degreased by the time they would reach these workers. Occasional spills, leakages, and not washed off enough would give the workers a potential of low dermal exposure.</p>	<p>Continuous; The paint workers were not likely to move about to other stations.</p>		
17 Post-assembly	<p>High; working on the post-assembly line would be a lot of hands on work with heavy PCB pollution.</p>	<p>Continuous; the workers could potentially move about in the sub-assembly area but they are all grouped together, and hence the frequency would be continuous exposure.</p>		
18 Pre-assembly	<p>Low; Pre-assembly workers do a lot of hands on work, but unlike the post-assembly workers the materials they assembled were not contaminated with PCB. Their dermal exposure would be from contaminated surface areas due to the plant's construction/layout.</p>	<p>Continuous; The pre-assembly workers could potentially move about their workstations, but not likely off to a totally different department. The pre-assembly category incorporates a range of operation in the pre-assembly of a capacitor.</p>		
19 Repair/ Salvage	<p>High; Salvage and repair would probably be the job task with the most extensive dermal exposure to PCB. This job would involve taking a filled capacitor apart.</p>	<p>Continuous; The salvage and repair job would probably last all day.</p>		
20 Research lab	<p>Medium; The research lab would encounter direct contact with PCB, but not as much as salvage and repair workers.</p>	<p>Intermittent; the researcher would probably not stay with one project all the time and hence the contact would be intermittent.</p>	<p>Low; A lot of the research work would be classified as low dermal exposure.</p>	<p>Intermittent</p>
21 Salary	<p>background; office workers and salaried workers are given the same intensity exposure for dermal contact which is background level.</p>	<p>Continuous; The salaried workers would not likely change job task.</p>		
22 Security	<p>background; Security workers would not go around touching neither machinery nor other surfaces and their dermal exposure would be background.</p>	<p>Continuous; There would not be much difference of exposure during the day.</p>		
23 Shipping	<p>Low; The only dermal exposure shipping workers experience would be from old spills and leakages.</p>	<p>Continuous; There would not be much difference of exposure during the day.</p>		
24 Solderer	<p>High; solderers would experience high dermal exposure because they would handle the impregnated capacitors before they were washed off.</p>	<p>Continuous; solderers would probably just this task all day.</p>		

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25 Kettle & Oven Operators	High; Oven operators would be dermally exposed to very heavily PCB contaminated surfaces in the oven area.	Continuous; these oven workers would probably not leave the tank room to go and work somewhere else during a day.
26 Unknown		
27 Welder	Low; Welders would have low dermal contact with PCB since most of the welding would take place in the pre-assembly area.	Continuous; Welders would probably do their skilled work all day.
28/ Wet inspector operator	Medium; Wet inspectors and operators would be working in department where direct contact with PCB would likely occur. However, these workers would not have the extent of dermal exposure as other workers e.g. salvage and repair or tank workers.	Intermittent; Their exposure would be intermittent especially for the inspectors that usually do not operate the machine. The operator will touch the equipment with contaminated hands and re-touch the surface. Low; The rest of the day would probably not give rise to higher dermal exposures. Intermittent
29 Winding	Low; The winding areas were usually kept clean and hence the exposure would come from other parts of the plant.	Continuous; Assume that the winder would keep to this department all day and hence experienced a continuous dermal exposure.

Table 35 Additional chemical exposure associated with certain categories

Cat	Cat. name	Additional chemical exposure
2	Degreaser Dry	TCE
4	Inspector/operator	soldering fumes from electrical work
7	Fireman	PCB can potentially decompose to more toxic compounds when heated. The firemen would be exposed to these fumes among others if the PCB part of the plant had a fire. Respiratory equipment are usually worn by firemen due to toxic fumes.
10	Large capacitors	Castor oil was also used for filling the large capacitors, the workers might have experienced exposure to this oil as well.
11	Machinist	Machine workers would probably have exposure to other chemicals as well like lubricant oil, soap, welding/soldering fumes etc.
15	Metal coating	Coating materials could be of different origin. From GE it is known that the capacitors were painted or oxidized to withstand weathering. At Aerovox, it is not known what type of coating was used.
17	Paint /sealant	painters and sealants would be exposed to other chemicals as well. The ingredients that make up paint and sealants were different over the time period. Especially lead based paint should be kept in mind.
25	Solderer	Soldering fumes would give additional exposure to the worker.
28	Welder	Welding would give additional exposure due to the welding fumes.

5.14 Developing the JEM

Assigning values to frequencies and intensities was the next step and this can be done in many ways. Since intensity rating was assigned based on the highest intensity exposure for a job task within a category, the intensity rating needed to be modified by task frequency to reflect the difference in exposure. The method used here was to assign the frequencies; continuous or intermittent. Continuous frequency exposure indicated that the exposure did not fluctuate much across the category. Intermittent frequency exposure accounts for fluctuation of intensity across within a job code within a category. Each category was rated continuous or intermittent frequency of exposure for inhalation and dermal exposure. Continuous frequency exposure was given a value of 1 and intermittent frequency exposure was given a frequency value of one half. The other tasks within the category with intermittent frequency involving less exposure were also given a frequency value of 0.5 but an intensity rating lower. The JEM values for each category was intensity multiplied with frequency for inhalation and dermal exposure, respectively, and summed across.

The exposure intensity was assigned by first determining the background exposure level. From the air concentration measurements performed by Kemper and NIOSH; the office area which was selected as the reference point, was measured to 0.05 mg/m³. The air concentration measurements from Aerovox were tried fitted in to the 11 steps describing the capacitor manufacturing process. These steps now fit in to different categories. The categories are qualitatively ranked high-medium-low. The air concentration measurements now fit into different categories. Air concentrations used in the assigning of exposure values for high, medium, low, and baseline is given in the table below.

Table 36 Air concentrations for each job and their exposure categories

Job or area	Exposure category	Air concentration (mg/m ³)									
		Personal					Area				
		n	mean	GM	GSD	Range	n	mean	GM	GSD	Range
High											
Degreaser	2	1	1.26	1.26	-	-					
Fill-hole soldering	24	4	0.52	0.50	1.33	0.40-0.74	1	0.27	0.27	-	-
Final test	28						4	0.70	0.68	1.33	0.51-0.98
Heat soak	25	3	0.69	0.68	1.32	0.50-0.87	4	1.22	1.08	1.86	0.44-1.78
Impregnation room	12	2	0.71	0.70	1.25	0.60-0.82	14	0.66	0.63	1.39	0.36-1.16
Leak test	12						4	0.85	0.82	1.36	0.55-1.13
Moveman-soldering	24	3	0.85	0.78	1.71	0.42-1.11					
Solder	24	5	0.78	0.70	1.74	0.33-1.09					
Tank room worker	25	11	0.80	0.77	1.33	0.51-1.26					
Medium											
Assembly area I	28						7	0.49	0.46	1.50	0.21-0.67
B-5B pump room	28						1	0.39	0.39		-
Pump mechanic	28	1	0.28	0.28	-	-					
Pump room	28						11	0.82	0.72	1.61	0.47-2.67
Test	28	3	0.29	0.29	1.14	0.25-0.32	5	0.32	0.31	1.26	0.21-0.37
Low											
Assembly area II	18						3	0.19	0.17	1.74	0.10-0.30
Cover Manufacturing	18						3	0.06	0.06	1.18	0.05-0.07
Floorman – preassembly	18	6	0.18	0.17	1.23	0.14-0.23					
Loading baskets	4	1	0.26	0.26	-	-					
Pre-assembly	18						4	0.14	0.12	2.13	0.04-0.22
Shipping	23						2	0.09	0.09	1.17	0.08-0.10
Winding	29						8	0.30	0.15	3.09	0.03-1.56
Baseline											
Office	16						2	0.05	0.05	-	-

Table 37 Air concentrations for the high, medium, low, baseline exposure groups

Exposure Rank	<u>Air concentrations (mg/m³)</u>							
	Personal			Area			Combined	
	Number of jobs	Mean across jobs	Range across jobs	Number of areas	Mean across areas	Range across areas	Range	Midpoint of range
High	7	0.80	0.52-1.26	5	0.74	0.27-1.22	0.27-1.26	0.77
Medium	2	0.29	0.28-0.29	4	0.51	0.32-0.82	0.28-0.82	0.55
Low	2	0.22	0.18-0.26	5	0.16	0.06-0.30	0.06-0.30	0.18
Baseline				1	0.05	-		0.05

The values in the JEM will be high: 770, medium 550, low 180, baseline 50.

Other methods would be applicable for assigning values to intensity exposure. For instance taking all 28 concentrations and divide them by three and take the third with the lowest values, average these and use this value for low exposure would be one plausible method. Using this method would have given us 0.95 mg/m³, 0.55 mg/m³, 0.19 mg/m³ for high, medium, and low, respectively. This is not a great difference compared to what our chosen method resulted in, probably due to the few numbers of air concentrations used.

The first method allows for fluctuation in air measurements. The second method changes dramatically with air measurements obtained while the first method would rely also on industrial hygiene data and information from the surveys when using the categories.

All the values are assigned for each of the 29 categories, shown in the table below. The values calculated for high, medium, low and background air measurements are converted from mg/m³ to µg/m³. The same values are used for dermal intensity to give dermal and inhalation equal weight.

Table 38 Assigned weights for frequency and intensity (primary and secondary) for inhalation and dermal exposure, and the total exposure and additional exposures given for all categories.

Job category	Inhalation exposure ($\mu\text{g}/\text{m}^3$)				Dermal exposure				Total exposure		Additional exposures
	Frequency ^A	Intensity ^B		Exposure Level ^C	Frequency	Intensity		Exposure Level			
		Primary	Secondary			Primary	Secondary				
1 CHECKING/RECEIVING/PACKER	C	L		180	C	L		180	180		
2 DEGREASER	I	H	M	660	I	H	M	660	660	TCE	
3 DRIVER	C	L		180	I	M	L	365	272.5	Exhaust	
4 DRY INSPECTOR/OPERATOR	C	L		180	C	L		180	180	Machine grease	
5 ELECTRICAL WORK	C	L		180	C	L		180	180		
6 ENGINEER	C	L		180	I	M	L	365	272.5		
7 FIREMAN	C	B		50	C	B		50	50		
8 STOCK MATERIAL WORKER	C	L		180	C	L		180	180		
9 LARGE CAPACITORS	I	M	L	365	I	H	M	660	512.5		
10 MACHINIST	C	L		180	I	M	L	365	272.5	Machine grease	
11 MAINTENANCE	I	M	L	365	I	H	M	660	512.5	Soap and water	
12 PROCESS CONTROL	C	H		770	C	H		770	770		
13 MATERIAL HANDLER & RACKER	I	M	L	365	I	M	L	365	365		
14 METAL COATING	C	L		180	C	L		180	180	Metal fumes, metal oxides, acids	
15 OFFICE	C	B		50	C	B		50	50		
16 PAINT/SEALANT	C	L		180	C	L		180	180	Organic solvents in paint	
17 POST-ASSEMBLY	I	H	M	660	C	H		770	715		
18 PRE-ASSEMBLY	C	L		180	C	L		180	180		
19 REPAIR/SALVAGE	I	H	M	660	C	H		770	715		
20 RESEARCH LAB	I	M	L	365	I	M	L	365	365		
21 SALARY	C	B		50	C	B		50	50		
22 SECURITY	C	B		50	C	B		50	50		
23 SHIPPING	C	L		180	C	L		180	180		
24 SOLDERER	I	H	M	660	C	H		770	715	Solder fumes, and	

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									combustion products of PCB	
25	KETTLE & OVEN OPERATORS	C	H	770	C	H	770	770		
26	UNKNOWN	NA	NA							
27	WELDER	C	L	180	C	L	180	180	Welding fumes	
28	WET INSPECTOR/OPERATOR	I	M	L	365	I	H	M	660	512.5
29	WINDING	C	L	180	C	L	180	180		

^A Frequency of exposure (I = intermittent, C = continuous);

^B Intensity of exposure (H = high, M = medium, L = low, B = background).

^C Exposure level is calculated using weights of 770 for high, 550 for medium, 180 for low, and 50 for background. For continuous exposure, the full workday is assigned to the primary intensity level. For intermittent exposures, half of the workday is assigned to the primary intensity level and the remaining half is assigned to the secondary intensity level. For example, for category 1, inhalation exposure is rated as ‘intermittent – high’, so the inhalation exposure level is assigned $0.5 \times 770 + 0.5 \times 550 = 660 \mu\text{g}/\text{m}^3$; similarly, dermal exposure is rated as ‘continuous – high’, so the dermal exposure level is assigned $1 \times 770 = 770$ units. Exposure levels for employment in the first half of the production period (October, 1957 – December, 1967) are estimated to be 20% higher.

^D TCE = trichloroethylene

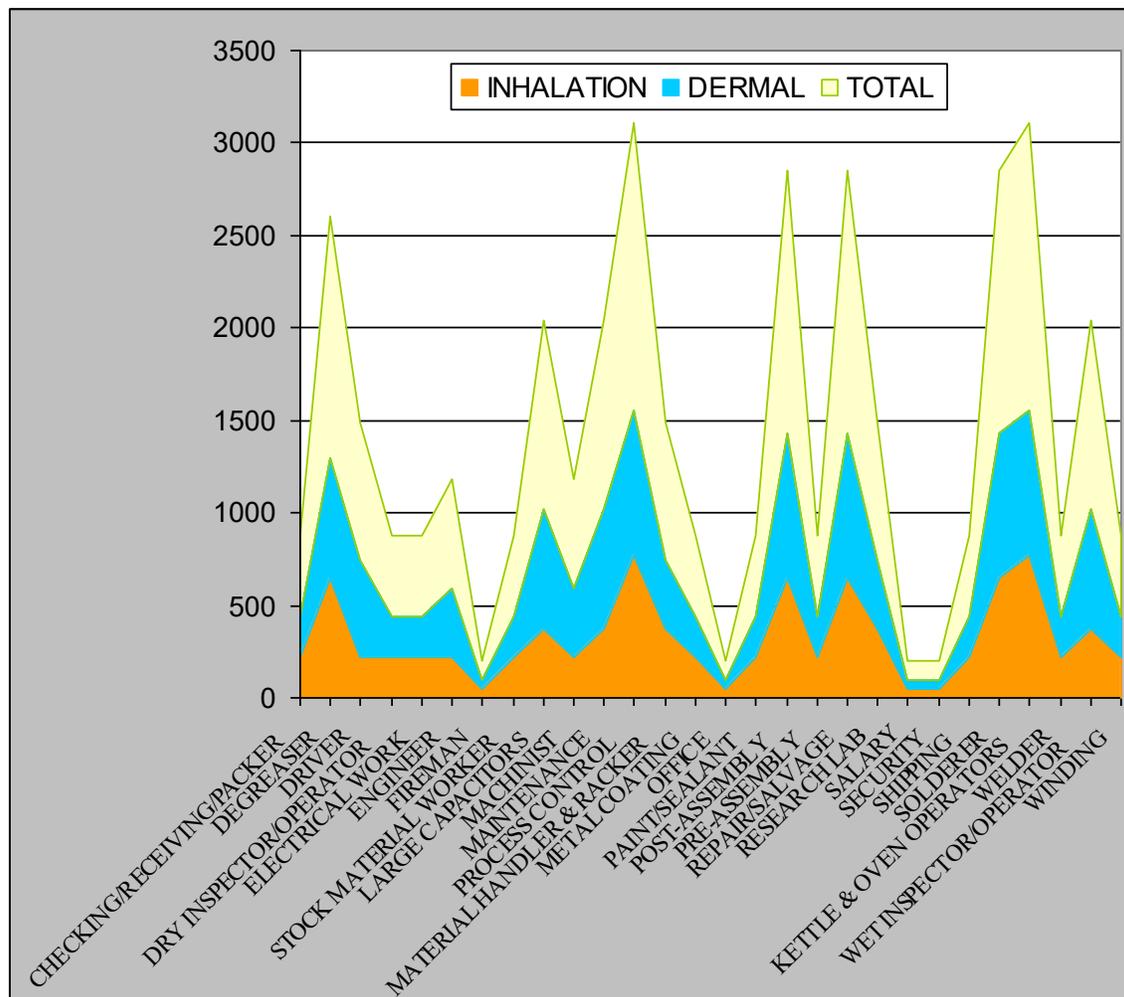


Figure 22 Dermal, inhalation and total scores for all categories

The chart above displays all the categories with their respective dermal, inhalation and total values. The inhalation and dermal values are highly correlated.

We consider the earlier time period to be of a more polluted character than the later JEM. In order to show this, the already developed JEM needs to be multiplied with a modification factor, f . This assumption that industrial hygiene improved over time is plausible, but how much it improved or when it started improving is somewhat arbitrary. We consider a 20% reduction over time a reasonable estimation, and the midpoint of the manufacturing of PCB filled capacitors were chosen as the dividing point for two eras. Below is the schematically overview of the matrix where I is intensity (50-777), F is frequency (0.5-1), inh is inhalation, derm is dermal, ACE is additional chemical exposure:

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$$\text{Combo-JEM} = f_{\text{era}} \left\{ \frac{1}{2} [(I_1F_1 + I_2F_2)_{\text{inh}}] + \frac{1}{2} [(I_1F_1 + I_2F_2)_{\text{derm}}] \right\} : \text{ACE}$$

↓ where $I_1F_1 + I_2F_2 =$ exposure level (EL)
DEL for dermal exposure level
IEL for inhalation exposure level

$$\text{Combo-JEM} = f_{\text{era}} \left[\frac{1}{2} \text{IEL} + \frac{1}{2} \text{DEL} \right]$$

f_{era} where era=1 1939-1957 $f=1.2$
 f_{era} where era=2 1958-1977 $f=1.0$

for the two separate JEMs:

$$\text{Inhalation-JEM} = f_{\text{era}} \text{IEL}$$

$$\text{Dermal-JEM} = f_{\text{era}} \text{DEL}$$

Figure 23 The formula for the job exposure matrix. The group with its inhalation and dermal matrices were adjusted with a factor f, for difference over time. ACE is additional chemical exposure, f is modification factor.

6 Appendix A: Job codes with job titles and descriptions

Job titles were recorded as they appeared in the work histories.

Table 39 JOB TITLES AND CODES SORTED BY JOB TITLE

JOB TITLE	JOB CODE
accounting manager/asst.	58
adm line	C2
administrative team leader	84
administrator, human resources	47
advertising	E7
AF climber	20
Aero II rework	1
Aeromet 2	2
Aeromet II tech	2
Aeromex tech	1
Aeropanel	3
Aging & wet winder	D8
analysis & repair, sec.	70
analyst, market	58
analyst, programmer	23
analyzation rejects & misc. operations	F5
Anode count station/Anode calculator	F7
Anode cutter/slicer	T9
Anode Foil Conv Clk	G5
anode stitcher	A3
Apex Printer Setup/Apex Tube Setup and Printer	U1
applicator, sealant	64
assembler / hi voltage	5
assembler / inspector	4
assembler / mica	4
assembler, motorized	59
assembler solderer	D1
assembler, tubular	90
assembler/ met. & filter	4
assembler/ met. Misc.	4
assembler/ oil	4
assembler/ paper I	5
assembler/ paper ii	5
assembler/ plastic/ plastic mixer	5
assembler / wax	4
Assembler & General Worker	T4
assembler & misc. operator	M2

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Assembler & Molder	O7
Assembler & Riveter	U5
assembler & service operator	N5
assembler & stamper	L8
assembly & lab cleaner	D4
assembly & solderer	D1
assembly tab	81
assembly & tester	F6
assistant dispatcher	31
assistant, administrative	11
assistant, executive	11
assistant, human resources	47
Auto PF facate	6
Auto Riveted Insulator Machine Operator	G9
Auto Silicone & Rivet Machine Op	U4
Autocan degreaser	7
Autoinsulat instr	8
Autolete/Assembler	8
Autolete Solder Machine Operator	G6
axial, back	9
axial, front	9
back axial	9
ballast cover / machine operator	56
ball plug	10
barcode labeler	11
base solderer	76
basket unloader / loader	A9
Basket Unloader & degreaser	P7
basket unloader & insulator	T6
basket unloader & solderer	O2
baths operator	63
bench worker	B1
bender, wire	B9
benefits manager	58
bonder, lase	54
bookkeeper	11
boxmaker	12
bracket fabricator	13
bracket & cap	Q7
brander	S8
bridge operator	O5
bridge tester	14
brush	33
brush/clear/drill	33
buyer	51
burn-in IMC-IMS04/helper	15

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burn-in tester & packer	M7
burn-in tester & unloader	U8
burn-off & slitting met paper	15
calculator	i1
calculating schedule & processing materials	P8
calibrator & stacker	N7
Callahan Roller and Material Handler	i7
Callahan setup / Roller / operator	16
Calculator	I1
can maker setup / can maker	17
can washer	R3
can maker & rack repairman	U2
Cap & bracket	Q7
capacity control	N2
Capper	S4
car muler	51
carpenter and helper	18
centrifuge op	K6
chauffeur	A7
checking returns	A1
chemist	B5
cleaning trays	K3
clear/drill/brush	33
clearing machine	19
clerk, stock or inventory	51
clerk/typist/posting	11
climber, AF	20
clincher (winder job)	95
cluster filler	21
cold press	22
color coder operator	C6
compound machine op	K7
computer operator, senior	23
controller	23
converter packer	K4
conveyor line	L7
cordinator, sample	72
coordinator, supplier material	51
coordinator, training	60
copper sprayer	96
copper sprayer & general worker	i4
cost estimator	H1
count station & expediter	M4
counter	25
cover welder	76
credit union	11

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crib attendant	51
crusher	B7
customer contact	11
cut & punch operator	62
cut & stitch	A3
cut stitcher	A3
cutter	61
cutter - insulation	P5
cutter & inspector	E6
cutter, mica	61
cutter mitre	17
cutter/slicer anode	T9
cutter, tube	89
cycle rel operator	62
D P H operator	Q1
data entry operator	23
degreaser	7
degreaser, autocan	7
degreaser & basket unloader	P7
degreaser & dispatcher & impregnator	P4
degreaser & general worker	R7
degreaser & heat test inspector	R8
degreaser & silicone machine operator	P9
degreaser & solderer	O1
degreaser & sprayer	T3
demask/ deburr	26
design drafter	27
die stamper & sealer	D6
die setter	28
die setter & die stamper/die stamper type setter	28
die setter & paper cutter	P6
die setter & power press op	U3
die setter & operator	28
die & tool maker	85
dip, wax/dip sealant machine operator	94
dipp. operator [tankman]	29
dipped mica	K1
dipper, paint cans	64
director	30
dispatcher (incl./ assistant & line dispatchers)	31
dispatcher & degreaser & impregnator	P4
dispenser, order	51
dist. specialist	31
documentation technician	11
dorners op	O4
drafter / draftman	32

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

drafter, design	27
drill/ brush/ clear	33
drill press operator	H5
driver, truck	A7
driver; storekeeper	61
ECE op/electro chem etch op	M8
electrical manager	57
electrical test lab tech	G8
electrical tester	85
electrician/helper	34
electro line	H6
electrostatic spray operator	62
end filler taping	82
end filler - tubular	88
engineer technician (all types)	35
engineer, filter	35
engineer, foil	35
engineer, mfg/industrial	35
engineering manager	57
environment technician	36
environmental health & safety manager	57
epoxy mixer	A8
epoxy mixer & tub assembler	S1
executive assistant	11
expediter	37
expediter & count station	M4
expediter/ shipper/packer	i9
FF assistant	F2
fabricator, bracket	13
fill hole solderer	76
fill hole soldering & unloader	G2
fill/tape	82
filler	38
filler, cluster	21
filler, end, taping	82
filler/plastic/wax	38
filler & repairer	L4
filler, tub	88
filler/wrapper	38
filler & mixer	S2
filling trays	Q8
filter & met. assembler	4
filter engineer	35
filter inspector	40
filter/impregnation/ operator	39
filterman grade 8	41

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

filter operator	39
final pert.	42
finisher	N8
fireman	43
flashing	61
flashing, mica	61
flex technician	36
flipper	O6
foil engineer	35
foil respooler	J6
foil slitter	56
foil tester	56
folder, tab	S6
foot press operator	62
foreman	78
form man racker	F3
foreman/supervisor	78
formation	B8
freight handler	51
front axial	9
FT Slant Bd Operator	E1
general maintenance	45
general helper	44
general worker	44
general worker & assembler	T4
general worker & degreaser	R7
general worker & packer & shipper	R9
general worker & power press	T7
general worker & sprayer	K2
general worker & tester	N9
general worker & welder	U7
ground lugs.	45
guard/watchman	46
handler, freight	51
handler, material	51
handler, salvage	51
hasher	61
hasher, mica	61
heat test inspector	50
heat test inspector & degreaser	R8
heat test oven operator & stamper	L1
heliane seamer	C1
helper, carpenter	18
helper, electrician	34
helper, general	44
helper, oiler	61

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

hi volt tester	85
hi voltage worker	C8
hi voltage worker & solderer	K9
hilton machine (winder)	95
hilton set up	O3
holley carb	Q5
hot tinner	A4
human resources (administrator/ specialist/ assistant)	47
Hunt machine (winder)	95
HV repair	45
HV/EDC tester	84
HV/PF tester	84
illness/ other leave/ vacation	93
impregnator	C9
impregnator/filter	39
impregnator & degreaser & dispatcher	P4
impregnator & kettle op	Q9
impreg. & packer	48
impregnator & pitch boy	R1
impregnator & tester	P1
impregnator & tester & stamper	T8
IMC IMS04 burn-in	15
incentive verifier	11
industrial engineer	35
infra red heat test oven shop	i2
inject molder	49
ink jet operator	11
insertor/tub	H4
inspector	50
inspector & cutter	E6
inspector, filter	40
inspector, heat test	50
inspector, assembler	4
inspector/leader, work	83
inspector & oven unloader	R4
inspector & packer	L6
inspector & stamper	S5
inspector & tester	J8
instr autoinsulate	8
insulation cutter	P5
insulator, kraft	52
insulator & basket unloader	T6
inventory clerk	51
jobber stock/ material stockroom/ material handler	51
kettle operator	C3
kettle operator & impregnator	Q9

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

keypunch operator	23
kiln operator	O8
knock out sections	U6
kraft insulator	52
lab cleaner & assembly	D4
lab technician	36
lab test electrical test	G8
labeler, barcode	11
laborer	53
lase bonder	54
Lawson papercutter	55
layoff/ leave/ quit/ leave for school/ child care	99
lead sprayer	96
lead storekeeper	51
leader	83
leader, sub-assembly	51
leader, team, administrative	84
leader, team, manufacturing	83
leader, team/manager	57
leader, work group	83
life pert tech	J2
line dispatcher	31
line dispatcher & service operator	E2
line, adm	C2
line, tubular	91
loader, basket	A9
loader, oven	63
lugs., ground	45
machine, clearing	19
machine operator / ballast cover	56
machine rework printer	H9
machine setter	S9
machinist	56
machinist helper	L2
mail clerk	O9
maintenance	45
maintenance manager	45
maintenance, general	45
maker, box	12
maker, sample	71
maker, tool & die	85
manager/ engineering/electrical sections	57
manager/ environmental health & safety	57
manager/ maintenance	45
manager/ manufacturing areas (includes materials)	57
manager/ service (sales/ accounting/ benefits/ marketing/ mis)	58

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

manager/ team leader for all departments	57
manufacturing manager	57
manufacturing operator	62
manufacturing team leader	83
marker, paint	64
market analyst	58
marketing manager	58
masking	24
mason	J4
material handler/callahan roller	i7
material handler	51
material handler& tester	H2
material handler & winder	H3
material handler/winder/service operator	J5
material stockroom	51
material supplier coordinator	51
material washer	i8
materials manager	57
mechanic	59
member, team	83
met. & filter assembler	4
met. misc. assembler	4
metalizer	60
metal cutter	17
mfg. engineer	35
mica clincher	95
mica splitter/ hasher /cutter/ stacker /flashing	61
millwright/millwright helper	C5
misc operator & assembler	M2
misc operator & tester	J1
miscarriage	97
mitre cutter	17
mixer, epoxy	A8
mixer - epoxy, & tub assembler	S1
mixer, plastic	5
mixer & filler	S2
model maker	T1
molder	B6
molder, inject	49
molder & assembler	O7
motorized assembler	59
mullilith operator	N1
multigraph operator	G1
no job code listed	0
nurse	60
office worker (incl. secretary/ admin. asst) QC	11

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

oil assembler	4
oiler/helper	61
operator	62
operator (multi-operator)	62
operator, baths	63
operator, computer, senior	23
operator, cyle rel.	62
operator, data entry/keypunch	23
operator, die	28
operator, dipp.	29
operator, electrostatic spray	62
operator, foot press	62
operator, ink jet	11
operator, kettle	C3
operator, keypunch	23
operator, machine	56
operator, manufacturing	62
operator, oven or oven loader	63
operator, PF	6
operator, pump	62
operator, service	60
operator, telephone	11
operator, transmitting	62
operator, cut & punch	62
order clerk or order typist	51
order dispenser	51
oven operator or loader / unloader	63
oven loader/unloader & inspector	R4
oven loader/unloader & plastic mixer	P3
packer converter	K4
packer utility op	R2
packer & burn-in tester	M7
packer and impregnator [ONLY FOR ASSEMBLY DEPTS]	48
packer and inspector	L6
packer and shipper and expediter	i9
packer, shipper & general worker	R9
packer & stamper	M3
packing, shipping and receiving/ packer	51
paint line/ paint marker/ dip paint cans	64
painter/spray painter	64
painter, sealant	64
paint sprayer & tester	T2
paper assembler	5
papercutter, Lawson	55
papercutter & die setter	P6
parker	65

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

payroll	11
Pay stat recorder	E5
PF operator	6
pig teller	89
piper	66
pitch delivery man/pitch dispenser	i3
pitch filling	P2
pitch pub op	K8
pitch boy & impregnator	R1
planner	74
plastic assembler	5
plastic mixer	5
plastic mixer & oven loader/unloader	P3
plastic mixer & tube etcher	N4
plastic tub	D5
plating man	M9
porter	67
posting clerk	11
power press	56
power press set-up	56
power press & die setter	U3
power press & general worker	T7
pregnancy	98
preselect tester	84
print press operator	i5
printed wiring	F8
printer	68
printer apex set up/apex tube setup & printer	U1
process & control inspector	G7
processing materials & calculating schedule	P8
production	44
production service man	G4
production supervisor	79
programmer, analyst	23
pump operator	62
punch & cut operator	62
QA inspector / (AF PT inspection)	50
QA supervisor	79
QC inspector	11
QC, office worker	11
QE, general worker & service operator	H7
quality control / inspector	11
quality control & tester	J3
rack repairman	J7
rack repairman & can maker	U2
racker	69

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racker form man	F3
racker & shipper	H8
receiving, shipping, packing	51
receptionist	11
reel packaging operator	D9
repair & analysis, sec.	70
repair line	70
repair, HV	45
repairer and filler	L4
research lab	N3
respooler	95
returns, checking	A1
rework, Aero II	1
rework, wax	84
riveter	56
riveter & assembler	U5
rivet machine operator & auto silicone	U4
rotary welder	76
rubber stamp maker	S7
rubber stamp maker & type setter	L3
sales clerk	11
sales manager	58
salvage handler	51
sample coordinator	72
sample maker	71
sampler	73
sampler/ small orders	73
scheduler / planner	74
school	99
sealer & die stamper	D6
sealant applicator	64
sealant painter	64
seamer, heliane / seamen	C1
sec. analysis & repair	70
secretary	11
security	46
service	60
service department	60
service manager	58
service operator	60
service operator winder	60
service operator & assembler	N5
service operator, material handler, winder	J5
service operator & QE general worker	H7
service operator & line dispatcher	E2
service operator & packing & receiving	GE3

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

service set up man	E4
set-up, power press	56
setter, die	28
setter, type	A6
setup, Callahan	16
setup, can maker	17
shipper	51
shipper, packer, expediter	i9
shipper, packer & general worker	R9
shipping, receiving, packing	51
short order converter	K5
silicone inserter machine op	M5
silicone machine operator & degreaser	P9
silicone auto & rivet machine operator	U4
silver mica op	R5
singer machine operator	56
singulator	75
slant board operator	E1
slitter	56
slitter, foil	56
slitting met paper & burn off	15
small orders sampler	73
soak cycle op	Q3
solderer	76
solderer, base	76
solder & basket unloader	O2
solder & degreaser	O1
solderer, fill hole	76
solderer and hi voltage worker	K9
solderer & paper filter	G3
solderer, welder	76
sorter	Q2
spec. writer/tech writer	C7
specialist, dist.	31
specialist, human resources	47
splitter, mica	61
spray, electrostatic, operator	62
sprayer	96
sprayer & degreaser	T3
sprayer and general worker	K2
sprayer, copper	96
sprayer, lead	96
sprayer, zinc	96
squeezer/squeeze operator/squeege op	B3
stacker	61
stacker & calibrator	N7

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

stacker, mica	61
stamper	D3
stamper and assembler	L8
stamper and heat test oven operator	L1
stamper & inspector	S5
stamper & packer	M3
stamper & tester	D2
stamper, tester & impregnator	T8
stamper, die	28
statistician	M6
stenographer	11
stitcher, anode	A3
stitcher, cut	A3
stock clerk	51
stock jobber	51
stocker, material	51
storekeeper	51
storekeeper - driver	51
storekeeper lead	51
sub-assembly leader	51
supermet.	77
supervisor, production	79
supervisor, QA	79
supervisor/ foreman	78
supplier material coordinator	51
T line	80
T-line welder	76
tab assembler	81
tab cleaner	M1
tab cutter	81
tab folder	S6
tab machine operator	N6
tab reinforcement	S3
tab welder	76
table worker	81
tank worker	29
tankman	29
tantalum operator / assembler	4
tankman	29
tape/fill	82
taping, end filler	82
tape wrapper	Q6
team leader, administrative	84
team leader, manuf. areas	83
team leader/manager	57
team member	83

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

tech Aeromet II	2
tech Aeromet II covers	2
tech operator	E8
tech Aeromex	1
tech writer/spec writer	C7
technician	36
technician, documentation	11
technician, engineer	35
technician, environment	36
technician, flex	36
technician, lab	36
telephone operator	11
teller, pig	89
tester	84
tester & assembler	F6
tester & general worker	N9
tester, bridge	14
tester, electrical	85
tester, foil	56
tester-hi volt	85
tester HV/PF	84
tester/HV/EDC	84
tester & impregnator	P1
tester & inspector	J8
tester & material handler/packer	H2
tester & misc. operator	J1
tester, preselect	84
tester & quality control	J3
tester & stamper	D2
tester & stamper	i6
tester, stamper & impregnator	T8
tester & tub assembler	T5
testing (final pert.)	42
timekeeper, accounting	11
time & methods man	L9
time study	C4
tinner, hot	A4
tool crib attendant	51
tool & die maker	85
toolmaker	86
trainee	87
training coordinator	60
transmitting operator	62
tray cleaner	K3
tray filling	Q8
truck driver/trucker/tow motor op/chauffeur	A7

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

tub assembler & epoxy mixer	S1
tub assembly & tester	T5
tub filler	88
tub inserter	H4
tubular endfiller	88
tube apex set up and printer/apex printer set up	U1
tube etcher & plastic mixer	N4
tuber/ tube cutter/ tube etcher	89
tubular assembler	90
tubular line	91
tubular repairer	F4
tubular & wax	D7
tunnels	92
type setter	A6
type setter and rubber stamp maker	L3
typist	11
unloader, basket	A9
unloader, basket & burn in tester	U8
utility operator	R6
vibrator	Q4
wash cans	R3
waste control	J9
watchman	46
watson mole (winder)	95
wax dip	94
wax rework	94
wax & tubular	D7
welder	76
welder, T-line	76
welder, rotary	76
welder-tab/cover	76
welder/solderer	76
welder & general worker	U7
winder- all types	95
winder service operator	60
winder & material handler	H3
winder & aging	D8
winder & production service operator	L5
winder, service operator & material handler	J5
wire bender / wireman	B9
work group leader	83
work leader/inspector	83
worker, bench	B1
worker, general	44
worker, high voltage	C8
worker, office	11

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

worker, table	81
worker, tank	29
wrapper/ filler	38
wrapper & tester	U9
zinc sprayer	96

Table 40 JOB TITLES AND CODES SORTED BY JOB CODE

JOB TITLE	JOB CODE
no job code listed	0
Aero II rework	1
Aeromex tech	1
rework, Aero II	1
tech Aeromex	1
Aeromet 2	2
Aeromet ii tech	2
tech Aeromet II	2
tech Aeromet II covers	2
Aeropanel	3
Assembly/ hi voltage	5
assembler / inspector	4
assembler/ mica	4
assembler/ met. & filter	4
assembler/ met. Misc.	4
assembler / wax	4
assembler/ oil	4
filter & met. assembler	4
inspector, assembler	4
met. & filter assembler	4
met. misc. assembler	4
oil assembler	4
tantalum operator / assembler	4
wax assembler	4
assembler/ paper I	5
assembler/ paper ii	5
assembler/ plastic/ plastic mixer	5
mixer, plastic	5
paper assembler	5
plastic assembler	5
plastic mixer	5
Auto PF facate	6
operator, PF	6
PF operator	6
Autocan degreaser	7
degreaser	7
degreaser, autocan	7

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

Autoinsulat instr	8
Autolete	8
instr autoinsulate	8
axial, back	9
axial, front	9
back axial	9
front axial	9
ball plug	10
QC, office worker	11
assistant, administrative	11
assistant, executive	11
barcode labeler	11
clerk/typist	11
documentation technician	11
executive assistant	11
ink jet operator	11
labeler, barcode	11
office worker (incl. secretary/ admin. asst) QC	11
operator, ink jet	11
operator, telephone	11
payroll	11
posting clerk	11
quality control / inspector	11
receptionist	11
secretary	11
stenographer	11
telephone operator	11
timekeeper, accounting	11
technician, documentation	11
typist	11
worker, office	11
boxmaker	12
maker, box	12
bracket fabricator	13
fabricator, bracket	13
bridge tester	14
tester, bridge	14
IMC-IMS04 burn-in	15
burn-in IMC-IMS04	15
Callahan setup / roller / operator	16
setup, Callahan / roller / operator	16
can maker setup or Can maker	17
metal cutter	17
setup, can maker	17
carpenter and helper	18
helper, carpenter	18

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

clearing machine	19
machine, clearing	19
AF climber	20
climber, AF	20
cluster filler	21
filler, cluster	21
cold press	22
analyst, programmer	23
computer operator, senior	23
controller	23
data entry operator	23
keypunch operator	23
operator, computer, senior	23
operator, data entry/keypunch	23
operator, keypunch	23
programmer, analyst	23
masking	24
counter	25
demask/ deburr	26
design drafter	27
drafter, design	27
die setter	28
die setter & die stamper	28
die setter & operator	28
operator, die	28
setter, die	28
stamper, die	28
dipp. operator (?) [tankman]	29
operator, dipp.	29
tank worker	29
tankman	29
tankman	29
worker, tank	29
director	30
assistant dispatcher	31
dispatcher (incl./ assistant & line dispatchers)	31
dist. specialist	31
line dispatcher	31
specialist, dist.	31
drafter	32
brush	33
brush/clear/drill	33
clear/drill/brush	33
drill/ brush/ clear	33
electrician	34
engineer technician (all types)	35

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

engineer, filter	35
engineer, foil	35
engineer, mfg/industrial	35
filter engineer	35
foil engineer	35
industrial engineer	35
mfg. engineer	35
technician, engineer	35
environment technician	36
flex technician	36
lab technician	36
technician	36
technician, environment	36
technician, flex	36
technician, lab	36
expediter	37
filler	38
filler, plastic	38
filler/wrapper	38
wrapper/ filler	38
filter/impregnation / operator	39
impregnation/filter	39
filter inspector	40
inspector, filter	40
filterman- grade 8	41
final pert." (Testing?)	42
testing (final pert.)	42
fireman	43
general helper	44
general worker	44
helper, general	44
production	44
worker, general	44
HV repair	45
general maintenance	45
ground lugs.	45
lugs., ground	45
maintenance	45
maintenance manager	45
maintenance, general	45
manager/ maintenance	45
repair, HV	45
guard/watchman	46
security	46
watchman	46
administrator, human resources	47

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

assistant, human resources	47
human resources (administrator/ specialist/ assistant)	47
specialist, human resources	47
impreg. & packer	48
packer and impregnator [ONLY FOR ASSEMBLY DEPTS]	48
inject molder	49
molder, inject	49
heat test inspector	50
inspector	50
inspector, heat test	50
QA inspector / (AF PT inspection)	50
buyer	51
car muler	51
clerk, stock or inventory	51
coordinator, supplier material	51
crib attendant	51
dispenser, order	51
freight handler	51
handler, freight	51
handler, material	51
handler, salvage	51
inventory clerk	51
jobber stock/ material stockroom/ material handler	51
lead storekeeper	51
leader, sub-assembly	51
material handler	51
material stockroom	51
material supplier coordinator	51
order clerk	51
order dispenser	51
packing, shipping and receiving / packing	51
receiving, shipping, packing	51
salvage handler	51
shipping, receiving, packing	51
shipper	51
stock clerk	51
stock jobber	51
stocker, material	51
storekeeper	51
storekeeper - driver	51
storekeeper lead	51
sub-assembly leader	51
supplier material coordinator	51
insulator, kraft	52
kraft insulator	52
laborer	53

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

bonder, lase	54
lase bonder	54
Lawson papercutter	55
papercutter, Lawson	55
foil slitter	56
ballast cover / machine operator	56
foil tester	56
machine operator / ballast cover	56
machinist	56
operator, machine	56
power press	56
power press set-up	56
riveter	56
set-up, power press	56
slitter	56
slitter, foil	56
tester, foil	56
electrical manager	57
engineering manager	57
environmental health & safety manager	57
leader, team/manager	57
manager/ engineering/electrical sections	57
manager/ environmental health & safety	57
manager/ manufacturing areas (includes materials)	57
manager/ team leader for all departments	57
manufacturing manager	57
materials manager	57
team leader/manager	57
accounting manager	58
analyst, market	58
benefits manager	58
manager/ service (sales/ accounting/ benefits/ marketing/ mis)	58
market analyst	58
marketing manager	58
sales manager	58
service manager	58
assembler, motorized	59
mechanic	59
motorized assembler	59
coordinator, training	60
metalizer	60
nurse	60
operator, service	60
service	60
service department	60
service operator	60

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

training coordinator	60
cutter	61
cutter, mica	61
driver-storekeeper	61
flashing	61
flashing, mica	61
hasher	61
hasher, mica	61
helper, oiler	61
mica splitter/ hasher /cutter/ stacker /flashing	61
oiler/helper	61
splitter, mica	61
stacker	61
stacker, mica	61
cut & punch operator	62
cycle rel operator	62
electrostatic spray operator	62
foot press operator	62
manufacturing operator	62
operator	62
operator (multi-operator)	62
operator, cut & punch	62
operator, cyle rel.	62
operator, electrostatic spray	62
operator, foot press	62
operator, manufacturing	62
operator, pump	62
operator, transmitting	62
pump operator	62
punch & cut operator	62
spray, electrostatic, operator	62
transmitting operator	62
baths operator	63
loader, oven	63
operator, baths	63
operator, oven or oven loader / unloader	63
oven operator or loader / unloader	63
applicator, sealant	64
dipper, paint cans	64
marker, paint	64
paint line/ paint marker/ dip paint cans	64
painter	64
painter, sealant	64
sealant applicator	64
sealant painter	64
parker	65

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

piper	66
porter	67
printer	68
racker	69
analysis & repair, sec.	70
repair & analysis, sec.	70
repair line	70
sec. analysis & repair	70
maker, sample	71
sample maker	71
coordinator, sample	72
sample coordinator	72
sampler	73
sampler/ small orders	73
small orders sampler	73
planner	74
scheduler / planner	74
singulator	75
T-line welder	76
base solderer	76
cover welder	76
fill hole solderer	76
rotary welder	76
solderer	76
solderer, base	76
solderer, fill hole	76
solderer, welder	76
tab welder	76
welder	76
welder, T-line	76
welder, rotary	76
welder-tab/cover	76
welder/solderer	76
supermet.	77
foreman	78
foreman/supervisor	78
supervisor/ foreman	78
QA supervisor	79
production supervisor	79
supervisor, QA	79
supervisor, production	79
T line	80
assembly tab	81
tab. assembler	81
tabcutter	81
table worker	81

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

worker, table	81
end filler taping	82
fill/tape	82
filler, end, taping	82
tape/fill	82
taping, end filler	82
inspector/leader, work	83
leader	83
leader, team, manufacturing	83
leader, work group	83
manufacturing team leader	83
member, team	83
team leader, manuf. areas	83
team member	83
work group leader	83
work leader/inspector	83
HV/EDC tester	84
HV/PF tester	84
administrative team leader	84
leader, team, administrative	84
preselect tester	84
rework, wax	84
team leader, administrative	84
tester	84
tester HV/PF	84
tester, preselect	84
tester/ HV/EDC	84
die & tool maker	85
electrical tester	85
hi volt tester	85
maker, tool & die	85
tester, electrical	85
tester-hi volt	85
tool & die maker	85
toolmaker	86
trainee	87
filler, tub	88
tub filler	88
tubular endfiller	88
cutter, tube	89
pig teller	89
teller, pig	89
tuber/ tube cutter	89
assembler, tubular	90
tubular assembler	90
line, tubular	91

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

tubular line	91
tunnels	92
illness/ other leave/ vacation	93
dip, wax	94
wax dip	94
wax rework	94
clincher	95
Hilton machine (winder)	95
Hunt machine (winder)	95
respooler	95
winder- all types	95
copper sprayer	96
lead sprayer	96
sprayer	96
sprayer, copper	96
sprayer, lead	96
sprayer, zinc	96
zinc sprayer	96
miscarriage	97
pregnancy	98
layoff/ leave/ quit/ leave for school / child care	99
school	99
checking returns	A1
returns, checking	A1
anode stitcher	A3
cut & stitch	A3
cut stitcher	A3
stitcher, anode	A3
stitcher, cut	A3
hot tinner	A4
tinner, hot	A4
setter, type	A6
type setter	A6
driver, truck	A7
truck driver	A7
epoxy mixer	A8
mixer, epoxy	A8
basket unloader / loader	A9
loader, basket	A9
unloader, basket	A9
bench worker	B1
worker, bench	B1
squeezer	B3
chemist	B5
molder	B6
crusher	B7

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

formation	B8
bender, wire	B9
wire bender / wireman	B9
heliane seamer / seamen	C1
seamer, heliane	C1
adm line	C2
line, adm	C2
kettle operator	C3
operator, kettle	C3
time study	C4
millwright	C5
color coder operator	C6
spec. writer	C7
hi voltage worker	C8
worker, high voltage	C8
impregnator	C9
assembly/solder	D1
tester/stamper	D2
stamper	D3
lab cleaner/assembly	D4
plastic tubular	D5
sealer/die stamper	D6
tubular/wax	D7
wet winder & aging	D8
Reel Pkg. Operator	D9
FT slant bridge operator	E1
service operator & dispatcher	E2
service operator & shipping & receiving	E3
service setup man	E4
pay stat recorder	E5
cotter & inspector	E6
advertising	E7
tech operator	E8
dip sealant machine operator	E9
hi volt tester & mat'l supplier	F1
FF asst.	F2
formation man	F3
tubular repairer	F4
analyzation rejects misc. operations	F5
assembler & tester	F6
anode count station	F7
printed wiring	F8
finisher	F9
multigraph operator	G1
fill hole soldering/unloading	G2
solderer & paper filter	G3

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

production Service man	G4
anode foil conv clerk	G5
autolete solder machine operator	G6
processing control	G7
lab tech & elec test	G8
auto revitted insul machine operator	G9
cost estimation	H1
material handler & tester	H2
material handler & winder	H3
tub inserter	H4
drill press operator	H5
electro line	H6
QE general winder & service op	H7
racker/shipper	H8
machine rework printer	H9
calculator	I1
infra red heat test oven shop	I2
pitch delivery man	I3
copper sprayer & general worker	I4
print press operator	I5
tester & stamper	I6
callahan roller & material handler	I7
material washer	I8
packer, shipper, expeditor	I9
misc. operator & tester	J1
life pert tech	J2
quality control & tester	J3
mason	J4
material handler, winder, service operator	J5
foil respooler	J6
rack repairman	J7
inspector-tester	J8
waste control	J9
dipped mica	K1
general worker & sprayer	K2
cleaning trays	K3
packer, converter	K4
short order converter	K5
centrifuge op	K6
compound machine op	K7
pitch pub operator	K8
solderer & hi voltage worker	K9
heat test oven operator & stamper	L1
helper, machinist	L2
rubber stamp maker & type setter	L3
filler & repairer	L4

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

winder & production service operator	L5
inspector & packer	L6
conveyor line	L7
stamper & assembler	L8
time & methods man	L9
tab cleaner	M1
assembler & misc. Operator	M2
packer & stamper	M3
count station & expediter	M4
silicone inserter machine op	M5
statistician	M6
burn-in tester & packer	M7
ECE op/electro chem etch op	M8
plating man	M9
mullilith operator	N1
capacity control	N2
research lab	N3
plastic mixer & tube etcher	N4
service operator & assembler	N5
tab machine operator	N6
calibrator & stacker	N7
finisher	N8
general worker & tester	N9
solderer & degreaser	O1
basket loader & solderer	O2
hilton set up	O3
dorners op	O4
Bridge operator	O5
flipper	O6
assembler & molder	O7
kiln operator	O8
mail clerk	O9
tester & impregnator	P1
pitch filling	P2
oven loader & plastic mixer	P3
impregnator & dispatcher & degreaser	P4
insulation cutter	P5
paper cutter & die setter	P6
degreaser & basket unloader	P7
calculating schedule & processing materials	P8
degreaser & silicone machine operator	P9
D P H operator	Q1
sorter	Q2
soak cycle op	Q3
vibrator	Q4
holley carb	Q5

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

taper wrapper	Q6
cap & bracket	Q7
filling trays	Q8
impregnator & kettle op	Q9
pitch boy & impregnator	R1
packer utility operator	R2
wash cans	R3
oven loader/unloader & inspector	R4
silver mica op	R5
utility op	R6
degreaser & general worker	R7
heat tester & degreaser	R8
packer, shipper & general worker	R9
epoxy mixer & tub assembler	S1
mixer & filler	S2
tab reinforcement	S3
capper	S4
inspector & stamper	S5
tab folder	S6
rubber stamp maker	S7
brander	S8
machine setter	S9
model maker	T1
paint sprayer & tester	T2
sprayer & degreaser	T3
assembler & general worker	T4
tubular assembler & tester	T5
basket loader/unloader & insulator	T6
general worker & power press	T7
impregnator, tester & stamper	T8
anode cutter/slicer	T9
apex printer setup/apex tube setup & printer	U1
rack repairman & can maker	U2
die setter & power press op	U3
auto silicone & rivet machine op	U4
assembler & riveter	U5
knock out sections	U6
welder & general worker	U7
burn in tester & basket loader/unloader	U8
wrapper & tester	U9

7 Appendix B: Job code with descriptions and category

DEPT OPER	DEPT DESC	OPER DESC	NEW JOB CODE DESC	CAT
81A1	Jobber Stock	returns, checking * checking returns	Checking	1
13M3	Paper I Assembly	packer & stamper	Packer	1
13R9	Paper I Assembly	packer, shipper & general worker	Packer	1
21I9	Paper II Assembly & Final test - PCB exposure	packer, shipper, expeditor	Packer	1
21L6	Paper II Assembly & Final test - PCB exposure	inspector & packer	Packer	1
21M3	Paper II Assembly & Final test - PCB exposure	packer & stamper	Packer	1
21M7	Paper II Assembly & Final test - PCB exposure	burn-in tester & packer	Packer	1
21R2	Paper II Assembly & Final test - PCB exposure	packer utility operator	Packer	1
21R9	Paper II Assembly & Final test - PCB exposure	packer, shipper & general worker	Packer	1
52I9	Materials, Stock Rooms	packer, shipper, expeditor	Packer	1
52M3	Materials, Stock Rooms	packer & stamper	Packer	1
52M7	Materials, Stock Rooms	burn-in tester & packer	Packer	1
52R2	Materials, Stock Rooms	packer utility operator	Packer	1
66I9	Firemen and Porters	packer, shipper, expeditor	Packer	1
67I9	Jobber Stock	packer, shipper, expeditor	Packer	1
81K4	Jobber Stock	packer, converter	Packer	1
81M3	Jobber Stock	packer & stamper	Packer	1
5500	Receiving & Storage room	no listed	Receiving	1

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

		supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler		
5551	Receiving & Storage room		Receiving	1
5583	Receiving & Storage room	work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader *	Receiving	1
1307	Paper I Assembly	degreaser, autocan * degreaser * Autocan degreaser	Degreaser	2
13K3	Paper I AssEmbly	cleaning trays	Degreaser	2
13R8	Paper I Assembly	heat tester & degreaser	Degreaser	2
2107	Paper II Assembly & Final test - PCB exposure	degreaser, autocan * degreaser * Autocan degreaser	Degreaser	2
21R7	Paper II Assembly & Final test - PCB exposure	degreaser & general worker	Degreaser	2
21T3	Paper II Assembly & Final test - PCB exposure	sprayer & degreaser	Degreaser	2
2407	Spec. Products	degreaser, autocan * degreaser * Autocan degreaser	Degreaser	2
24P9	Spec. Products	degreaser & silicOne machine operator	Degreaser	2
2507	Sub-Assembly	degreaser, autocan * degreaser * Autocan degreaser	Degreaser	2
5207	Materials, Stock Rooms	degreaser, autocan * degreaser * Autocan degreaser	Degreaser	2
6607	Firemen and Porters	degreaser, autocan * degreaser * Autocan degreaser	Degreaser	2
66R7	Firemen and Porters	degreaser & general worker	Degreaser	2
32K3	Electrical Impregnation and Winding	cleaning trays	Degreaser	2
52T3	Materials, Stock Rooms	sprayer & degreaser	Degreaser	2
13A7	Paper I Assembly	truck driver * driver, truck	Driver	3
21A7	Paper II Assembly & Final test - PCB exposure	truck driver * driver, truck	Driver	3
32A7	Electrical Impregnation and Winding	truck driver * driver, truck	Driver	3

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

33A7	Electrical Assembly and Final testing	truck driver * driver, truck	Driver	3
50A7	Shipping	truck driver * driver, truck	Driver	3
52A7	Materials, Stock Rooms	truck driver * driver, truck	Driver	3
53A7		truck driver * driver, truck	Driver	3
55A7	Receiving & Storage room	truck driver * driver, truck	Driver	3
62A7	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	truck driver * driver, truck	Driver	3
66A7	Firemen and Porters	truck driver * driver, truck	Driver	3
70A7	Shipping	truck driver * driver, truck	Driver	3
1083	Paper I Winding	work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inspector/leader, work	Dry Inspector	4
1340	Paper I Assembly	inspector, filter * filter inspector	Dry Inspector	4
1383	Paper I Assembly	work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inspector/leader, work	Dry Inspector	4
13J8	Paper I Assembly	inspector-tester	Dry Inspector	4
2083	Paper II Winding	work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inspector/leader, work	Dry Inspector	4
2483	Spec. Products	work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inspector/leader, work	Dry Inspector	4
2550	Sub-Assembly	QA inspector / (AF PT inspection) * inspector, heat test * inspector * heat test inspector	Dry Inspector	4
2583	Sub-Assembly	work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inspector/leader, work	Dry Inspector	4
2983	Preform and Anodes	work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inspector/leader, work	Dry Inspector	4
3250	Electrical Impregnation and Winding	QA inspector / (AF PT inspection) * inspector, heat test * inspector * heat test inspector	Dry Inspector	4

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

3283	Electrical Impregnation and Winding	work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inspector/leader, work	Dry Inspector	4
3350	Electrical Assembly and Final testing	QA inspector / (AF PT inspection) * inspector, heat test * inspector * heat test inspector	Dry Inspector	4
3383	Electrical Assembly and Final testing	work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inspector/leader, work	Dry Inspector	4
3483	Electrolysis	work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inspector/leader, work	Dry Inspector	4
3583	Electrolysis	work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inspector/leader, work	Dry Inspector	4
3683		work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inspector/leader, work	Dry Inspector	4
3783		work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inspector/leader, work	Dry Inspector	4
3883		work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inspector/leader, work	Dry Inspector	4
4383	Mica	work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inspector/leader, work	Dry Inspector	4
52J8	Materials, Stock Rooms	inspector-tester	Dry Inspector	4
6683	Firemen and Porters	work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inspector/leader, work	Dry Inspector	4
66S5	Firemen and Porters	inspector & stamper	Dry Inspector	4
83		work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inspector/leader, work	Dry Inspector	4

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

J 83	Mica	work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inspector/leader, work	Dry Inspector	4
K 83		work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inspector/leader, work	Dry Inspector	4
M 83	Tantalum	work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inspector/leader, work	Dry Inspector	4
K83			Dry inspector	4
M83	Tantalum		Dry inspector	4
K C6		color coder operator	Dry Operator	4
M H5		drill press operator	Dry Operator	4
00N1		mullilith operator	Dry Operator	4
1362	Paper I Assembly	transmitting operator * spray, electrostatic, operator * punch & cut operator * pump operator * operator, transmitting * operator, pump * operator, manufacturing * operator, foot press * operator, electrostatic spray * operator, cycle rel. * operator, cut & punch * operator (multi-operator) * operator * manufacturing operator * foot press operator * electrostatic spray operator * cycle rel operator * cut & punch operator	Dry Operator	4
13D9	Paper I Assembly	Reel Pkg. Operator	Dry Operator	4
13I5	Paper I Assembly	print press operator	Dry Operator	4
2116	Paper II Assembly & Final test - PCB exposure	setup, Callahan / roller / operator * Callahan setup / roller / operator	Dry Operator	4
2562	Sub-Assembly	transmitting operator * spray, electrostatic, operator * punch & cut operator * pump operator * operator, transmitting * operator, pump * operator, manufacturing * operator, foot press * operator, electrostatic spray * operator, cycle rel. * operator, cut & punch * operator (multi-operator) * operator * manufacturing operator * foot press operator * electrostatic spray operator * cycle rel operator * cut & punch operator	Dry Operator	4
25H5	Sub-Assembly	drill press operator	Dry Operator	4
25I5	Sub-Assembly	print press operator	Dry Operator	4
25K7	Sub-Assembly	compound machine op	Dry Operator	4
25M5	Sub-Assembly	silicone inserter machine op	Dry Operator	4
25O3	Sub-Assembly	hilton set up	Dry Operator	4
25T7	Sub-Assembly	general worker & power press	Dry Operator	4
25U4	Sub-Assembly	auto silicone & rivet machine op	Dry Operator	4

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

29G9	Preform and Anodes	auto revitted insul machine operator	Dry Operator	4
29K6	Preform and Anodes	centrifuge op	Dry Operator	4
32K6	Electrical Impregnation and Winding	centrifuge op	Dry Operator	4
3333	Electrical Assembly and Final testing	drill/ brush/ clear * clear/drill/brush * brush/clear/drill * brush	Dry Operator	4
3662		transmitting operator * spray, electrostatic, operator * punch & cut operator * pump operator * operator, transmitting * operator, pump * operator, manufacturing * operator, foot press * operator, electrostatic spray * operator, cyle rel. * operator, cut & punch * operator (multi-operator) * operator * manufacturing operator * foot press operator * electrostatic spray operator * cycle rel operator * cut & punch operator	Dry Operator	4
43H5	Mica	drill press operator	Dry operator	4
4.80E+09		tech operator	Dry operator	4
5216	Materials, Stock Rooms	setup, Callahan / roller / operator * Callahan setup / roller / operator	Dry operator	4
52C5	Materials, Stock Rooms	millwright	Dry operator	4
52I5	Materials, Stock Rooms	print press operator	Dry operator	4
52K7	Materials, Stock Rooms	compound machine op	Dry operator	4
52N1	Materials, Stock Rooms	mullilith operator	Dry operator	4
52N6	Materials, Stock Rooms	tab machine operator	Dry operator	4
52O4	Materials, Stock Rooms	dorners op	Dry operator	4
52Q1	Materials, Stock Rooms	D P H operator	Dry operator	4
52R6	Materials, Stock Rooms	utility op	Dry operator	4
59N1	QC (Quality Control)	mullilith operator	Dry operator	4
62G1	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	multigraph operator	Dry operator	4
62N1	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	mullilith operator	Dry operator	4
62N6	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	tab machine operator	Dry operator	4
65N6	Maintenance	tab machine operator	Dry operator	4
6616	Firemen and Porters	setup, Callahan / roller / operator * Callahan setup / Roller / operator	Dry operator	4
66G9	Firemen and Porters	auto revitted insul machine operator	Dry operator	4
66O4	Firemen and Porters	dorners op	Dry operator	4
K O8		kiln operator	Dry operator	4
K N1		mullilith operator	Dry operator	4

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

Y N6		tab machine operator	Dry operator	4
5.20E+09	Materials, Stock RoOms	tech operator	Dry operator	4
M E8		tech operator	Dry operator	4
KC6			Dry operator	4
KN1			Dry operator	4
KO8			Dry operator	4
ME8	Tantalum		Dry operator	4
MH5	Tantalum		Dry operator	4
3300	Electrical Assembly and Final testing	no listed	Electric tester	5
84		tester/ HV/EDC * tester, preselect * tester HV/PF * tester * team leader, administrative * rework, wax * preselect tester * leader, team, administrative * HV/PF tester * HV/EDC tester * administrative team leader	Electrical tester	5
1014	Paper I Winding	tester, bridge * bridge tester	Electrical tester	5
1042	Paper I Winding	testing (final pert.) * final pert." (Testing?)	Electrical tester	5
1084	Paper I Winding	tester/ HV/EDC * tester, preselect * tester HV/PF * tester * team leader, administrative * rework, wax * preselect tester * leader, team, administrative * HV/PF tester * HV/EDC tester * administrative team leader	Electrical tester	5
10A3	Paper I Winding	stitcher, cut * stitcher, anode * cut stitcher * cut & stitch * anode stitcher	Electrical tester	5
1.00E+02	Paper I Winding	FT slant bridge operator	Electrical tester	5
1284	Tank Room - PCB Exposure. Impregnation and Pump Mech.	tester/ HV/EDC * tester, preselect * tester HV/PF * tester * team leader, administrative * rework, wax * preselect tester * leader, team, administrative * HV/PF tester * HV/EDC tester * administrative team leader	Electrical tester	5
1314	Paper I Assembly	tester, bridge * bridge tester	Electrical tester	5
1342	Paper I Assembly	testing (final pert.) * final pert." (Testing?)	Electrical tester	5
1384	Paper I Assembly	tester/ HV/EDC * tester, preselect * tester HV/PF * tester * team leader, administrative * rework, wax * preselect tester * leader, team, administrative * HV/PF tester * HV/EDC tester * administrative team leader	Electrical tester	5
13A3	Paper I Assembly	stitcher, cut * stitcher, anode * cut stitcher * cut & stitch * anode stitcher	Electrical tester	5
13C8	Paper I Assembly	worker, high voltage * hi voltage worker	Electrical tester	5
1.30E+02	Paper I Assembly	FT slant bridge operator	Electrical tester	5
13H6	Paper I Assembly	electro line	Electrical tester	5
13N2	Paper I Assembly	capacity control	Electrical tester	5
13O5	Paper I Assembly	Bridge operator	Electrical tester	5
2084	Paper II Winding	tester/ HV/EDC * tester, preselect * tester HV/PF * tester * team leader, administrative * rework, wax * preselect tester * leader, team, administrative * HV/PF tester * HV/EDC tester * administrative team leader	Electrical tester	5
20C8	Paper II Winding	worker, high voltage * hi voltage worker	Electrical tester	5

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

2114	Paper II Assembly & Final test - PCB exposure	tester, bridge * bridge tester	Electrical tester	5
2142	Paper II Assembly & Final test - PCB exposure	testing (final pert.) * final pert." (Testing?)	Electrical tester	5
2184	Paper II Assembly & Final test - PCB exposure	tester/ HV/EDC * tester, preselect * tester HV/PF * tester * team leader, administrative * rework, wax * preselect tester * leader, team, administrative * HV/PF tester * HV/EDC tester * administrative team leader	Electrical tester	5
21C8	Paper II Assembly & Final test - PCB exposure	worker, high voltage * hi voltage worker	Electrical tester	5
21F1	Paper II Assembly & Final test - PCB exposure	hi volt tester & mat=1 supplier	Electrical tester	5
21I6	Paper II Assembly & Final test - PCB exposure	tester & stamper	Electrical tester	5
2445	Spec. Products	repair, HV * manager/ maintenance * maintenance, general * maintenance manager * maintenance * lugs., ground * HV repair * ground lugs. * general maintenance	Electrical tester	5
2484	Spec. Products	tester/ HV/EDC * tester, preselect * tester HV/PF * tester * team leader, administrative * rework, wax * preselect tester * leader, team, administrative * HV/PF tester * HV/EDC tester * administrative team leader	Electrical tester	5
24C8	Spec. Products	worker, high voltage * hi voltage worker	Electrical tester	5
2545	Sub-Assembly	repair, HV * manager/ maintenance * maintenance, general * maintenance manager * maintenance * lugs., ground * HV repair * ground lugs. * general maintenance	Electrical tester	5
2584	Sub-Assembly	tester/ HV/EDC * tester, preselect * tester HV/PF * tester * team leader, administrative * rework, wax * preselect tester * leader, team, administrative * HV/PF tester * HV/EDC tester * administrative team leader	Electrical tester	5
2945	Preform and Anodes	repair, HV * manager/ maintenance * maintenance, general * maintenance manager * maintenance * lugs., ground * HV repair * ground lugs. * general maintenance	Electrical tester	5
2984	Preform and Anodes	tester/ HV/EDC * tester, preselect * tester HV/PF * tester * team leader, administrative * rework, wax * preselect tester * leader, team, administrative * HV/PF tester * HV/EDC tester * administrative team leader	Electrical tester	5
29C8	Preform and Anodes	worker, high voltage * hi voltage worker	Electrical tester	5
2.90E+02	Preform and Anodes	FT slant bridge operator	Electrical tester	5
29O5	Preform and Anodes	Bridge operator	Electrical tester	5
3214	Electrical Impregnation and Winding	tester, bridge * bridge tester	Electrical tester	5

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

3242	Electrical Impregnation and Winding	testing (final pert.) * final pert." (Testing?)	Electrical tester	5
3284	Electrical Impregnation and Winding	tester/ HV/EDC * tester, preselect * tester HV/PF * tester * team leader, administrative * rework, wax * preselect tester * leader, team, administrative * HV/PF tester * HV/EDC tester * administrative team leader	Electrical tester	5
3314	Electrical Assembly and Final testing	tester, bridge * bridge tester	Electrical tester	5
3320	Electrical Assembly and Final testing	climber, AF * AF climber	Electrical tester	5
3342	Electrical Assembly and Final testing	testing (final pert.) * final pert." (Testing?)	Electrical tester	5
3345	Electrical Assembly and Final testing	repair, HV * manager/ maintenance * maintenance, general * maintenance manager * maintenance * lugs., ground * HV repair * ground lugs. * general maintenance	Electrical tester	5
3384	Electrical Assembly and Final testing	tester/ HV/EDC * tester, preselect * tester HV/PF * tester * team leader, administrative * rework, wax * preselect tester * leader, team, administrative * HV/PF tester * HV/EDC tester * administrative team leader	Electrical tester	5
33A1	Electrical Assembly and Final testing	returns, checking * checking returns	Electrical tester	5
33B1	Electrical Assembly and Final testing	worker, bench * bench worker	Electrical tester	5
33J8	Electrical Assembly and Final testing	inspector-tester	Electrical tester	5
3484	Electrolysis	tester/ HV/EDC * tester, preselect * tester HV/PF * tester * team leader, administrative * rework, wax * preselect tester * leader, team, administrative * HV/PF tester * HV/EDC tester * administrative team leader	Electrical tester	5
3584	Electrolysis	tester/ HV/EDC * tester, preselect * tester HV/PF * tester * team leader, administrative * rework, wax * preselect tester * leader, team, administrative * HV/PF tester * HV/EDC tester * administrative team leader	Electrical tester	5
3684		tester/ HV/EDC * tester, preselect * tester HV/PF * tester * team leader, administrative * rework, wax * preselect tester * leader, team, administrative * HV/PF tester * HV/EDC tester * administrative team leader	Electrical tester	5
3784		tester/ HV/EDC * tester, preselect * tester HV/PF * tester * team leader, administrative * rework, wax * preselect tester * leader, team, administrative * HV/PF tester * HV/EDC tester * administrative team leader	Electrical tester	5
3914		tester, bridge * bridge tester	Electrical tester	5
3984		tester/ HV/EDC * tester, preselect * tester HV/PF * tester * team leader, administrative * rework, wax * preselect tester * leader, team, administrative * HV/PF tester * HV/EDC tester * administrative team leader	Electrical tester	5

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

3.90E+02		FT slant bridge operator	Electrical tester	5
4314	Mica	tester, bridge * bridge tester	Electrical tester	5
4342	Mica	testing (final pert.) * final pert." (Testing?)	Electrical tester	5
4384	Mica	tester/ HV/EDC * tester, preselect * tester HV/PF * tester * team leader, administrative * rework, wax * preselect tester * leader, team, administrative * HV/PF tester * HV/EDC tester * administrative team leader	Electrical tester	5
43N2	Mica	capaCity control	Electrical tester	5
5214	Materials, Stock Rooms	tester, bridge * bridge tester	Electrical tester	5
5242	Materials, Stock Rooms	testing (final pert.) * final pert." (Testing?)	Electrical tester	5
5284	Materials, Stock Rooms	tester/ HV/EDC * tester, preselect * tester HV/PF * tester * team leader, administrative * rework, wax * preselect tester * leader, team, administrative * HV/PF tester * HV/EDC tester * administrative team leader	Electrical tester	5
52J2	Materials, Stock Rooms	life pert tech	Electrical tester	5
52N2	Materials, Stock Rooms	capaCity control	Electrical tester	5
6284	Office/Office services, Sales*, data processing*, Accounting and Finance, General Administrative	tester/ HV/EDC * tester, preselect * tester HV/PF * tester * team leader, administrative * rework, wax * preselect tester * leader, team, administrative * HV/PF tester * HV/EDC tester * administrative team leader	Electrical tester	5
6614	Firemen and Porters	tester, bridge * bridge tester	Electrical tester	5
6642	Firemen and Porters	testing (final pert.) * final pert." (Testing?)	Electrical tester	5
6684	Firemen and Porters	tester/ HV/EDC * tester, preselect * tester HV/PF * tester * team leader, administrative * rework, wax * preselect tester * leader, team, administrative * HV/PF tester * HV/EDC tester * administrative team leader	Electrical tester	5
66C8	Firemen and Porters	worker, high voltage * hi voltage worker	Electrical tester	5
K 84		tester/ HV/EDC * tester, preselect * tester HV/PF * tester * team leader, administrative * rework, wax * preselect tester * leader, team, administrative * HV/PF tester * HV/EDC tester * administrative team leader	Electrical tester	5
M 84		tester/ HV/EDC * tester, preselect * tester HV/PF * tester * team leader, administrative * rework, wax * preselect tester * leader, team, administrative * HV/PF tester * HV/EDC tester * administrative team leader	Electrical tester	5
Y 84		tester/ HV/EDC * tester, preselect * tester HV/PF * tester * team leader, administrative * rework, wax * preselect tester * leader, team, administrative * HV/PF tester * HV/EDC tester * administrative team leader	Electrical tester	5
K84			Electrical tester	5
M84	Tantalum		Electrical tester	5
Y84			Electrical tester	5
3200	Electrical Impregnation and Winding	no listed	Electrical worker	5

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

00C8		worker, high voltage * hi voltage worker	Electrical worker	5
33D8	Electrical Assembly and Final testing	wet winder & aging	Electrical worker	5
3.30E+02	Electrical Assembly and Final testing	FT slant bridge operator	Electrical worker	5
3.30E+09	Electrical Assembly and Final testing	tech operator	Electrical worker	5
33F2	Electrical Assembly and Final testing	FF asst.	Electrical worker	5
33F7	Electrical Assembly and Final testing	anode count station	Electrical worker	5
33F8	Electrical Assembly and Final testing	printed wiring	Electrical worker	5
33K6	Electrical Assembly and Final testing	centrifuge op	Electrical worker	5
33K8	Electrical Assembly and Final testing	pitch pub operator	Electrical worker	5
33L5	Electrical Assembly and Final testing	winder & production service operator	Electrical worker	5
33O5	Electrical Assembly and Final testing	Bridge operator	Electrical worker	5
33P2	Electrical Assembly and Final testing	pitch filling	Electrical worker	5
33R6	Electrical Assembly and Final testing	utility op	Electrical worker	5
33T4	Electrical Assembly and Final testing	assembler & general worker	Electrical worker	5
3400	Electrolysis	no listed	Electrical worker	5
3444	Electrolysis	worker, general * production * helper, general * general worker * general helper	Electrical worker	5
34I3	Electrolysis	pitch delivery man	Electrical worker	5
34K8	Electrolysis	pitch pub operator	Electrical worker	5
34R1	Electrolysis	pitch boy & impregnator	Electrical worker	5
3500	Electrolysis	no listed	Electrical worker	5
3544	Electrolysis	worker, general * production * helper, general * general worker * general helper	Electrical worker	5
38A3		stitcher, cut * stitcher, anode * cut stitcher * cut & stitch * anode stitcher	Electrical worker	5
38O5		Bridge operator	Electrical worker	5
3900		no listed	Electrical worker	5
4 00	Electrolysis	no listed	Electrical worker	5
4000	Electrolysis	no listed	Electrical worker	5
41M8		ECE op/electro Chem etch op	Electrical worker	5
44A3		stitcher, cut * stitcher, anode * cut stitcher * cut & stitch * anode stitcher	Electrical worker	5
5234	Materials, Stock Rooms	electrician	Electrical worker	5
5245	Materials, Stock Rooms	repair, HV * manager/ maintenance * maintenance, general * maintenance manager * maintenance * lugs., ground * HV repair * ground lugs. * general maintenance	Electrical worker	5

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

52A3	Materials, Stock Rooms	stitcher, cut * stitcher, anode * cut stitcher * cut & stitch * anode stitcher	Electrical worker	5
52C8	Materials, Stock Rooms	worker, high voltage * hi voltage worker	Electrical worker	5
52F1	Materials, Stock Rooms	hi volt tester & mat=l supplier	Electrical worker	5
52M8	Materials, Stock Rooms	ECE op/electro Chem etch op	Electrical worker	5
52O5	Materials, Stock Rooms	Bridge operator	Electrical worker	5
6534	Maintenance	electrician	Electrical worker	5
6634	Firemen and Porters	electrician	Electrical worker	5
66A3	Firemen and Porters	stitcher, cut * stitcher, anode * cut stitcher * cut & stitch * anode stitcher	Electrical worker	5
6.60E+02	Firemen and Porters	FT slant bridge operator	Electrical worker	5
66M8	Firemen and Porters	ECE op/electro Chem etch op	Electrical worker	5
7534	Maintenance	electrician	Electrical worker	5
MM9	Tantalum		Metal coating	15
5.20E+02	Materials, Stock Rooms	FT slant bridge operator	Electrocal worker	5
00C9		impregnator	Impregnation	5
1348	Paper I Assembly	packer and impregnator [ONLY FOR ASSEMBLY DEPTS] * impreg. & packer	Impregnation	5
13C9	Paper I AssEmbly	impregnator	Impregnation	5
13P1	Paper I Assembly	tester & impregnator	Impregnation	5
2048	Paper II Winding	packer and impregnator [ONLY FOR ASSEMBLY DEPTS] * impreg. & packer	Impregnation	5
20C9	Paper II Winding	impregnator	Impregnation	5
2148	Paper II Assembly & Final test - PCB exposure	packer and impregnator [ONLY FOR ASSEMBLY DEPTS] * impreg. & packer	Impregnation	5
21C9	Paper II Assembly & Final test - PCB exposure	impregnator	Impregnation	5
21P1	Paper II Assembly & Final test - PCB exposure	tester & impregnator	Impregnation	5
21T8	Paper II Assembly & Final test - PCB exposure	impregnator, tester & stamper	Impregnation	5
25C9	Sub-AssEmbly	impregnator	Impregnation	5
2948	Preform and Anodes	packer and impregnator [ONLY FOR ASSEMBLY DEPTS] * impreg. & packer	Impregnation	5
29C9	Preform and Anodes	impregnator	Impregnation	5
29Q9	Preform and Anodes	impregnator & kettle op	Impregnation	5
3248	Electrical Impregnation and Winding	packer and impregnator [ONLY FOR ASSEMBLY DEPTS] * impreg. & packer	Impregnation	5
32C9	Electrical Impregnation and Winding	impregnator	Impregnation	5
32Q9	Electrical Impregnation and Winding	impregnator & kettle op	Impregnation	5
3348	Electrical Assembly and Final testing	packer and impregnator [ONLY FOR ASSEMBLY DEPTS] * impreg. & packer	Impregnation	5
33Q9	Electrical Assembly and Final testing	impregnator & kettle op	Impregnation	5

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

35C9	Electrolysis	impregnator	Impregnation	5
3748		packer and impregnator [ONLY FOR ASSEMBLY DEPTS] * impreg. & packer	Impregnation	5
4348	Mica	packer and impregnator [ONLY FOR ASSEMBLY DEPTS] * impreg. & packer	Impregnation	5
43C9	Mica	impregnator	Impregnation	5
5248	Materials, Stock Rooms	packer and impregnator [ONLY FOR ASSEMBLY DEPTS] * impreg. & packer	Impregnation	5
52C9	Materials, Stock Rooms	impregnator	Impregnation	5
52P1	Materials, Stock Rooms	tester & impregnator	Impregnation	5
52T8	Materials, Stock Rooms	impregnator, tester & stamper	Impregnation	5
6648	Firemen and Porters	packer and impregnator [ONLY FOR ASSEMBLY DEPTS] * impreg. & packer	Impregnation	5
2900	Preform and Anodes	no listed	P&A	5
2904	Preform and Anodes	wax assembler * tantalum operator / assembler * oil assembler * met. misc. assembler * met. & filter assembler * inspector, assembler * filter & met. assembler * assembler/ oil * assembler/ mica * assembler/ met. Misc. * assembler/ met. & filter * assembler / wax * assembler / inspector	P&A	5
2905	Preform and Anodes	plastic mixer * plastic assembler * paper assembler * mixer, plastic * Assembly/ hi voltage * assembler/ plastic/ plastic mixer * assembler/ paper ii * assembler/ paper I	P&A	5
2944	Preform and Anodes	worker, general * production * helper, general * general worker * general helper	P&A	5
2953	Preform and Anodes	laborer	P&A	5
2966	Preform and Anodes	piper	P&A	5
2981	Preform and Anodes	worker, table * table worker * tabcutter * tab. assembler * assembly tab	P&A	5
29A3	Preform and Anodes	stitcher, cut * stitcher, anode * cut stitcher * cut & stitch * anode stitcher	P&A	5
29B1	Preform and Anodes	worker, bench * bench worker	P&A	5
29B3	Preform and Anodes	squeezer	P&A	5
29B6	Preform and Anodes	molder	P&A	5
29B8	Preform and Anodes	formation	P&A	5
29C7	Preform and Anodes	spec. writer	P&A	5
29F7	Preform and Anodes	anode count station	P&A	5
29G5	Preform and Anodes	anode foil conv clerk	P&A	5
29G8	Preform and Anodes	lab tech & elec test	P&A	5
29M8	Preform and Anodes	ECE op/electro chem etch op	P&A	5
29Q2	Preform and Anodes	sorter	P&A	5
3100		no listed	P&A	5
31A3		stitcher, cut * stitcher, anode * cut stitcher * cut & stitch * anode stitcher	P&A	5
32A3	Electrical Impregnation and Winding	stitcher, cut * stitcher, anode * cut stitcher * cut & stitch * anode stitcher	P&A	5
32F7	Electrical Impregnation and Winding	anode count station	P&A	5

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

32T9	Electrical Impregnation and Winding	anode cutter/slicer	P&A	5
33A3	Electrical Assembly and Final testing	stitcher, cut * stitcher, anode * cut stitcher * cut & stitch * anode stitcher	P&A	5
36A3		stitcher, cut * stitcher, anode * cut stitcher * cut & stitch * anode stitcher	P&A	5
52F7	Materials, Stock Rooms	anode count station	P&A	5
52F8	Materials, Stock Rooms	printed wiring	P&A	5
52T9	Materials, Stock Rooms	anode cutter/slicer	P&A	5
35		technician, engineer * mfg. engineer * industrial engineer * foil engineer * filter engineer * engineer, mfg/industrial * engineer, foil * engineer, filter * engineer technician (all types)	Engineer	6
5235	Materials, Stock Rooms	technician, engineer * mfg. engineer * industrial engineer * foil engineer * filter engineer * engineer, mfg/industrial * engineer, foil * engineer, filter * engineer technician (all types)	Engineer	6
7535	Maintenance	technician, engineer * mfg. engineer * industrial engineer * foil engineer * filter engineer * engineer, mfg/industrial * engineer, foil * engineer, filter * engineer technician (all types)	Engineer	6
7700	Engineers	no listed	Engineer	6
7835	Firemen	technician, engineer * mfg. engineer * industrial engineer * foil engineer * filter engineer * engineer, mfg/industrial * engineer, foil * engineer, filter * engineer technician (all types)	Engineer	6
5600	Engineers - Industrial or Product	no listed	Engineer	6
5635	Engineers - Industrial or Product	technician, engineer * mfg. engineer * industrial engineer * foil engineer * filter engineer * engineer, mfg/industrial * engineer, foil * engineer, filter * engineer technician (all types)	Engineer	6
5683	Engineers - Industrial or Product	work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inspector/leader, work	Engineer	6
5835	Guards, Security	technician, engineer * mfg. engineer * industrial engineer * foil engineer * filter engineer * engineer, mfg/industrial * engineer, foil * engineer, filter * engineer technician (all types)	Engineer	6
5935	QC (Quality Control)	technician, engineer * mfg. engineer * industrial engineer * foil engineer * filter engineer * engineer, mfg/industrial * engineer, foil * engineer, filter * engineer technician (all types)	Engineer	6
6035	Machine Shop	technician, engineer * mfg. engineer * industrial engineer * foil engineer * filter engineer * engineer, mfg/industrial * engineer, foil * engineer, filter * engineer technician (all types)	Engineer	6
6235	Office/Office services, Sales*, data processing*, Accounting and Finance, General Administrative	technician, engineer * mfg. engineer * industrial engineer * foil engineer * filter engineer * engineer, mfg/industrial * engineer, foil * engineer, filter * engineer technician (all types)	Engineer	6

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

6635	Firemen and Porters	technician, engineer * mfg. engineer * industrial engineer * foil engineer * filter engineer * engineer, mfg/industrial * engineer, foil * engineer, filter * engineer technician (all types)	Engineer	6
6735	Jobber Stock	technician, engineer * mfg. engineer * industrial engineer * foil engineer * filter engineer * engineer, mfg/industrial * engineer, foil * engineer, filter * engineer technician (all types)	Engineer	6
O 35		technician, engineer * mfg. engineer * industrial engineer * foil engineer * filter engineer * engineer, mfg/industrial * engineer, foil * engineer, filter * engineer technician (all types)	Engineer	6
Q 35		technician, engineer * mfg. engineer * industrial engineer * foil engineer * filter engineer * engineer, mfg/industrial * engineer, foil * engineer, filter * engineer technician (all types)	Engineer	6
O35			Engineer	6
Q35			Engineer	6
1335	Paper I Assembly	technician, engineer * mfg. engineer * industrial engineer * foil engineer * filter engineer * engineer, mfg/industrial * engineer, foil * engineer, filter * engineer technician (all types)	Engineer - Foil	6
2135	Paper II Assembly & Final test - PCB exposure	technician, engineer * mfg. engineer * industrial engineer * foil engineer * filter engineer * engineer, mfg/industrial * engineer, foil * engineer, filter * engineer technician (all types)	Engineer - paper and final test	6
7335	QC	technician, engineer * mfg. engineer * industrial engineer * foil engineer * filter engineer * engineer, mfg/industrial * engineer, foil * engineer, filter * engineer technician (all types)	Engineer QC	6
5243	Materials, Stock Rooms	fireman	fireman	7
6543	Maintenance	fireman	fireman	7
6600	Firemen and Porters	no listed	fireman	7
6643	Firemen and Porters	fireman	fireman	7
7800	Firemen	no listed	fireman	7
7843	Firemen	fireman	fireman	7
6700	Jobber Stock	no listed	Jobber stock	8
6744	Jobber Stock	worker, general * production * helper, general * general worker * general helper	Jobber stock	8

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

		supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler		
6751	Jobber Stock		Jobber stock	8
8100	Jobber Stock	no listed	Jobber stock	8
8144	Jobber Stock	worker, general * production * helper, general * general worker * general helper	Jobber stock	8
		supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler		
8151	Jobber Stock		Jobber stock	8
		work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inspector/leader, work		
8183	Jobber Stock		Jobber stock	8
81K5	Jobber Stock	short order converter	Jobber stock	8
52J4	Materials, Stock Rooms	mason	Stock room	8
52	Materials, Stock Rooms	[ONLY FOR SHIP/REC DEPTS]	Stock room	8
5200	Materials, Stock Rooms	no listed	Stock room	8
		worker, general * production * helper, general * general worker * general helper		
5244	Materials, Stock Rooms		Stock room	8
5253	Materials, Stock Rooms	laborer	Stock room	8
5266	Materials, Stock Rooms	piper	Stock room	8
		small orders sampler * sampler/ small orders * sampler		
5273	Materials, Stock Rooms		Stock room	8

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

		work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader *		
5283	Materials, Stock Rooms	inspector/leader, work	Stock room	8
52B1	Materials, Stock Rooms	worker, bench * bench worker	Stock room	8
52B4	Materials, Stock Rooms		Stock room	8
52D9	Materials, Stock Rooms	Reel Pkg. Operator	Stock room	8
52F2	Materials, Stock Rooms	FF asst.	Stock room	8
52I3	Materials, Stock Rooms	pitch delivery man	Stock room	8
52J1	Materials, Stock Rooms	misc. operator & tester	Stock room	8
52K5	Materials, Stock Rooms	short order converter	Stock room	8
52N9	Materials, Stock Rooms	general worker & tester	Stock room	8
52O6	Materials, Stock Rooms	flipper	Stock room	8
52Q7	Materials, Stock Rooms	cap & bracket	Stock room	8
52T7	Materials, Stock Rooms	general worker & power press	Stock room	8
29C3	Preform and Anodes	operator, kettle * kettle operator	Kettle operator	26
32C3	Electrical Impregnation and Winding	operator, kettle * kettle operator	Kettle operator	26
52C3	Materials, Stock Rooms	operator, kettle * kettle operator	Kettle operator	26
66C3	Firemen and Porters	operator, kettle * kettle operator	Kettle operator	26
1306	Paper I Assembly	PF operator * operator, PF * Auto PF facate	Large capacitors	9
2506	Sub-Assembly	PF operator * operator, PF * Auto PF facate	Large capacitors	9
2906	Preform and Anodes	PF operator * operator, PF * Auto PF facate	Large capacitors	9
3306	Electrical Assembly and Final testing	PF operator * operator, PF * Auto PF facate	Large capacitors	9
5206	Materials, Stock Rooms	PF operator * operator, PF * Auto PF facate	Large capacitors	9
6006	Machine Shop	PF operator * operator, PF * Auto PF facate	Large capacitors	9
6606	Firemen and Porters	PF operator * operator, PF * Auto PF facate	Large capacitors	9
60L9	Machine Shop	time & methods man	Machinist	10
60N1	Machine Shop	millilith operator	Machinist	10
62T1	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	model maker	Machinist	10
10S9	Paper I Winding	machine setter	Machinist	10
52L2	Materials, Stock Rooms	helper, machinist	Machinist	10
6000	Machine Shop	no listed	Machinist	10
60L2	Machine Shop	helper, machinist	Machinist	10
61L2	QC (Quality Control)	helper, machinist	Machinist	10
73L2	QC	helper, machinist	Machinist	10
4385	Mica	tool & die maker * tester?hi volt * tester, electrical * maker, tool & die * hi volt tester * electrical tester * die & tool maker	Tool & die	10
5228	Materials, Stock Rooms	stamper, die * setter, die * operator, die * die setter & operator * die setter & die stamper * die setter	Tool & die	10

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

5285	Materials, Stock Rooms	tool & die maker * tester?hi volt * tester, electrical * maker, tool & die * hi volt tester * electrical tester * die & tool maker	Tool & die	10
5286	Materials, Stock Rooms	toolmaker	Tool & die	10
52A6	Materials, Stock Rooms	type setter * setter, type	Tool & die	10
52L3	Materials, Stock Rooms	rubber stamp maker & type setter	Tool & die	10
52P6	Materials, Stock Rooms	paper cutter & die setter	Tool & die	10
52U3	Materials, Stock Rooms	die setter & power press op	Tool & die	10
6085	Machine Shop	tool & die maker * tester?hi volt * tester, electrical * maker, tool & die * hi volt tester * electrical tester * die & tool maker	Tool & die	10
6186	QC (Quality Control)	toolmaker	Tool & die	10
6628	Firemen and Porters	stamper, die * setter, die * operator, die * die setter & operator * die setter & die stamper * die setter	Tool & die	10
66A6	Firemen and Porters	type setter * setter, type	Tool & die	10
7385	QC	tool & die maker * tester?hi volt * tester, electrical * maker, tool & die * hi volt tester * electrical tester * die & tool maker	Tool & die	10
7386	QC	toolmaker	Tool & die	10
8128	Jobber Stock	stamper, die * setter, die * operator, die * die setter & operator * die setter & die stamper * die setter	Tool & die	10
M 85		tool & die maker * tester?hi volt * tester, electrical * maker, tool & die * hi volt tester * electrical tester * die & tool maker	Tool & die	10
M85	Tantalum		Tool & die	10
1328	Paper I Assembly	stamper, die * setter, die * operator, die * die setter & operator * die setter & die stamper * die setter	Tool & dye	10
1385	Paper I Assembly	tool & die maker * tester?hi volt * tester, electrical * maker, tool & die * hi volt tester * electrical tester * die & tool maker	Tool & dye	10
13A6	Paper I Assembly	type setter * setter, type	Tool & dye	10
13L3	Paper I Assembly	rubber stamp maker & type setter	Tool & dye	10
2085	Paper II Winding	tool & die maker * tester?hi volt * tester, electrical * maker, tool & die * hi volt tester * electrical tester * die & tool maker	Tool & dye	10
2128	Paper II Assembly & Final test - PCB exposure	stamper, die * setter, die * operator, die * die setter & operator * die setter & die stamper * die setter	Tool & dye	10
2185	Paper II Assembly & Final test - PCB exposure	tool & die maker * tester?hi volt * tester, electrical * maker, tool & die * hi volt tester * electrical tester * die & tool maker	Tool & dye	10
21A6	Paper II Assembly & Final test - PCB exposure	type setter * setter, type	Tool & dye	10
2485	Spec. Products	tool & die maker * tester?hi volt * tester, electrical * maker, tool & die * hi volt tester * electrical tester * die & tool maker	Tool & dye	10
24A6	Spec. Products	type setter * setter, type	Tool & dye	10

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

2528	Sub-Assembly	stamper, die * setter, die * operator, die * die setter & operator * die setter & die stamper * die setter	Tool & dye	10
25A6	Sub-Assembly	type setter * setter, type	Tool & dye	10
25P6	Sub-Assembly	paper cutter & die setter	Tool & dye	10
25U3	Sub-Assembly	die setter & power press op	Tool & dye	10
2986	Preform and Anodes	toolmaker	Tool & dye	10
3328	Electrical Assembly and Final testing	stamper, die * setter, die * operator, die * die setter & operator * die setter & die stamper * die setter	Tool & dye	10
3428	Electrolysis	stamper, die * setter, die * operator, die * die setter & operator * die setter & die stamper * die setter	Tool & dye	10
34D6	Electrolysis	Sealer/die stamper	Tool & dye	10
6086	Machine Shop	toolmaker	Tool & dye	10
6053	Machine Shop	laborer	Laborer	11
6653	Firemen and Porters	laborer	Laborer	11
1045	Paper I Winding	repair, HV * manager/ maintenance * maintenance, general * maintenance manager * maintenance * lugs., ground * HV repair * ground lugs. * general maintenance	Maintenance	11
1.00E+05	Paper I Winding	Service setup man	Maintenance	11
10J9	Paper I Winding	waste control	Maintenance	11
1.30E+05	Paper I Assembly	Service setup man	Maintenance	11
13N5	Paper I Assembly	service operator & assembler	Maintenance	11
2.00E+05	Paper II Winding	Service setup man	Maintenance	11
2918	Preform and Anodes	helper, carpenter * carpenter and helper	Maintenance	11
32G4	Electrical Impregnation and Winding	production Service man	Maintenance	11
3.30E+05	Electrical Assembly and Final testing	Service setup man	Maintenance	11
33G4	Electrical Assembly and Final testing	production Service man	Maintenance	11
5218	Materials, Stock Rooms	helper, carpenter * carpenter and helper	Maintenance	11
5.20E+05	Materials, Stock Rooms	Service setup man	Maintenance	11
52G4	Materials, Stock Rooms	production Service man	Maintenance	11
52H7	Materials, Stock Rooms	QE general winder & service op	Maintenance	11
52J9	Materials, Stock Rooms	waste control	Maintenance	11
52N5	Materials, Stock Rooms	service operator & assembler	Maintenance	11
6500	Maintenance	no listed	Maintenance	11
6518	Maintenance	helper, carpenter * carpenter and helper	Maintenance	11
6544	Maintenance	worker, general * production * helper, general * general worker * general helper	Maintenance	11
6545	Maintenance	repair, HV * manager/ maintenance * maintenance, general * maintenance manager * maintenance * lugs., ground * HV repair * ground lugs. * general maintenance	Maintenance	11
6553	Maintenance	laborer	Maintenance	11
6566	Maintenance	piper	Maintenance	11

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

65C5	MaintEnance	millwright	Maintenance	11
65J4	Maintenance	mason	Maintenance	11
7500	Maintenance	no listed	Maintenance	11
7518	Maintenance	helper, carpenter * carPenter and helper	Maintenance	11
7544	Maintenance	worker, general * production * helper, general * general worker * general helper	Maintenance	11
7583	Maintenance	work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inspeCtor/leader, work	Maintenance	11
6576	Maintenance	welder?tab/cover * welder/solderer * welder, T?line * welder, rotary * welder * T?line welder * tab welder * solderer, welder * solderer, fill hole * solderer, base * solderer * rotary welder * fill hole solderer * cover welder * base solderer	Maintenance	11
6583	Maintenance	work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inspeCtor/leader, work	Maintenance	11
13G7	Paper I Assembly	pProcessing control	Manufacture	12
2162	Paper II Assembly & Final test - PCB exposure	transmitting operator * spray, electrostatic, operator * punch & cut operator * pump operator * operator, transmitting * operator, pump * operator, manufacturing * operator, foot press * operator, electrostatic spray * operator, cyle rel. * operator, cut & punch * operator (multi-operator) * operator * manufacturing operator * foot press operator * electrostatic spray operator * cycle rel operator * cut & punch operator	Manufacture	12
2462	Spec. Products	transmitting operator * spray, electrostatic, operator * punch & cut operator * pump operator * operator, transmitting * operator, pump * operator, manufacturing * operator, foot press * operator, electrostatic spray * operator, cyle rel. * operator, cut & punch * operator (multi-operator) * operator * manufacturing operator * foot press operator * electrostatic spray operator * cycle rel operator * cut & punch operator	Manufacture	12
25G7	Sub-Assembly	pProcessing control	Manufacture	12
29N2	Preform and Anodes	capacity control	Manufacture	12
52G7	Materials, Stock Rooms	pProcessing control	Manufacture	12
59G7	QC (Quality Control)	pProcessing control	Manufacture	12
62G7	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	pProcessing control	Manufacture	12
7200	Process Control	no listed	Manufacture	12

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

7235	Process control	technician, engineer * mfg. engineer * industrial engineer * foil engineer * filter engineer * engineer, mfg/industrial * engineer, foil * engineer, filter * engineer technician (all types)	Manufacture	12
72G7	Process control	processing control	Manufacture	12
3651		supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler	material handler	13
4451		supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler	Material handler	13
6551	Maintenance	supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler	Material handler	13
M51	Tantalum		Material handler	13

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

3251	Electrical Impregnation and Winding	supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler	Material handler & racker	13
3451	Electrolysis	supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler	Material handler & racker	13
3551	Electrolysis	supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler	Material handler & racker	13

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

4051		supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler	Material handler & racker	13
4351	Mica	supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler	Material handler & racker	13
52H2	Materials, Stock Rooms	material handler & tester	Material handler & racker	13
52J5	Materials, Stock Rooms	material handler, winder, service operator	Material handler & racker	13
5851	Guards, Security	supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler	Material handler & racker	13

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

6051	Machine Shop	supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler	Material handler & racker	13
6251	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler	Material handler & racker	13
6651	Firemen and Porters	supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler	Material handler & racker	13
32H3	Electrical Impregnation and Winding	material handler & winder	Material handler & racker	13

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

3351	Electrical Assembly and Final testing	supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler	Material handler & racker	13
33H2	Electrical Assembly and Final testing	material handler & tester	Material handler & racker	13
51		supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler	Material handler & racker	13
1051	Paper I Winding	supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler	Material handler & racker	13

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

1251	Tank Room - PCB Exposure. Impregnation and Pump Mech.	supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler	Material handler & racker	13
1351	Paper I Assembly	supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler	Material handler & racker	13
13H3	Paper I Assembly	material handler & winder	Material handler & racker	13
1551		supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler	Material handler & racker	13

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

		supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler		
2051	Paper II Winding		Material handler & racker	13
2053	Paper II Winding	laborer	Material handler & racker	13
21H2	Paper II Assembly & Final test - PCB exposure	material handler & tester	Material handler & racker	13
2117	Paper II Assembly & Final test - PCB exposure	callahan roller & material handler	Material handler & racker	13
		supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler		
2351	Supervisor, plant area	muler	Material handler & racker	13
		supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler		
2551	Sub-Assembly	muler	Material handler & racker	13

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

		supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler		
2951	Preform and Anodes		Material handler & racker	13
M 51		supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler	Material handler & racker	13
1396	Paper I Assembly	zinc sprayer * sprayer, zinc * sprayer, lead * sprayer, copper * sprayer * lead sprayer * copper sprayer	Metal coating	14
1314	Paper I Assembly	copper sprayer & general worker	Metal coating	14
13K2	Paper I Assembly	general worker & sprayer	Metal coating	14
2196	Paper II Assembly & Final test - PCB exposure	zinc sprayer * sprayer, zinc * sprayer, lead * sprayer, copper * sprayer * lead sprayer * copper sprayer	Metal coating	14
21K2	Paper II Assembly & Final test - PCB exposure	general worker & sprayer	Metal coating	14
25A4	Sub-Assembly	tinner, hot * hot tinner	Metal coating	14
2962	Preform and Anodes	transmitting operator * spray, electrostatic, operator * punch & cut operator * pump operator * operator, transmitting * operator, pump * operator, manufacturing * operator, foot press * operator, electrostatic spray * operator, cyle rel. * operator, cut & punch * operator (multi-operator) * operator * manufacturing operator * foot press operator * electrostatic spray operator * cycle rel operator * cut & punch operator	Metal coating	14
29A4	Preform and Anodes	tinner, hot * hot tinner	Metal coating	14

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

32F9	Electrical Impregnation and Winding	finisher	Metal coating	14
32N8	Electrical Impregnation and Winding	finisher	Metal coating	14
3362	Electrical Assembly and Final testing	transmitting operator * spray, electrostatic, operator * punch & cut operator * pump operator * operator, transmitting * operator, pump * operator, manufacturing * operator, foot press * operator, electrostatic spray * operator, cycle rel. * operator, cut & punch * operator (multi-operator) * operator * manufacturing operator * foot press operator * electrostatic spray operator * cycle rel operator * cut & punch operator	Metal coating	14
3396	Electrical Assembly and Final testing	zinc sprayer * sprayer, zinc * sprayer, lead * sprayer, copper * sprayer * lead sprayer * copper sprayer	Metal coating	14
5296	Materials, Stock Rooms	zinc sprayer * sprayer, zinc * sprayer, lead * sprayer, copper * sprayer * lead sprayer * copper sprayer	Metal coating	14
52A4	Materials, Stock Rooms	tinner, hot * hot tinner	Metal coating	14
52I4	Materials, Stock Rooms	copper sprayer & general worker	Metal coating	14
52K2	Materials, Stock Rooms	general worker & sprayer	Metal coating	14
M 96		zinc sprayer * sprayer, zinc * sprayer, lead * sprayer, copper * sprayer * lead sprayer * copper sprayer	Metal coating	14
4362	Mica	transmitting operator * spray, electrostatic, operator * punch & cut operator * pump operator * operator, transmitting * operator, pump * operator, manufacturing * operator, foot press * operator, electrostatic spray * operator, cycle rel. * operator, cut & punch * operator (multi-operator) * operator * manufacturing operator * foot press operator * electrostatic spray operator * cycle rel operator * cut & punch operator	Metal coating	14
5262	Materials, Stock Rooms	transmitting operator * spray, electrostatic, operator * punch & cut operator * pump operator * operator, transmitting * operator, pump * operator, manufacturing * operator, foot press * operator, electrostatic spray * operator, cycle rel. * operator, cut & punch * operator (multi-operator) * operator * manufacturing operator * foot press operator * electrostatic spray operator * cycle rel operator * cut & punch operator	Metal coating	14

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

6062	Machine Shop	transmitting operator * spray, electrostatic, operator * punch & cut operator * pump operator * operator, transmitting * operator, pump * operator, manufacturing * operator, foot press * operator, electrostatic spray * operator, cyle rel. * operator, cut & punch * operator (multi-operator) * operator * manufacturing operator * foot press operator * electrostatic spray operator * cycle rel operator * cut & punch operator	Metal coating	14
6562	Maintenance	transmitting operator * spray, electrostatic, operator * punch & cut operator * pump operator * operator, transmitting * operator, pump * operator, manufacturing * operator, foot press * operator, electrostatic spray * operator, cyle rel. * operator, cut & punch * operator (multi-operator) * operator * manufacturing operator * foot press operator * electrostatic spray operator * cycle rel operator * cut & punch operator	Metal coating	14
6662	Firemen and Porters	transmitting operator * spray, electrostatic, operator * punch & cut operator * pump operator * operator, transmitting * operator, pump * operator, manufacturing * operator, foot press * operator, electrostatic spray * operator, cyle rel. * operator, cut & punch * operator (multi-operator) * operator * manufacturing operator * foot press operator * electrostatic spray operator * cycle rel operator * cut & punch operator	Metal coating	14
66A4	Firemen and Porters	tinner, hOt * hot tinner	Metal coating	14
7162	Test lab	transmitting operator * spray, electrostatic, operator * punch & cut operator * pump operator * operator, transmitting * operator, pump * operator, manufacturing * operator, foot press * operator, electrostatic spray * operator, cyle rel. * operator, cut & punch * operator (multi-operator) * operator * manufacturing operator * foot press operator * electrostatic spray operator * cycle rel operator * cut & punch operator	Metal coating	14
7462	Tantalum	transmitting operator * spray, electrostatic, operator * punch & cut operator * pump operator * operator, transmitting * operator, pump * operator, manufacturing * operator, foot press * operator, electrostatic spray * operator, cyle rel. * operator, cut & punch * operator (multi-operator) * operator * manufacturing operator * foot press operator * electrostatic spray operator * cycle rel operator * cut & punch operator	Metal coating	14

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

J 62		transmitting operator * spray, electrostatic, operator * punch & cut operator * pump operator * operator, transmitting * operator, pump * operator, manufacturing * operator, foot press * operator, electrostatic spray * operator, cycle rel. * operator, cut & punch * operator (multi-operator) * operator * manufacturing operator * foot press operator * electrostatic spray operator * cycle rel operator * cut & punch operator	Metal coating	14
M 62		transmitting operator * spray, electrostatic, operator * punch & cut operator * pump operator * operator, transmitting * operator, pump * operator, manufacturing * operator, foot press * operator, electrostatic spray * operator, cycle rel. * operator, cut & punch * operator (multi-operator) * operator * manufacturing operator * foot press operator * electrostatic spray operator * cycle rel operator * cut & punch operator	Metal coating	14
M M9		plating man	Metal coating	14
M62	Tantalum		Metal coating	14
M96	Tantalum		Metal coating	14
1037	Paper I Winding	expediter	Dispatcher	15
1.00E+03	Paper I Winding	service operator & dispatcher	Dispatcher	15
1237	Tank Room - PCB Exposure. Impregnation and Pump Mech.	expediter	Dispatcher	15
1331	Paper I Assembly	specialist, dist. * line dispatcher * dist. specialist * dispatcher (incl./ assistant & line dispatchers) * assistant dispatcher	Dispatcher	15
1337	Paper I Assembly	expediter	Dispatcher	15
1.30E+03	Paper I Assembly	service operator & dispatcher	Dispatcher	15
1537		expediter	Dispatcher	15
2031	Paper II Winding	specialist, dist. * line dispatcher * dist. specialist * dispatcher (incl./ assistant & line dispatchers) * assistant dispatcher	Dispatcher	15
2.00E+03	Paper II Winding	service operator & dispatcher	Dispatcher	15
2131	Paper II Assembly & Final test - PCB exposure	specialist, dist. * line dispatcher * dist. specialist * dispatcher (incl./ assistant & line dispatchers) * assistant dispatcher	Dispatcher	15
2137	Paper II Assembly & Final test - PCB exposure	expediter	Dispatcher	15
2.10E+03	Paper II Assembly & Final test - PCB exposure	service operator & dispatcher	Dispatcher	15
2337	Supervisor, plant area	expediter	Dispatcher	15
2531	Sub-Assembly	specialist, dist. * line dispatcher * dist. specialist * dispatcher (incl./ assistant & line dispatchers) * assistant dispatcher	Dispatcher	15

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

2537	Sub-Assembly	expediter	Dispatcher	15
2.50E+03	Sub-Assembly	service operator & dispatcher	Dispatcher	15
2937	Preform and Anodes	expediter	Dispatcher	15
3.20E+03	Electrical Impregnation and Winding	service operator & dispatcher	Dispatcher	15
3331	Electrical Assembly and Final testing	specialist, dist. * line dispatcher * dist. specialist * dispatcher (incl./ assistant & line dispatchers) * asSistant dispatcher	Dispatcher	15
3431	Electrolysis	specialist, dist. * line dispatcher * dist. specialist * dispatcher (incl./ assistant & line dispatchers) * asSistant dispatcher	Dispatcher	15
3531	Electrolysis	specialist, dist. * line dispatcher * dist. specialist * dispatcher (incl./ assistant & line dispatchers) * asSistant dispatcher	Dispatcher	15
3.50E+03	Electrolysis	service operator & dispatcher	Dispatcher	15
3631		specialist, dist. * line dispatcher * dist. specialist * dispatcher (incl./ assistant & line dispatchers) * asSistant dispatcher	Dispatcher	15
3931		specialist, dist. * line dispatcher * dist. specialist * dispatcher (incl./ assistant & line dispatchers) * asSistant dispatcher	Dispatcher	15
5231	Materials, Stock Rooms	specialist, dist. * line dispatcher * dist. specialist * dispatcher (incl./ assistant & line dispatchers) * asSistant dispatcher	dispatcher	15
5.20E+03	Materials, Stock Rooms	service operator & dispatcher	dispatcher	15
5531	Receiving & Storage room	specialist, dist. * line dispatcher * dist. specialist * dispatcher (incl./ assistant & line dispatchers) * asSistant dispatcher	dispatcher	15
6231	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	specialist, dist. * line dispatcher * dist. specialist * dispatcher (incl./ assistant & line dispatchers) * asSistant dispatcher	dispatcher	15
6631	Firemen and Porters	specialist, dist. * line dispatcher * dist. specialist * dispatcher (incl./ assistant & line dispatchers) * asSistant dispatcher	dispatcher	15
8131	Jobber Stock	specialist, dist. * line dispatcher * dist. specialist * dispatcher (incl./ assistant & line dispatchers) * asSistant dispatcher	Dispatcher	15
8000	Distribution and sales	no listed	Distribution and sales	15
8037	Distribution and sales	expediter	Distribution and sales	15

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

		supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler		
8051	Distribution and sales		Distribution and sales	15
8200	Distribution and sales	no listed	Distribution and sales	15
5232	Materials, Stock Rooms	drafter	drafter	15
5632	Engineers - Industrial or Product	drafter	drafter	15
6032	Machine Shop	drafter	drafter	15
6232	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	drafter	drafter	15
6627	Firemen and Porters	drafter, deSign * design drafter	Drafter	15
6632	Firemen and Porters	drafter	drafter	15
7227	Process control	drafter, deSign * design drafter	drafter	15
7232	PrOcess control	drafter	drafter	15
7327	QC	drafter, deSign * design drafter	drafter	15
7332	QC	drafter	drafter	15
7532	Maintenance	drafter	drafter	15
7732	Engineers	drafter	drafter	15
Q 32		drafter	drafter	15
Q32			Drafter	15
6283	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inspector/leader, work	Office worker	15
6783	Jobber Stock	work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader *	Office worker	15
X O9		mail clerk	Office worker	15
K S8		brander	Office worker	15

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

23		programmer, analyst * operator, keypunch * operator, data entry/keypunch * operator, computer, senior * keypunch operator * data entry operator * controller * computer operator, senior * analyst, programmer	Office worker	15
1011	Paper I Winding	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
1311	Paper I Assembly	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
1368	Paper I Assembly	printer	Office worker	15
1511		worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
2011	Paper II Winding	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

2111	Paper II Assembly & Final test - PCB exposure	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
2311	Supervisor, plant area	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
2511	Sub-Assembly	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
2611		worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
2911	Preform and Anodes	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

2923	Preform and Anodes	programmer, analyst * operator, keypunch * operator, data entry/keypunch * operator, computer, senior * keypunch operator * data entry operator * controller * computer operator, senior * analyst, programmer	Office worker	15
2909	Preform and Anodes	mail clerk	Office worker	15
3211	Electrical Impregnation and Winding	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
3311	Electrical Assembly and Final testing	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
3.30E+06	Electrical Assembly and Final testing	pay stat recorder	Office worker	15
3511	Electrolysis	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
4011		worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

4211		worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
4311	Mica	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
4323	Mica	programmer, analyst * operator, keypunch * operator, data entry/keypunch * operator, computer, senior * keypunch operator * data entry operator * controller * computer operator, senior * analyst, programmer	Office worker	15
5011	Shipping	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
5.00E+06	Shipping	pay stat recorder	Office worker	15
5100	Manuf. Admin.	no listed	Office worker	15
5111	Manuf. Admin.	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

5211	Materials, Stock Rooms	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
5223	Materials, Stock Rooms	programmer, analyst * operator, keypunch * operator, data entry/keypunch * operator, computer, senior * keypunch operator * data entry operator * controller * computer operator, senior * analyst, programmer	Office worker	15
52C7	Materials, Stock Rooms	spec. writer	Office worker	15
5.20E+06	Materials, Stock Rooms	pay stat recorder	Office worker	15
5.20E+08	Materials, Stock Rooms	advertising	Office worker	15
52H1	Materials, Stock Rooms	Cost estimation	Office worker	15
5511	Receiving & Storage room	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
5611	Engineers - Industrial or Product	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
56C7	Engineers - Industrial or Product	spec. writer	Office worker	15
5711		worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

		worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative		
5811	Guards, Security		Office worker	15
58C7	Guards, Security	spec. writer	Office worker	15
		worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative		
5911	QC (Quality Control)		Office worker	15
		worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative		
6011	Machine Shop		Office worker	15
60C7	Machine Shop	spec. writer	office worker	15
		worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative		
6111	QC (Quality Control)		Office worker	15
6200	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	no listed	Office worker	15

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

6211	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
6223	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	programmer, analyst * operator, keypunch * operator, data entry/keypunch * operator, computer, senior * keypunch operator * data entry operator * controller * computer operator, senior * analyst, programmer	Office worker	15
62C7	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	spec. writer	Office worker	15
6.20E+06	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	pay stat recorder	Office worker	15
6.20E+08	Personnel and First Aid	advertising	Office worker	15
62H1	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	Cost estimation	office worker	15
62O9	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	mail clerk	office worker	15
6511	Maintenance	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
6523	Maintenance	programmer, analyst * operator, keypunch * operator, data entry/keypunch * operator, computer, senior * keypunch operator * data entry operator * controller * computer operator, senior * analyst, programmer	Office worker	15

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

6611	Firemen and Porters	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
6623	Firemen and Porters	programmer, analyst * operator, keypunch * operator, data entry/keypunch * operator, computer, senior * keypunch operator * data entry operator * controller * computer operator, senior * analyst, programmer	Office worker	15
6711	Jobber Stock	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
7011	Shipping	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
70C7	Shipping	spec. writer	office worker	15
70H1	Shipping	Cost estimation	office worker	15
7111	Test lab	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

7211	Process control	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
75C7	MaintenanCe	spec. writer	office worker	15
77C7	Engineers	spec. writer	office worker	15
78C7	Firemen	spec. writer	office worker	15
8023	Distribution and sales	programmer, analyst * operator, keypunch * operator, data entry/keypunch * operator, computer, senior * keypunch operator * data entry operator * controller * computer operator, senior * analyst, programmer	Office worker	15
8711	Advertising	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
K 10		worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
M 10		worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

O 10		worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
X 10		worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
Y 10		worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
Y 23		programmer, analyst * operator, keypunch * operator, data entry/keypunch * operator, computer, senior * keypunch operator * data entry operator * controller * computer operator, senior * analyst, programmer	Office worker	15
K11			Office worker	15
KS8			Office worker	15
M11	Tantalum		Office worker	15
O11			Office worker	15
X11	Accounting /Personnel		Office worker	15
XO9	Accounting /Personnel		Office worker	15
Y11			Office worker	15
Y23			Office worker	15

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

7311	QC	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
7411	Tantalum	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
7511	Maintenance	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
7811	Firemen	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
8011	Distribution and sales	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

8111	Jobber Stock	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
8211	Distribution and sales	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
8511	Sales	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
8911		worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Office worker	15
1074	Paper I Winding	scheduler / planner * planner	Planner	15
10C4	Paper I Winding	time study	Planner	15
1325	PapEr I Assembly	counter	Planner	15
1574		scheduler / planner * planner	Planner	15
2374	Supervisor, plant area	scheduler / planner * planner	Planner	15
2925	Preform and Anodes	counter	Planner	15
2974	Preform and Anodes	scheduler / planner * planner	Planner	15
29P8	Preform and Anodes	calculating schedule & processing materials	Planner	15
3225	Electrical Impregnation and Winding	counter	Planner	15

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

32I1	Electrical Impregnation and Winding	calculator	Planner	15
3325	Electrical Assembly and Final testing	counter	Planner	15
33I1	Electrical Assembly and Final testing	calculator	Planner	15
33M4	Electrical Assembly and Final testing	count station & expediter	Planner	15
3437	Electrolysis	expediter	Planner	15
4037		expediter	Planner	15
5025	Shipping	counter	Planner	15
5074	Shipping	scheduler / planner * planner	Planner	15
5225	Materials, Stock Rooms	counter	Planner	15
5237	Materials, Stock Rooms	expediter	Planner	15
5274	Materials, Stock Rooms	scheduler / planner * planner	Planner	15
52C4	Materials, Stock Rooms	time study	Planner	15
52I1	Materials, Stock Rooms	calculator	Planner	15
52L9	Materials, Stock Rooms	time & methods man	Planner	15
56C4	Engineers - Industrial Or Product	time study	Planner	15
60C4	Machine Shop	time study	Planner	15
6237	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	expediter	Planner	15
6274	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	scheduler / planner * planner	Planner	15
62C4	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	time study	Planner	15
62L9	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	time & methods man	Planner	15
6625	Firemen and Porters	counter	Planner	15
6637	Firemen and Porters	expediter	Planner	15
6674	Firemen and Porters	scheduler / planner * planner	Planner	15
66I1	Firemen and Porters	calculator	Planner	15
7074	Shipping	scheduler / planner * planner	Planner	15
8137	Jobber Stock	expediter	Planner	15
12J3	Tank Room - PCB Exposure. Impregnation and Pump Mech.	quality control & tester	QC	15

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

52J3	Materials, Stock Rooms	quality control & tester	QC	15
7300	QC	no listed	QC	15
7380	QC	T line	QC	15
73J3	QC	quality control & tester	QC	15
5900	QC (Quality Control)	no listed	QC	15
6100	QC (Quality Control)	no listed	QC	15
7383	QC	work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inspector/leader, work	QC	15
8500	Sales	no listed	Sales	15
8551	Sales	supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler	Sales	15
1078	Paper I Winding	supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
1278	Tank Room - PCB Exposure. Impregnation and Pump Mech.	supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
1378	Paper I Assembly	supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
2078	Paper II Winding	supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
2178	Paper II Assembly & Final test - PCB exposure	supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
2179	Paper II Assembly & Final test - PCB exposure	supervisor, QA * supervisor, production * QA supervisor * production supervisor	Supervisor	15
2300	Supervisor, plant area	no listed	Supervisor	15
2344	Supervisor, plant area	worker, general * production * helper, general * general worker * general helper	Supervisor	15
2578	Sub-Assembly	supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
2978	Preform and Anodes	supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
3378	Electrical Assembly and Final testing	supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

3478	Electrolysis	supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
3678		supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
3878		supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
4378	Mica	supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
5078	Shipping	supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
5178	Manuf. Admin.	supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
5278	Materials, Stock Rooms	supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
5279	Materials, Stock Rooms	supervisor, QA * supervisor, production * QA supervisor * production supervisor	Supervisor	15
5578	Receiving & Storage room	supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
5678	Engineers - Industrial or Product	supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
5679	Engineers - Industrial or Product	supervisor, QA * supervisor, production * QA supervisor * production supervisor	Supervisor	15
5878	Guards, Security	supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
5978	QC (Quality Control)	supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
6078	Machine Shop	supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
6278	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
6279	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	supervisor, QA * supervisor, production * QA supervisor * production supervisor	Supervisor	15
6578	Maintenance	supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
6678	Firemen and Porters	supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
6778	Jobber Stock	supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
7078	Shipping	supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
7178	Test lab	supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
7378	QC	supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
7778	Engineers	supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

8078	Distribution and sales	supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
8178	Jobber Stock	supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
8278	Distribution and sales	supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
J 78		supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
K 78		supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
M 78		supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
X 78		supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
3278	Electrical Impregnation and Winding	supervisor/ foreman * foreman/supervisor * foreman	Supervisor	15
J78	Mica		Supervisor	15
K78			Supervisor	15
M78	Tantalum		Supervisor	15
X78	Accounting /Personnel		Supervisor	15
60		training coordinator * service operator * service department * service * operator, service * nurse * metalizer * cOordinator, training	Training	15
1060	Paper I Winding	training coordinator * service operator * service department * service * operator, service * nurse * metalizer * cOordinator, training	Training	15
1087	Paper I Winding	trainee	Training	15
1260	Tank Room - PCB Exposure. Impregnation and Pump Mech.	training coordinator * service operator * service department * service * operator, service * nurse * metalizer * cOordinator, training	Training	15
1360	Paper I Assembly	training coordinator * service operator * service department * service * operator, service * nurse * metalizer * cOordinator, training	Training	15
1387	Paper I Assembly	trainee	Training	15
2060	Paper II Winding	training coordinator * service operator * service department * service * operator, service * nurse * metalizer * cOordinator, training	Training	15
2087	Paper II Winding	trainee	Training	15
2160	Paper II Assembly & Final test - PCB exposure	training coordinator * service operator * service department * service * operator, service * nurse * metalizer * cOordinator, training	Training	15
2187	Paper II Assembly & Final test - PCB exposure	trainee	Training	15
2460	Spec. Products	training coordinator * service operator * service department * service * operator, service * nurse * metalizer * cOordinator, training	Training	15
2560	Sub-Assembly	training coordinator * service operator * service department * service * operator, service * nurse * metalizer * cOordinator, training	Training	15
2587	Sub-Assembly	trainee	Training	15

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

2960	Preform and Anodes	training coordinator * service operator * service department * service * operator, service * nurse * metalizer * cOordinator, training	Training	15
3260	Electrical Impregnation and Winding	training coordinator * service operator * service department * service * operator, service * nurse * metalizer * cOordinator, training	Training	15
3287	Electrical Impregnation and Winding	trainee	Training	15
3360	Electrical Assembly and Final testing	training coordinator * service operator * service department * service * operator, service * nurse * metalizer * cOordinator, training	Training	15
3387	Electrical Assembly and Final testing	trainee	Training	15
3460	Electrolysis	training coordinator * service operator * service department * service * operator, service * nurse * metalizer * cOordinator, training	Training	15
3560	Electrolysis	training coordinator * service operator * service department * service * operator, service * nurse * metalizer * cOordinator, training	Training	15
3660		training coordinator * service operator * service department * service * operator, service * nurse * metalizer * cOordinator, training	Training	15
3687		trainee	Training	15
3760		training coordinator * service operator * service department * service * operator, service * nurse * metalizer * cOordinator, training	Training	15
4360	Mica	training coordinator * service operator * service department * service * operator, service * nurse * metalizer * cOordinator, training	Training	15
5260	Materials, Stock Rooms	training coordinator * service operator * service department * service * operator, service * nurse * metalizer * cOordinator, training	Training	15
5287	Materials, Stock Rooms	trainee	Training	15
5660	Engineers - Industrial or Product	training coordinator * service operator * service department * service * operator, service * nurse * metalizer * cOordinator, training	Training	15
5887	Guards, Security	trainee	Training	15
6260	Office/Office services, Sales*, data processing*, Accounting and Finance, General Administrative	training coordinator * service operator * service department * service * operator, service * nurse * metalizer * cOordinator, training	Training	15
6587	Maintenance	trainee	Training	15
6660	Firemen and Porters	training coordinator * service operator * service department * service * operator, service * nurse * metalizer * cOordinator, training	Training	15
6687	Firemen and Porters	trainee	Training	15
6760	Jobber Stock	training coordinator * service operator * service department * service * operator, service * nurse * metalizer * cOordinator, training	Training	15
7587	Maintenance	trainee	Training	15

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

K 60		training coordinator * service operator * service department * service * operator, service * nurse * metalizer * cOordinator, training	Training	15
M 60		training coordinator * service operator * service department * service * operator, service * nurse * metalizer * cOordinator, training	Training	15
M 87		trainee	Training	15
O 87		trainee	Training	15
K60			Training	15
M60	Tantalum		Training	15
M87	Tantalum		Training	15
O87			Training	15
5264	Materials, Stock Rooms	sealant painter * sealant applicator * painter, sealant * painter * paint line/ paint marker/ dip paint cans * marker, paint * dipper, paint cans * applicator, sealant	Paint /sealant	16
52D6	Materials, Stock Rooms	sealer/die stamper	Paint /sealant	16
6564	Maintenance	sealant painter * sealant applicator * painter, sealant * painter * paint line/ paint marker/ dip paint cans * marker, paint * dipper, paint cans * applicator, sealant	Paint /sealant	16
6664	Firemen and Porters	sealant painter * sealant applicator * painter, sealant * painter * paint line/ paint marker/ dip paint cans * marker, paint * dipper, paint cans * applicator, sealant	Paint /sealant	16
6764	Jobber Stock	sealant painter * sealant applicator * painter, sealant * painter * paint line/ paint marker/ dip paint cans * marker, paint * dipper, paint cans * applicator, sealant	Paint /sealant	16
7564	Maintenance	sealant painter * sealant applicator * painter, sealant * painter * paint line/ paint marker/ dip paint cans * marker, paint * dipper, paint cans * applicator, sealant	Paint /sealant	16
1364	Paper I Assembly	sealant painter * sealant applicator * painter, sealant * painter * paint line/ paint marker/ dip paint cans * marker, paint * dipper, paint cans * applicator, sealant	Painter/sealant	16
13A8	Paper I Assembly	mixer, epoxy * epoxy mixer	Painter/sealant	16
13S1	Paper I Assembly	epoxy mixer & tub assembler	Painter/sealant	16
2164	Paper II Assembly & Final test - PCB exposure	sealant painter * sealant applicator * painter, sealant * painter * paint line/ paint marker/ dip paint cans * marker, paint * dipper, paint cans * applicator, sealant	Painter/sealant	16
21T2	Paper II Assembly & Final test - PCB exposure	paint sprayer & tester	Painter/sealant	16
2564	Sub-Assembly	sealant painter * sealant applicator * painter, sealant * painter * paint line/ paint marker/ dip paint cans * marker, paint * dipper, paint cans * applicator, sealant	Painter/sealant	16
2.50E+10	Sub-Assembly	dip sealant machine operator	Painter/sealant	16

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

2964	Preform and Anodes	sealant painter * sealant applicator * painter, sealant * painter * paint line/ paint marker/ dip paint cans * marker, paint * dipper, paint cans * applicator, sealant	Painter/sealant	16
29A8	Preform and Anodes	mixer, epoxy * epoxy mixer	Painter/sealant	16
29N8	Preform and Anodes	finisher	Painter/sealant	16
3364	Electrical Assembly and Final testing	sealant painter * sealant applicator * painter, sealant * painter * paint line/ paint marker/ dip paint cans * marker, paint * dipper, paint cans * applicator, sealant	Painter/sealant	16
33A8	Electrical Assembly and Final testing	mixer, epoxy * epoxy mixer	Painter/sealant	16
33N8	Electrical Assembly and Final testing	finisher	Painter/sealant	16
3464	Electrolysis	sealant painter * sealant applicator * painter, sealant * painter * paint line/ paint marker/ dip paint cans * marker, paint * dipper, paint cans * applicator, sealant	Painter/sealant	16
37A8		mixer, epoxy * epoxy mixer	Painter/sealant	16
52A8	Materials, Stock Rooms	mixer, epoxy * epoxy mixer	Painter/sealant	16
2100	Paper II Assembly & Final test - PCB exposure	no listed	Post-assembly	17
2104	Paper II Assembly & Final test - PCB exposure	wax assembler * tantalum operator / assembler * oil assembler * met. misc. assembler * met. & filter assembler * inspector, assembler * filter & met. assembler * assembler/ oil * assembler/ mica * assembler/ met. Misc. * assembler/ met. & filter * assembler / wax * assembler / inspector	Post-assembly	17
2105	Paper II Assembly & Final test - PCB exposure	plastic mixer * plastic assembler * paper assembler * mixer, plastic * Assembly/ hi voltage * assembler/ plastic/ plastic mixer * assembler/ paper ii * assembler/ paper 1	Post-assembly	17
2112	Paper II Assembly & Final test - PCB exposure	maker, box * boxmaker	Post-assembly	17
2115	Paper II Assembly & Final test - PCB exposure	IMC?IMS04 burn?in * burn?in IMC?IMS04	Post-assembly	17
2138	Paper II Assembly & Final test - PCB exposure	wrapper/ filler * filler/wrapper * filler, plastic * filler	Post-assembly	17
2144	Paper II Assembly & Final test - PCB exposure	worker, general * production * helper, general * general worker * general helper	Post-assembly	17
2173	Paper II Assembly & Final test - PCB exposure	small orders sampler * sampler/ small orders * sampler	Post-assembly	17
2194	Paper II Assembly & Final test - PCB exposure	wax rework * wax dip * dip, wax	Post-assembly	17

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

21B1	Paper II Assembly & Final test - PCB exposure	worker, bench * bench worker	Post-assembly	17
21D2	Paper II Assembly & Final test - PCB exposure	tester/stamper	Post-assembly	17
21D3	Paper II Assembly & Final test - PCB exposure	stamper	Post-assembly	17
2.10E+09	Paper II Assembly & Final test - PCB exposure	tech operator	Post-assembly	17
21J1	Paper II Assembly & Final test - PCB exposure	misc. operator & tester	Post-assembly	17
21N9	Paper II Assembly & Final test - PCB exposure	general worker & tester	Post-assembly	17
21O6	Paper II Assembly & Final test - PCB exposure	flipper	Post-assembly	17
21Q1	Paper II Assembly & Final test - PCB exposure	D P H operator	Post-assembly	17
21Q7	Paper II Assembly & Final test - PCB exposure	cap & bracket	Post-assembly	17
21S4	Paper II Assembly & Final test - PCB exposure	capper	Post-assembly	17
1361	Paper I Assembly	stacker, mica * stacker * splitter, mica * oiler/helper * mica splitter/ hasher /cutter/ stacker /flashing * helper, oiler * hasher, mica * hasher * flashing, mica * flashing * driver?storekeeper * cutter, mica * cutter	Mica	18
2061	Paper II Winding	stacker, mica * stacker * splitter, mica * oiler/helper * mica splitter/ hasher /cutter/ stacker /flashing * helper, oiler * hasher, mica * hasher * flashing, mica * flashing * driver?storekeeper * cutter, mica * cutter	Mica	18
2161	Paper II Assembly & Final test - PCB exposure	stacker, mica * stacker * splitter, mica * oiler/helper * mica splitter/ hasher /cutter/ stacker /flashing * helper, oiler * hasher, mica * hasher * flashing, mica * flashing * driver?storekeeper * cutter, mica * cutter	Mica	18
2561	Sub-Assembly	stacker, mica * stacker * splitter, mica * oiler/helper * mica splitter/ hasher /cutter/ stacker /flashing * helper, oiler * hasher, mica * hasher * flashing, mica * flashing * driver?storekeeper * cutter, mica * cutter	Mica	18
3361	Electrical Assembly and Final testing	stacker, mica * stacker * splitter, mica * oiler/helper * mica splitter/ hasher /cutter/ stacker /flashing * helper, oiler * hasher, mica * hasher * flashing, mica * flashing * driver?storekeeper * cutter, mica * cutter	Mica	18

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

4300	Mica	no listed	Mica	18
4304	Mica	wax assembler * tantalum operator / assembler * oil assembler * met. misc. assembler * met. & filter assembler * inspector, assembler * filter & met. assembler * assembler/ oil * assembler/ mica * assembler/ met. Misc. * assembler/ met. & filter * assembler / wax * assembler / inspector	Mica	18
4305	Mica	plastic mixer * plastic assembler * paper assembler * mixer, plastic * Assembly/ hi voltage * assembler/ plastic/ plastic mixer * assembler/ paper ii * assembler/ paper I	Mica	18
4344	Mica	worker, general * production * helper, general * general worker * general helper	Mica	18
4349	Mica	molder, inject * inject molder	Mica	18
4361	Mica	stacker, mica * stacker * splitter, mica * oiler/helper * mica splitter/ hasher /cutter/ stacker /flashing * helper, oiler * hasher, mica * hasher * flashing, mica * flashing * driver?storekeeper * cutter, mica * cutter	Mica	18
4373	Mica	small orders sampler * sampler/ small orders * sampler	Mica	18
43B1	Mica	worker, bench * bench worker	Mica	18
43B3	Mica	squeezer	Mica	18
43B6	Mica	molder	Mica	18
43C2	Mica	line, adm * adm line	Mica	18
43C6	Mica	color coder operator	Mica	18
4.30E+07	Mica	cotter & inspector	Mica	18
4.30E+09	Mica	tech operator	Mica	18
43K1	Mica	dipped mica	Mica	18
43N7	Mica	calibrator & stacker	Mica	18
43O4	Mica	dorners op	Mica	18
43O7	Mica	assembler & molder	Mica	18
43Q8	Mica	filling trays	Mica	18
43R5	Mica	silver mica op	Mica	18
43S6	Mica	tab folder	Mica	18
43S8	Mica	brander	Mica	18
5261	Materials, Stock Rooms	stacker, mica * stacker * splitter, mica * oiler/helper * mica splitter/ hasher /cutter/ stacker /flashing * helper, oiler * hasher, mica * hasher * flashing, mica * flashing * driver?storekeeper * cutter, mica * cutter	Mica	18
52K1	Materials, Stock Rooms	dipped mica	Mica	18
52R5	Materials, Stock Rooms	silver mica op	Mica	18
6561	Maintenance	stacker, mica * stacker * splitter, mica * oiler/helper * mica splitter/ hasher /cutter/ stacker /flashing * helper, oiler * hasher, mica * hasher * flashing, mica * flashing * driver?storekeeper * cutter, mica * cutter	Mica	18

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

6661	Firemen and Porters	stacker, mica * stacker * splitter, mica * oiler/helper * mica splitter/ hasher /cutter/ stacker /flashing * helper, oiler * hasher, mica * hasher * flashing, mica * flashing * driver?storekeeper * cutter, mica * cutter	Mica	18
7561	Maintenance	stacker, mica * stacker * splitter, mica * oiler/helper * mica splitter/ hasher /cutter/ stacker /flashing * helper, oiler * hasher, mica * hasher * flashing, mica * flashing * driver?storekeeper * cutter, mica * cutter	Mica	18
J 44	Mica	worker, general * production * helper, general * general worker * general helper	Mica	18
J04	Mica		Mica	18
J44	Mica		Mica	18
J62	Mica		Metal coating	15
J83	Mica		Dry inspector	4
JB1	Mica		Mica	18
JB6	Mica		Mica	18
66C5	Firemen and Porters	millwright	millwright	18
73C5	QC	millwright	millwright	18
75C5	Maintenance	millwright	millwright	18
M B8		formation	Pre-assembly	18
J B6		molder	pre-assembly	18
7566	Maintenance	piper	pre-assembly	18
3210	Electrical Impregnation and Winding	ball plug	Pre-assembly	18
4		wax assembler * tantalum operator / assembler * oil assembler * met. misc. assembler * met. & filter assembler * inspector, assembler * filter & met. assembler * assembler/ oil * assembler/ mica * assembler/ met. Misc. * assembler/ met. & filter * assembler / wax * assembler / inspector	Pre-assembly	18
59		motorized assembler * mechanic * assembler, motorized	Pre-assembly	18
88		tubular endfiller * tub filler * filler, tub	Pre-assembly	18
00B3		squeezer	Pre-assembly	18
00B6		molder	Pre-assembly	18
00S6		tab folder	Pre-assembly	18
1000	Paper I Winding	no listed	Pre-assembly	18
1004	Paper I Winding	wax assembler * tantalum operator / assembler * oil assembler * met. misc. assembler * met. & filter assembler * inspector, assembler * filter & met. assembler * assembler/ oil * assembler/ mica * assembler/ met. Misc. * assembler/ met. & filter * assembler / wax * assembler / inspector	Pre-assembly	18
1005	Paper I Winding	plastic mixer * plastic assembler * paper assembler * mixer, plastic * Assembly/ hi voltage * assembler/ plastic/ plastic mixer * assembler/ paper ii * assembler/ paper I	Pre-assembly	18

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

1008	Paper I Winding	instr autoinsulate * Autolete (?) * Autoinsulat instr	Pre-assembly	18
1010	Paper I Winding	ball plug	Pre-assembly	18
1015	Paper I Winding	IMC?IMS04 burn?in * burn?in IMC?IMS04	Pre-assembly	18
1044	Paper I Winding	worker, general * production * helper, general * general worker * general helper	Pre-assembly	18
1059	Paper I Winding	motorized assembler * mechanic * asseMbler, motorized	Pre-assembly	18
1081	Paper I Winding	worker, table * table worker * tabcutter * tab. assembler * assembly tab	Pre-assembly	18
1089	Paper I Winding	tuber/ tube cutter * teller, pig * pig teller * cutter, tube	Pre-assembly	18
1090	Paper I Winding	tubular assembler * asSembler, tubular	Pre-assembly	18
10F6	Paper I Winding	asSembler & tester	Pre-assembly	18
10N8	Paper I Winding	finisher	Pre-assembly	18
10S3	Paper I Winding	tab reinforcement	Pre-assembly	18
1259	Tank Room - PCB Exposure. Impregnation and Pump Mech.	motorized assembler * mechanic * asseMbler, motorized	Pre-assembly	18
1300	Paper I AsSembly	no listed	Pre-assembly	18
1303	Paper I AsSembly	Aeropanel	Pre-assembly	18
1304	Paper I Assembly	wax assembler * tantalum operator / assembler * oil assembler * met. misc. assembler * met. & filter assembler * inspector, assembler * filter & met. assembler * assembler/ oil * assembler/ mica * assembler/ met. Misc. * assembler/ met. & filter * assembler / wax * assembler / inspector	Pre-assembly	18
1305	Paper I Assembly	plastic mixer * plastic assembler * paper assembler * mixer, plastic * Assembly/ hi voltage * assembler/ plastic/ plastic mixer * assembler/ paper ii * asSembler/ paper I	Pre-assembly	18
1308	Paper I Assembly	instr autoinsulate * Autolete (?) * Autoinsulat instr	Pre-assembly	18
1338	Paper I Assembly	wrapper/ filler * filler/wrapper * filler, Plastic * filler	Pre-assembly	18
1344	Paper I Assembly	worker, general * production * helper, general * general worker * general helper	Pre-assembly	18
1359	Paper I Assembly	motorized assembler * mechanic * asseMbler, motorized	Pre-assembly	18
1373	Paper I Assembly	small orders sampler * sampler/ small Orders * sampler	Pre-assembly	18
1381	Paper I Assembly	worker, table * table worker * tabcutter * tab. assembler * assembly tab	Pre-assembly	18
1382	Paper I Assembly	taping, end filler * tape/fill * filler, end, taping * fill/tape * end filler taping	Pre-assembly	18
1388	Paper I Assembly	tubular endfiller * tub filler * filler, tub	Pre-assembly	18
1389	Paper I Assembly	tuber/ tube cutter * teller, pig * pig teller * cutter, tube	Pre-assembly	18
1390	Paper I Assembly	tubular assembler * asSembler, tubular	Pre-assembly	18

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

1391	Paper I Assembly	tubular line * line, tubular	Pre-assembly	18
1394	Paper I Assembly	wax rework * waX dip * dip, wax	Pre-assembly	18
13B1	Paper I Assembly	worker, bench * bench worker	Pre-assembly	18
13B3	Paper I Assembly	squeezer	Pre-assembly	18
13B6	Paper I Assembly	molder	Pre-assembly	18
13B9	Paper I Assembly	wire bender / wireman * bender, wire	Pre-assembly	18
13C1	Paper I Assembly	seamer, heliane * heliane seamer / seamen	Pre-assembly	18
13C6	Paper I Assembly	color coder operator	Pre-assembly	18
13D3	Paper I Assembly	stamper	Pre-assembly	18
13D5	Paper I Assembly	plastic tubular	Pre-assembly	18
13D7	Paper I Assembly	tubular/wax	Pre-assembly	18
13F4	Paper I Assembly	tubular repairer	Pre-assembly	18
13F6	Paper I Assembly	assembler & tester	Pre-assembly	18
13F8	Paper I Assembly	printed wiring	Pre-assembly	18
13H4	Paper I Assembly	tub inserter	Pre-assembly	18
13L8	Paper I Assembly	stamper & assembler	Pre-assembly	18
13N4	Paper I Assembly	plastic mixer & tube etcher	Pre-assembly	18
13O6	Paper I Assembly	flipper	Pre-assembly	18
13Q5	Paper I Assembly	holley carb	Pre-assembly	18
13Q6	Paper I Assembly	taper wrapper	Pre-assembly	18
13S2	Paper I Assembly	mixer & filler	Pre-assembly	18
13S6	Paper I Assembly	tab folder	Pre-assembly	18
13T5	Paper I Assembly	tubular assembler & tester	Pre-assembly	18
13U1	Paper I Assembly	apex printer setup/apex tube setup & printer	Pre-assembly	18
13U9	Paper I Assembly	Wrapper & tester	Pre-assembly	18
1404	Assembly Plastic	wax assembler * tantalum operator / assembler * oil assembler * met. misc. assembler * met. & filter assembler * inspector, assembler * filter & met. assembler * assembler/ oil * assembler/ mica * assembler/ met. Misc. * assembler/ met. & filter * assembler / wax * assembler / inspector	Pre-assembly	18
1405	Assembly Plastic	plastic mixer * plastic assembler * paper assembler * mixer, plastic * Assembly/ hi voltage * assembler/ plastic/ plastic mixer * assembler/ paper ii * assembler/ paper I	Pre-assembly	18
1505		plastic mixer * plastic assembler * paper assembler * mixer, plastic * Assembly/ hi voltage * assembler/ plastic/ plastic mixer * assembler/ paper ii * assembler/ paper I	Pre-assembly	18
2 00		no listed	unknown	27
2000	Paper II Winding	no listed	Pre-assembly	18
2003	Paper II Winding	Aeropanel	Pre-assembly	18

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

2004	Paper II Winding	wax assembler * tantalum operator / assembler * oil assembler * met. misc. assembler * met. & filter assembler * inspector, assembler * filter & met. assembler * assembler/ oil * assembler/ mica * assembler/ met. Misc. * assembler/ met. & filter * assembler / wax * assembler / inspector	Pre-assembly	18
2005	Paper II Winding	plastic mixer * plastic assembler * paper assembler * mixer, plastic * Assembly/ hi voltage * assembler/ plastic/ plastic mixer * assembler/ paper ii * assembler/ paper I	Pre-assembly	18
2012	Paper II Winding	maker, box * boxmaker	Pre-assembly	18
2044	Paper II Winding	worker, general * production * helper, general * general worker * general helper	Pre-assembly	18
2059	Paper II Winding	motorized assembler * mechanic * assembler, motorized	Pre-assembly	18
2081	Paper II Winding	worker, table * table worker * tabcutter * tab. assembler * assembly tab	Pre-assembly	18
2155	Paper II Assembly & Final test - PCB exposure	papercutter, Lawson * Lawson papercutter	Pre-assembly	18
2188	Paper II Assembly & Final test - PCB exposure	tubular endfiller * tub filler * filler, tub	Pre-assembly	18
2189	Paper II Assembly & Final test - PCB exposure	tuber/ tube cutter * teller, pig * pig teller * cutter, tube	Pre-assembly	18
2190	Paper II Assembly & Final test - PCB exposure	tubular assembler * assembler, tubular	Pre-assembly	18
2191	Paper II Assembly & Final test - PCB exposure	tubular line * line, tubular	Pre-assembly	18
21B6	Paper II Assembly & Final test - PCB exposure	molder	Pre-assembly	18
21C1	Paper II Assembly & Final test - PCB exposure	seamer, heliane * heliane seamer / seamen	Pre-assembly	18
2244		worker, general * production * helper, general * general worker * general helper	Pre-assembly	18
2400	Spec. Products	no listed	Pre-assembly	18
2404	Spec. Products	wax assembler * tantalum operator / assembler * oil assembler * met. misc. assembler * met. & filter assembler * inspector, assembler * filter & met. assembler * assembler/ oil * assembler/ mica * assembler/ met. Misc. * assembler/ met. & filter * assembler / wax * assembler / inspector	Pre-assembly	18
2444	Spec. Products	worker, general * production * helper, general * general worker * general helper	Pre-assembly	18

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

2604		wax assembler * tantalum operator / assembler * oil assembler * met. misc. assembler * met. & filter assembler * inspector, assembler * filter & met. assembler * assembler/ oil * assembler/ mica * assembler/ met. Misc. * assembler/ met. & filter * assembler / wax * assembler / inspector	Pre-assembly	18
2644		worker, general * production * helper, general * general worker * general helper	Pre-assembly	18
2800		no listed	Pre-assembly	18
2916	Preform and Anodes	setup, Callahan / roller / operator * Callahan setup / roller / operator	Pre-assembly	18
2917	Preform and Anodes	setup, can maker * metal cutter * can maker setup or Can maker	Pre-assembly	18
2938	Preform and Anodes	wrapper/ filler * filler/wrapper * filler, plastic * filler	Pre-assembly	18
2989	Preform and Anodes	tuber/ tube cutter * teller, pig * pig teller * cutter, tube	Pre-assembly	18
2990	Preform and Anodes	tubular assembler * assembler, tubular	Pre-assembly	18
3208	Electrical Impregnation and Winding	instr autoinsulate * Autolete (?) * Autoinsulat instr	Pre-assembly	18
3238	Electrical Impregnation and Winding	wrapper/ filler * filler/wrapper * filler, Plastic * filler	Pre-assembly	18
3244	Electrical Impregnation and Winding	worker, general * production * helper, general * general worker * general helper	Pre-assembly	18
3281	Electrical Impregnation and Winding	worker, table * table worker * tabcutter * tab. assembler * assembly tab	Pre-assembly	18
3282	Electrical Impregnation and Winding	taping, end filler * tape/fill * filler, end, taping * fill/tape * end filler taping	Pre-assembly	18
32B1	Electrical Impregnation and Winding	worker, bench * bench worker	Pre-assembly	18
32B4	Electrical Impregnation and Winding		Pre-assembly	18
32B8	Electrical Impregnation and Winding	formation	Pre-assembly	18
32I8	Electrical Impregnation and Winding	material washer	Pre-assembly	18
32M1	Electrical Impregnation and Winding	tab cleaner	Pre-assembly	18
32Q2	Electrical Impregnation and Winding	sorter	Pre-assembly	18
32R3	Electrical Impregnation and Winding	wash cans	Pre-assembly	18
32U6	Electrical Impregnation and Winding	knock out sections	Pre-assembly	18
3304	Electrical Assembly and Final testing	wax assembler * tantalum operator / assembler * oil assembler * met. misc. assembler * met. & filter assembler * inspector, assembler * filter & met. assembler * assembler/ oil * assembler/ mica * assembler/ met. Misc. * assembler/ met. & filter * assembler / wax * assembler / inspector	Pre-assembly	18

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

3305	Electrical Assembly and Final testing	plastic mixer * plastic assembler * paper assembler * mixer, plastic * Assembly/ hi voltage * assembler/ plastic/ plastic mixer * assembler/ paper ii * assembler/ paper 1	Pre-assembly	18
3308	Electrical Assembly and Final testing	instr autoinsulate * Autolete (?) * Autoinsulat instr	Pre-assembly	18
3317	Electrical Assembly and Final testing	setup, can maker * metal cutter * can maker setup or Can maker	Pre-assembly	18
3338	Electrical Assembly and Final testing	wrapper/ filler * filler/wrapper * filler, plastic * filler	Pre-assembly	18
3344	Electrical Assembly and Final testing	worker, general * production * helper, general * general worker * general helper	Pre-assembly	18
3359	Electrical Assembly and Final testing	motorized assembler * mechanic * assembler, motorized	Pre-assembly	18
3372	Electrical Assembly and Final testing	sample coordinator * coordinator, sample	Pre-assembly	18
3373	Electrical Assembly and Final testing	small orders sampler * sampler/ small Orders * sampler	Pre-assembly	18
3381	Electrical Assembly and Final testing	worker, table * table worker * tabcutter * tab. assembler * assembly tab	Pre-assembly	18
3382	Electrical Assembly and Final testing	taping, end filler * tape/fill * filler, end, taping * fill/tape * end filler taping	Pre-assembly	18
3390	Electrical Assembly and Final testing	tubular assembler * assembler, tubular	Pre-assembly	18
3391	Electrical Assembly and Final testing	tubular line * line, tubular	Pre-assembly	18
33B8	Electrical Assembly and Final testing	formation	Pre-assembly	18
33D3	Electrical Assembly and Final testing	stamper	Pre-assembly	18
33F3	Electrical Assembly and Final testing	formation man	Pre-assembly	18
33F6	Electrical Assembly and Final testing	assembler & tester	Pre-assembly	18
33M1	Electrical Assembly and Final testing	tab cleaner	Pre-assembly	18
33N5	Electrical Assembly and Final testing	service operator & assembler	Pre-assembly	18
3404	Electrolysis	wax assembler * tantalum operator / assembler * oil assembler * met. misc. assembler * met. & filter assembler * inspector, assembler * filter & met. assembler * assembler/ oil * assembler/ mica * assembler/ met. Misc. * assembler/ met. & filter * assembler / wax * assembler / inspector	Pre-assembly	18
3504	Electrolysis	wax assembler * tantalum operator / assembler * oil assembler * met. misc. assembler * met. & filter assembler * inspector, assembler * filter & met. assembler * assembler/ oil * assembler/ mica * assembler/ met. Misc. * assembler/ met. & filter * assembler / wax * assembler / inspector	Pre-assembly	18

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

3505	Electrolysis	plastic mixer * plastic assembler * paper assembler * mixer, plastic * Assembly/ hi voltage * assembler/ plastic/ plastic mixer * assembler/ paper ii * assembler/ paper I	Pre-assembly	18
3538	Electrolysis	wrapper/ filler * filler/wrapper * filler, plastic * filler	Pre-assembly	18
3559	Electrolysis	motorized assembler * mechanic * assembler, motorized	Pre-assembly	18
3604		wax assembler * tantalum operator / assembler * oil assembler * met. misc. assembler * met. & filter assembler * inspector, assembler * filter & met. assembler * assembler/ oil * assembler/ mica * assembler/ met. Misc. * assembler/ met. & filter * assembler / wax * assembler / inspector	Pre-assembly	18
3644		worker, general * production * helper, general * general worker * general helper	Pre-assembly	18
3704		wax assembler * tantalum operator / assembler * oil assembler * met. misc. assembler * met. & filter assembler * inspector, assembler * filter & met. assembler * assembler/ oil * assembler/ mica * assembler/ met. Misc. * assembler/ met. & filter * assembler / wax * assembler / inspector	Pre-assembly	18
3804		wax assembler * tantalum operator / assembler * oil assembler * met. misc. assembler * met. & filter assembler * inspector, assembler * filter & met. assembler * assembler/ oil * assembler/ mica * assembler/ met. Misc. * assembler/ met. & filter * assembler / wax * assembler / inspector	Pre-assembly	18
3838		wrapper/ filler * filler/wrapper * filler, plastic * filler	Pre-assembly	18
38B8		formation	Pre-assembly	18
4317	Mica	setup, can maker * metal cutter * can maker setup or Can maker	Pre-assembly	18
4404		wax assembler * tantalum operator / assembler * oil assembler * met. misc. assembler * met. & filter assembler * inspector, assembler * filter & met. assembler * assembler/ oil * assembler/ mica * assembler/ met. Misc. * assembler/ met. & filter * assembler / wax * assembler / inspector	Pre-assembly	18
4459		motorized assembler * mechanic * assembler, motorized	Pre-assembly	18
4504		wax assembler * tantalum operator / assembler * oil assembler * met. misc. assembler * met. & filter assembler * inspector, assembler * filter & met. assembler * assembler/ oil * assembler/ mica * assembler/ met. Misc. * assembler/ met. & filter * assembler / wax * assembler / inspector	Pre-assembly	18
45B8		formation	Pre-assembly	18
5203	Materials, Stock Rooms	Aeropanel	Pre-assembly	18

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

5204	Materials, Stock Rooms	wax assembler * tantalum operator / assembler * oil assembler * met. misc. assembler * met. & filter assembler * inspector, assembler * filter & met. assembler * assembler/ oil * assembler/ mica * assembler/ met. Misc. * assembler/ met. & filter * assembler / wax * assembler / inspector	Pre-assembly	18
5205	Materials, Stock Rooms	plastic mixer * plastic assembler * paper assembler * mixer, plastic * Assembly/ hi voltage * assembler/ plastic/ plastic mixer * assembler/ paper ii * asSembler/ paper I	Pre-assembly	18
5208	Materials, Stock Rooms	instr autoinsulate * Autolete (?) * Autoinsulat instr	Pre-assembly	18
5210	Materials, Stock Rooms	ball plug	Pre-assembly	18
5213	Materials, Stock Rooms	fabricator, bracket * bräcket fabricator	Pre-assembly	18
5215	Materials, Stock Rooms	IMC?IMS04 burn?in * bürn?in IMC?IMS04	Pre-assembly	18
5217	Materials, Stock Rooms	setup, can maker * metal cutter * can maker setup or Can maker	Pre-assembly	18
5238	Materials, Stock Rooms	wrapper/ filler * filler/wrapper * filler, Plastic * filler	Pre-assembly	18
5249	Materials, Stock Rooms	molder, inject * inject molder	Pre-assembly	18
5255	Materials, Stock Rooms	papercutter, Lawson * LaWson papercutter	Pre-assembly	18
5259	Materials, Stock Rooms	motorized assembler * mechanic * asseMbler, motorized	Pre-assembly	18
5268	Materials, Stock Rooms	printer	Pre-assembly	18
5281	Materials, Stock Rooms	worker, table * table worker * tabcutter * tab. assembler * assembly tab	Pre-assembly	18
5282	Materials, Stock Rooms	taping, end filler * tape/fill * filler, end, taping * fill/tape * end filler taping	Pre-assembly	18
5288	Materials, Stock Rooms	tubular endfiller * tub filler * filler, tub	Pre-assembly	18
5289	Materials, Stock Rooms	tuber/ tube cutter * teller, pig * pig teller * cutter, tube	Pre-assembly	18
5290	Materials, Stock Rooms	tubular assembler * asSembler, tubular	Pre-assembly	18
5291	Materials, Stock Rooms	tubular line * line, tubular	Pre-assembly	18
5294	Materials, Stock Rooms	wax rework * waX dip * dip, wax	Pre-assembly	18
52B6	Materials, Stock Rooms	molder	Pre-assembly	18
52B8	Materials, Stock Rooms	formation	Pre-assembly	18
52B9	Materials, Stock Rooms	wire bender / wireman * bender, wire	Pre-assembly	18
52C1	Materials, Stock Rooms	seamer, heliane * heliane seamer / seamen	Pre-assembly	18
52D2	Materials, Stock Rooms	tester/stamper	Pre-assembly	18
52D3	Materials, Stock Rooms	stamper	Pre-assembly	18
52D5	Materials, Stock Rooms	plastic tubular	Pre-assembly	18
52D8	Materials, Stock Rooms	wet winder & aging	Pre-assembly	18
52F3	Materials, Stock Rooms	formation man	Pre-assembly	18
52F6	Materials, Stock Rooms	asSembler & tester	Pre-assembly	18
52G1	Materials, Stock Rooms	multigraph operator	Pre-assembly	18
52H4	Materials, Stock Rooms	tub inserter	Pre-assembly	18
52H9	Materials, Stock Rooms	machinE rework printer	Pre-assembly	18
52I8	Materials, Stock Rooms	material washer	Pre-assembly	18

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

52L7	Materials, Stock Rooms	conveyor line	Pre-assembly	18
52M5	Materials, Stock Rooms	silicone insErter machine op	Pre-assembly	18
52S6	Materials, Stock Rooms	tab folder	Pre-assembly	18
52T5	Materials, Stock Rooms	tubular asSembler & tester	Pre-assembly	18
52U4	Materials, Stock Rooms	auto silicone & rivet machine op	Pre-assembly	18
5849	Guards, Security	molder, inject * inject molder	Pre-assembly	18
5891	Guards, Security	tubular line * line, tubular	Pre-assembly	18
6059	Machine Shop	motorized assemBler * mechanic * assemBler, motorized	Pre-assembly	18
62B9	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	wire bender / wireman * bender, wire	Pre-assembly	18
62D3	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	stamper	Pre-assembly	18
6559	Maintenance	motorized assemBler * mechanic * assemBler, motorized	Pre-assembly	18
6604	Firemen and Porters	wax assemBler * tantalum operator / assemBler * oil assemBler * met. misc. assemBler * met. & filter assemBler * inspector, assemBler * filter & met. assemBler * assemBler/ oil * assemBler/ mica * assemBler/ met. Misc. * assemBler/ met. & filter * assemBler / wax * assemBler / inspector	Pre-assembly	18
6605	Firemen and Porters	plastic mixer * plastic assemBler * paper assemBler * mixer, plastic * Assembly/ hi voltage * assemBler/ plastic/ plastic mixer * assemBler/ paper ii * assemBler/ paper I	Pre-assembly	18
6615	Firemen and Porters	IMC?IMS04 burn?in * burn?in IMC?IMS04	Pre-assembly	18
6617	Firemen and Porters	setup, can maker * metal cutter * can maker setup or Can maker	Pre-assembly	18
6638	Firemen and Porters	wrapper/ filler * filler/wrapper * filler, plastic * filler	Pre-assembly	18
6659	Firemen and Porters	motorized assemBler * mechanic * assemBler, motorized	Pre-assembly	18
6681	Firemen and Porters	worker, table * table worker * tabcutter * tab. assemBler * assembly tab	Pre-assembly	18
6682	Firemen and Porters	taping, end filler * tape/fill * filler, end, taping * fill/tape * end filler taping	Pre-assembly	18
6688	Firemen and Porters	tubular endfiller * tub filler * filler, tub	Pre-assembly	18
6689	Firemen and Porters	tuber/ tube cutter * teller, pig * pig teller * cutter, tube	Pre-assembly	18
6690	Firemen and Porters	tubular assemBler * assemBler, tubular	Pre-assembly	18
6691	Firemen and Porters	tubular line * line, tubular	Pre-assembly	18
6694	Firemen and Porters	wax rework * waX dip * dip, wax	Pre-assembly	18
66B6	Firemen and Porters	molder	Pre-assembly	18
66B8	Firemen and Porters	formation	Pre-assembly	18

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

66F3	Firemen and Porters	formation man	Pre-assembly	18
66N4	Firemen and Porters	plastic mixer & tube etcher	Pre-assembly	18
66N9	Firemen and Porters	general worker & tester	Pre-assembly	18
66Q4	Firemen and Porters	vibrator	Pre-assembly	18
66S2	Firemen and Porters	mixer & filler	Pre-assembly	18
66S6	Firemen and Porters	tab folder	Pre-assembly	18
66T4	Firemen and Porters	assembler & general worker	Pre-assembly	18
6704	Jobber Stock	wax assembler * tantalum operator / assembler * oil assembler * met. misc. assembler * met. & filter assembler * inspector, assembler * filter & met. assembler * assembler/ oil * assembler/ mica * assembler/ met. Misc. * assembler/ met. & filter * assembler / wax * assembler / inspector	Pre-assembly	18
6768	Jobber Stock	printer	Pre-assembly	18
67D3	Jobber Stock	stamper	Pre-assembly	18
67S7	Jobber Stock	rubber stamp maker	Pre-assembly	18
7400	Tantalum	no listed	Pre-assembly	18
7559	Maintenance	motorized assembler * mechanic * assembler, motorized	Pre-assembly	18
8168	Jobber Stock	printer	Pre-assembly	18
8189	Jobber Stock	tuber/ tube cutter * teller, pig * pig teller * cutter, tube	Pre-assembly	18
81H9	Jobber Stock	machine rework printer	Pre-assembly	18
81S7	Jobber Stock	rubber stamp maker	Pre-assembly	18
8559	Sales	motorized assembler * mechanic * assembler, motorized	Pre-assembly	18
M 90		tubular assembler * assembler, tubular	Pre-assembly	18
M F8		printed wiring	Pre-assembly	18
3204	Electrical Impregnation and Winding	wax assembler * tantalum operator / assembler * oil assembler * met. misc. assembler * met. & filter assembler * inspector, assembler * filter & met. assembler * assembler/ oil * assembler/ mica * assembler/ met. Misc. * assembler/ met. & filter * assembler / wax * assembler / inspector	Pre-assembly	18
J 04		wax assembler * tantalum operator / assembler * oil assembler * met. misc. assembler * met. & filter assembler * inspector, assembler * filter & met. assembler * assembler/ oil * assembler/ mica * assembler/ met. Misc. * assembler/ met. & filter * assembler / wax * assembler / inspector	Pre-assembly	18
K 04		wax assembler * tantalum operator / assembler * oil assembler * met. misc. assembler * met. & filter assembler * inspector, assembler * filter & met. assembler * assembler/ oil * assembler/ mica * assembler/ met. Misc. * assembler/ met. & filter * assembler / wax * assembler / inspector	Pre-assembly	18

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

M 04		wax assembler * tantalum operator / assembler * oil assembler * met. misc. assembler * met. & filter assembler * inspector, assembler * filter & met. assembler * assembler/ oil * assembler/ mica * assembler/ met. Misc. * assembler/ met. & filter * assembler / wax * assembler / inspector	Pre-assembly	18
M B9	Tantalum	wire bender / wireman * bender, wire	Pre-assembly	18
J B1	Mica	worker, bench * bench worker	Pre-assembly	18
K 44		worker, general * production * helper, general * general worker * general helper	Pre-assembly	18
M 44	Tantalum	worker, general * production * helper, general * general worker * general helper	Pre-assembly	18
81	Tantalum	worker, table * table worker * tabcutter * tab. assembler * assembly tab	Pre-assembly	18
K04			Pre-assembly	18
K44			Pre-assembly	18
M00	Tantalum		Pre-assembly	18
M04	Tantalum		Pre-assembly	18
M44	Tantalum		Pre-assembly	18
M81	Tantalum		Pre-assembly	18
M90	Tantalum		Pre-assembly	18
MB8	Tantalum		Pre-assembly	18
MB9	Tantalum		Pre-assembly	18
MF8	Tantalum		Pre-assembly	18
2500	Sub-Assembly	no listed	Sub-assembly	18
2504	Sub-Assembly	wax assembler * tantalum operator / assembler * oil assembler * met. misc. assembler * met. & filter assembler * inspector, assembler * filter & met. assembler * assembler/ oil * assembler/ mica * assembler/ met. Misc. * assembler/ met. & filter * assembler / wax * assembler / inspector	Sub-assembly	18
2505	Sub-Assembly	plastic mixer * plastic assembler * paper assembler * mixer, plastic * Assembly/ hi voltage * assembler/ plastic/ plastic mixer * assembler/ paper ii * assembler/ paper I	Sub-assembly	18
2508	Sub-Assembly	instr autoinsulate * Autolete (?) * Autoinsulat instr	Sub-assembly	18
2513	Sub-Assembly	fabricator, bracket * bracket fabricator	Sub-assembly	18
2516	Sub-Assembly	setup, Callahan / roller / operator * Callahan setup / roller / operator	Sub-assembly	18
2517	Sub-Assembly	setup, can maker * metal cutter * can maker setup or Can maker	Sub-assembly	18
2533	Sub-Assembly	drill/ brush/ clear * clear/drill/brush * brush/clear/drill * brush	Sub-assembly	18
2544	Sub-Assembly	worker, general * production * helper, general * general worker * general helper	Sub-assembly	18
2552	Sub-Assembly	kraft insulator * insulator, kraft	Sub-assembly	18
2555	Sub-Assembly	papercutter, Lawson * Lawson papercutter	Sub-assembly	18

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

2559	Sub-Assembly	motorized assembler * mechanic * assembler, motorized	Sub-assembly	18
2568	Sub-Assembly	printer	Sub-assembly	18
2573	Sub-Assembly	small orders sampler * sampler/ small Orders * sampler	Sub-assembly	18
2581	Sub-Assembly	worker, table * table worker * tabcutter * tab. assembler * assembly tab	Sub-assembly	18
2589	Sub-Assembly	tuber/ tube cutter * teller, pig * pig teller * cutter, tube	Sub-assembly	18
2590	Sub-Assembly	tubular assembler * assembler, tubular	Sub-assembly	18
2594	Sub-Assembly	wax rework * waX dip * dip, wax	Sub-assembly	18
25B1	Sub-Assembly	worker, bench * bench worker	Sub-assembly	18
25B3	Sub-Assembly	squeezer	Sub-assembly	18
25B9	Sub-Assembly	wire bender / wireman * bender, wire	Sub-assembly	18
25C7	Sub-Assembly	spec. writer	Sub-assembly	18
2.50E+09	Sub-Assembly	tech operator	Sub-assembly	18
25L7	Sub-Assembly	conveyor line	Sub-assembly	18
25P5	Sub-Assembly	insulation cutter	Sub-assembly	18
2151	Paper II Assembly & Final test - PCB exposure	supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler	Repair/Salvage	19
21F5	Paper II Assembly & Final test - PCB exposure	analyzation rejects misc. operations	Repair/Salvage	19
3370	Electrical Assembly and Final testing	sec. analysis & repair * repair line * repair & analysis, sec. * analysis & repair, sec.	Repair/Salvage	19
3470	Electrolysis	sec. analysis & repair * repair line * repair & analysis, sec. * analysis & repair, sec.	Repair/Salvage	19
3570	Electrolysis	sec. analysis & repair * repair line * repair & analysis, sec. * analysis & repair, sec.	Repair/Salvage	19
5270	Materials, Stock Rooms	sec. analysis & repair * repair line * repair & analysis, sec. * analysis & repair, sec.	Repair/Salvage	19
52J7	Materials, Stock Rooms	Tack repairman	Repair/Salvage	19
6670	Firemen and Porters	sec. analysis & repair * repair line * repair & analysis, sec. * analysis & repair, sec.	Repair/Salvage	19
1370	Paper I Assembly	sec. analysis & repair * repair line * repair & analysis, sec. * analysis & repair, sec.	Repair/Salvage	19
13L4	Paper I Assembly	filler & repairer	Repair/Salvage	19

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

2170	Paper II Assembly & Final test - PCB exposure	sec. analysis & repair * repair line * repair & analysis, sec. * analysis & repair, sec.	Repair/Salvage	19
2470	Spec. Products	sec. analysis & repair * repair line * repair & analysis, sec. * analysis & repair, sec.	Repair/Salvage	19
52G8	Materials, Stock Rooms	lab tech & elec test	Lab technician	20
33D4	Electrical Assembly and Final testing	lab cleaner/assembly	Lab technician	20
1236	Tank Room - PCB Exposure. Impregnation and Pump Mech.	technician, lab * technician, flex * technician, environment * technician * lab technician * flex technician * environment technician	Lab technician	20
12J2	Tank Room - PCB Exposure. Impregnation and Pump Mech.	life pert tech	Lab technician	20
1336	Paper I Assembly	technician, lab * technician, flex * technician, environment * technician * lab technician * flex technician * environment technician	Lab technician	20
3236	Electrical Impregnation and Winding	technician, lab * technician, flex * technician, environment * technician * lab technician * flex technician * environment technician	Lab technician	20
4336	Mica	technician, lab * technician, flex * technician, environment * technician * lab technician * flex technician * environment technician	Lab technician	20
5036	Shipping	technician, lab * technician, flex * technician, environment * technician * lab technician * flex technician * environment technician	Lab technician	20
5236	Materials, Stock Rooms	technician, lab * technician, flex * technician, environment * technician * lab technician * flex technician * environment technician	Lab technician	20
5636	Engineers - Industrial or Product	technician, lab * technician, flex * technician, environment * technician * lab technician * flex technician * environment technician	Lab technician	20
5836	Guards, Security	technician, lab * technician, flex * technician, environment * technician * lab technician * flex technician * environment technician	Lab technician	20
5936	QC (Quality Control)	technician, lab * technician, flex * technician, environment * technician * lab technician * flex technician * environment technician	Lab technician	20
6036	Machine Shop	technician, lab * technician, flex * technician, environment * technician * lab technician * flex technician * environment technician	Lab technician	20
6136	QC (Quality Control)	technician, lab * technician, flex * technician, environment * technician * lab technician * flex technician * environment technician	Lab technician	20
6236	Office/Office services, Sales*, data processing, Accounting and Finance, General Administrative	technician, lab * technician, flex * technician, environment * technician * lab technician * flex technician * environment technician	Lab technician	20
6636	Firemen and Porters	technician, lab * technician, flex * technician, environment * technician * lab technician * flex technician * environment technician	Lab technician	20

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

7036	Shipping	technician, lab * technician, flex * technician, environment * technician * lab technician * flex technician * environment technician	Lab technician	20
7136	Test lab	technician, lab * technician, flex * technician, environment * technician * lab technician * flex technician * environment technician	Lab technician	20
7436	Tantalum	technician, lab * technician, flex * technician, environment * technician * lab technician * flex technician * environment technician	Lab technician	20
M 36		technician, lab * technician, flex * technician, environment * technician * lab technician * flex technician * environment technician	Lab technician	20
O 36		technician, lab * technician, flex * technician, environment * technician * lab technician * flex technician * environment technician	Lab technician	20
Q 36		technician, lab * technician, flex * technician, environment * technician * lab technician * flex technician * environment technician	Lab technician	20
36		technician, lab * technician, flex * technician, environment * technician * lab technician * flex technician * environment technician	Research lab	20
52N3	Materials, Stock Rooms	research lab	Research lab	20
56G8	Engineers - Industrial or Product	lab tech & elec test	Research lab	20
62G8	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	lab tech & elec test	Research lab	20
62J2	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	life pert tech	Research lab	20
62N3	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	research lab	Research lab	20
66N3	Firemen and Porters	research lab	Research lab	20
71G8	Test lab	lab tech & elec test	Research lab	20
74G8	Tantalum	lab tech & elec test	Research lab	20
7836	Firemen	technician, lab * technician, flex * technician, environment * technician * lab technician * flex technician * environment technician	Research lab	20
8136	Jobber Stock	technician, lab * technician, flex * technician, environment * technician * lab technician * flex technician * environment technician	Research lab	20
7100	Test lab	no listed	Research lab	20
7144	Test lab	worker, general * production * helper, general * general worker * general helper	Research lab	20

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

		supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler		
7151	Test lab		Research lab	20
M36	Tantalum		Research lab	20
O36			Research lab	20
Q36			Research lab	20
8700	Advertising	no listed	Advertising	21
12B5	Tank Room - PCB Exposure. Impregnation and Pump Mech.	chemist	Chemist	21
52B5	Materials, Stock Rooms	chemist	chemist	21
62B5	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	chemist	chemist	21
71B5	Test lab	chemist	chemist	21
1357	Paper I Assembly	team leader/manager * materials manager * manufacturing manager * manager/ team leader for all departments * manager/ manufacturing areas (includes materials) * manager/ environmental health & safety * manager/ engineering/electrical sections * leader, team/manager * environmental health & safety manager * engineering manager * electrical manager	Manager	21
1558		manager/ service (sales/ accounting/ benefits/ marketing/ mis) * service manager * sales manager * marketing manager * market analyst * benefits manager * analyst, market * accounting manager	Manager	21
2357	Supervisor, plant area	team leader/manager * materials manager * manufacturing manager * manager/ team leader for all departments * manager/ manufacturing areas (includes materials) * manager/ environmental health & safety * manager/ engineering/electrical sections * leader, team/manager * environmental health & safety manager * engineering manager * electrical manager	Manager	21

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

5257	Materials, Stock Rooms	team leader/manager * materials manager * manufacturing manager * manager/ team leader for all departments * manager/ manufacturing areas (includes materials) * manager/ environmental health & safety * manager/ engineering/electrical sections * leader, team/manager * environmental health & safety manager * engineering manager * electrical manager	Manager	21
5258	Materials, Stock Rooms	manager/ service (sales/ accounting/ benefits/ marketing/ mis) * service manager * sales manager * marketing manager * market analyst * benefits manager * analyst, market * accounting manager	Manager	21
6258	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	manager/ service (sales/ accounting/ benefits/ marketing/ mis) * service manager * sales manager * marketing manager * market analyst * benefits manager * analyst, market * accounting manager	Manager	21
6558	Maintenance	manager/ service (sales/ accounting/ benefits/ marketing/ mis) * service manager * sales manager * marketing manager * market analyst * benefits manager * analyst, market * accounting manager	Manager	21
6658	Firemen and Porters	manager/ service (sales/ accounting/ benefits/ marketing/ mis) * service manager * sales manager * marketing manager * market analyst * benefits manager * analyst, market * accounting manager	Manager	21
8058	Distribution and sales	manager/ service (sales/ accounting/ benefits/ marketing/ mis) * service manager * sales manager * marketing manager * market analyst * benefits manager * analyst, market * accounting manager	Manager	21
8558	Sales	manager/ service (sales/ accounting/ benefits/ marketing/ mis) * service manager * sales manager * marketing manager * market analyst * benefits manager * analyst, market * accounting manager	Manager	21
X 58		manager/ service (sales/ accounting/ benefits/ marketing/ mis) * service manager * sales manager * marketing manager * market analyst * benefits manager * analyst, market * accounting manager	Manager	21
X58	AcCounting /Personnel		Manager	21
10M6	Paper I Winding	statistician	statistician	21
52M6	Materials, Stock RoOms	statistician	statistician	21
62M6	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	statistician	statistician	21
72M6	Process contfol	statistician	statistician	21
5246	Materials, Stock Rooms	watchman * security * guard/watchman	Security	22

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

5267	Materials, Stock Rooms	porter	Security	22
5646	Engineers - Industrial or Product	watchman * security * guard/watchman	Security	22
5667	Engineers - Industrial or Product	porter	Security	22
5800	Guards, Security	no listed	Security	22
5818	Guards, Security	helper, carpenter * Carpenter and helper	Security	22
5846	Guards, Security	watchman * security * guard/watchman	Security	22
5883	Guards, Security	work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inSpector/leader, work	Security	22
6567	Maintenance	porter	Security	22
6644	Firemen and Porters	worker, general * production * helper, general * general worker * general helper	Security	22
6646	Firemen and Porters	watchman * security * guard/watchman	Security	22
6666	Firemen and Porters	piPer	Security	22
6667	Firemen and Porters	porter	Security	22
7567	Maintenance	porter	Security	22
7646		watchman * security * guard/watchman	Security	22
7767	Engineers	porter	Security	22
8167	Jobber Stock	porter	Security	22
2946	Preform and Anodes	watchman * security * guard/watchman	Security	22
5051	Shipping	supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler	Freight handler	23

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

		supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler		
5251	Materials, Stock Rooms		Freight handler	23
7083	Shipping	work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inSpector/leader, work	shipping	23
2.10E+04	Paper II Assembly & Final test - PCB exposure	service operator & Shipping & receiving	Shipping	23
29	Preform and Anodes	[ONLY FOR SHIP/REC DEPTS]	Shipping	23
3237	Electrical Impregnation and Winding	expediter	Shipping	23
3337	Electrical Assembly and Final testing	expediter	Shipping	23
5000	Shipping	no listed	Shipping	23
5083	Shipping	work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inSpector/leader, work	Shipping	23
66	Firemen and Porters	[ONLY FOR SHIP/REC DEPTS]	Shipping	23
7000	Shipping	no listed	Shipping	23
7051	Shipping	supplier material coordinator * sub?assembly leader * storekeeper lead * storekeeper ? driver * storekeeper * stocker, material * stock jobber * stock clerk * shipping, receiving, packing * shipper * salvage handler * receiving, shipping, packing * packing, shipping and receiving / packing * order dispenser * order clerk * material supplier coordinator * material stockroom * material handler * leader, sub?assembly * lead storekeeper * jobber stock/ material stockroom/ material handler * inventory clerk * handler, salvage * handler, material * handler, freight * freight handler * dispenser, order * crib attendant * coordinator, supplier material * clerk, stock or inventory * car muler	Shipping	23

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

1276	Tank Room - PCB Exposure. Impregnation and Pump Mech.	welder?tab/cover * welder/solderer * welder, T?line * welder, rotary * welder * T?line welder * tab welder * solderer, welder * solderer, fill hole * solderer, base * solderer * rotary welder * fill hole solderer * cover welder * base solderer	Solderer	24
13D1	Paper I Assembly	assembly/solder	Solderer	24
14G3	Assembly Plastic	solderer & paper filter	Solderer	24
2176	Paper II Assembly & Final test - PCB exposure	welder?tab/cover * welder/solderer * welder, T?line * welder, rotary * welder * T?line welder * tab welder * solderer, welder * solderer, fill hole * solderer, base * solderer * rotary welder * fill hole solderer * cover welder * base solderer	Solderer	24
21D1	Paper II Assembly & Final test - PCB exposure	assembly/solder	Solderer	24
21G2	Paper II Assembly & Final test - PCB exposure	fill hole soldering/unloading	Solderer	24
21K9	Paper II Assembly & Final test - PCB exposure	solderer & hi voltage worker	Solderer	24
21O1	Paper II Assembly & Final test - PCB exposure	Solderer & degreaser	Solderer	24
29D1	Preform and Anodes	assembly/solder	Solderer	24
35D1	Electrolysis	assembly/solder	Solderer	24
52D1	Materials, Stock Rooms	assembly/solder	Solderer	24
52K9	Materials, Stock Rooms	solderer & hi voltage worker	Solderer	24
52G2	Materials, Stock Rooms	fill hole soldering/unloading	Solderer	24
52G3	Materials, Stock Rooms	solderer & paper filter	Solderer	24
1339	Paper I Assembly	impregnation/filter * filter/imprEgnation / operator	Kettle & Oven Operators	25
1341	Paper I Assembly	filterman? grade 8	Kettle & Oven Operators	25
2039	Paper II Winding	impregnation/filter * filter/imprEgnation / operator	Kettle & Oven Operators	25
21P4	Paper II Assembly & Final test - PCB exposure	impregnator & dispatcher & degreaser	Kettle & Oven Operators	25
2539	Sub-Assembly	impregnation/filter * filter/imprEgnation / operator	Kettle & Oven Operators	25
2939	Preform and Anodes	impregnation/filter * filter/imprEgnation / operator	Kettle & Oven Operators	25
3239	Electrical Impregnation and Winding	impregnation/filter * filter/imprEgnation / operator	Kettle & Oven Operators	25
5239	Materials, Stock Rooms	impregnation/filter * filter/imprEgnation / operator	Kettle & Oven Operators	25
5241	Materials, Stock Rooms	filterman? grade 8	Kettle & Oven Operators	25
6639	Firemen and Porters	impregnation/filter * filter/imprEgnation / operator	Kettle & Oven Operators	25
29		worker, tank * tankman * tankman * tank worker * operator, dipp. * dipp. operator (?) [tankman]	Oven operator	25

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

1363	Paper I Assembly	oven operator or loader / unloader * operator, oven or oven loader / unloader * operator, baths * loader, oven * baths operator	Oven operator	25
13P3	Paper I Assembly	oven loader & plastic mixer	Oven operator	25
2163	Paper II Assembly & Final test - PCB exposure	oven operator or loader / unloader * operator, oven or oven loader / unloader * operator, baths * loader, oven * baths operator	Oven operator	25
21A9	Paper II Assembly & Final test - PCB exposure	unloader, basket * loader, basket * basket unloader / loader	Oven operator	25
21I2	Paper II Assembly & Final test - PCB exposure	infra red heat test oven shop	Oven operator	25
21O2	Paper II Assembly & Final test - PCB exposure	basket loader & solderer	Oven operator	25
21P7	Paper II Assembly & Final test - PCB exposure	degreaser & basket unloader	Oven operator	25
21R4	Paper II Assembly & Final test - PCB exposure	oven loader/unloader & inspector	Oven operator	25
21T6	Paper II Assembly & Final test - PCB exposure	basket loader/unloader & insulator	Oven operator	25
21U8	Paper II Assembly & Final test - PCB exposure	burn in tester & basket loader/unloader	Oven operator	25
22A9		unloader, basket * loader, basket * basket unloader / loader	Oven operator	25
2563	Sub-Assembly	oven operator or loader / unloader * operator, oven or oven loader / unloader * operator, baths * loader, oven * baths operator	Oven operator	25
25A9	Sub-Assembly	unloader, basket * loader, basket * basket unloader / loader	Oven operator	25
4463		oven operator or loader / unloader * operator, oven or oven loader / unloader * operator, baths * loader, oven * baths operator	Oven operator	25
5263	Materials, Stock Rooms	oven operator or loader / unloader * operator, oven or oven loader / unloader * operator, baths * loader, oven * baths operator	Oven operator	25
52A9	Materials, Stock Rooms	unloader, basket * loader, basket * basket unloader / loader	Oven operator	25
52I2	Materials, Stock Rooms	infra red heat test oven shop	Oven operator	25
52O2	Materials, Stock Rooms	basket loader & solderer	Oven operator	25
52R4	Materials, Stock Rooms	oven loader/unloader & inspector	Oven operator	25
52T6	Materials, Stock Rooms	basket loader/unloader & insulator	Oven operator	25
6563	Maintenance	oven operator or loader / unloader * operator, oven or oven loader / unloader * operator, baths * loader, oven * baths operator	Oven operator	25
6663	Firemen and Porters	oven operator or loader / unloader * operator, oven or oven loader / unloader * operator, baths * loader, oven * baths operator	Oven operator	25

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

66A9	Firemen and Porters	unloader, basket * loader, basket * basket unloader / loader	Oven operator	25
66I2	Firemen and Porters	infra red heat test oven shop	Oven operator	25
66O2	Firemen and Porters	basket loader & solderer	Oven operator	25
M69	Tantalum		Racker /floorman	14
3369	Electrical Assembly and Final testing	racker	Racker/Floorman	14
33H8	Electrical Assembly and Final testing	racker/shipper	Racker/Floorman	14
33J7	Electrical Assembly and Final testing	rack repairman	Racker/Floorman	14
3469	Electrolysis	racker	Racker/Floorman	14
3569	Electrolysis	racker	Racker/Floorman	14
4369	Mica	racker	Racker/Floorman	14
43H8	Mica	racker/shipper	Racker/Floorman	14
4469		racker	Racker/Floorman	14
5269	Materials, Stock Rooms	racker	Racker/Floorman	14
52H8	Materials, Stock Rooms	racker/shipper	Racker/Floorman	14
6569	Maintenance	racker	Racker/Floorman	14
6669	Firemen and Porters	racker	Racker/Floorman	14
M 69		racker	Racker/Floorman	14
3269	Electrical Impregnation and Winding	racker	Racker/Floorman	14
69		racker	Racker/Floorman	14
1069	Paper I Winding	racker	Racker/Floorman	14
1369	Paper I Assembly	racker	Racker/Floorman	14
2169	Paper II Assembly & Final test - PCB exposure	racker	Racker/Floorman	14
2569	Sub-Assembly	racker	Racker/Floorman	14
25J7	Sub-Assembly	rack repairman	Racker/Floorman	14
25U2	Sub-Assembly	rack repairman & can maker	Racker/Floorman	14
2969	Preform and Anodes	racker	Racker/Floorman	14
1200	Tank Room - PCB Exposure. Impregnation and Pump Mech.	no listed	Kettle & Oven Operators	25
1204	Tank Room - PCB Exposure. Impregnation and Pump Mech.	wax assembler * tantalum operator / assembler * oil assembler * met. misc. assembler * met. & filter assembler * inspector, assembler * filter & met. assembler * assembler/ oil * assembler/ mica * assembler/ met. Misc. * assembler/ met. & filter * assembler / wax * assembler / inspector	Kettle & Oven Operators	25

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

1211	Tank Room - PCB Exposure. Impregnation and Pump Mech.	worker, office * typist * timekeeper, accounting * telephone operator * technician, documentation * stenographer * secretary * receptionist * quality control / inspector * QC, office worker * posting clerk * payroll * operator, telephone * operator, ink jet * office worker (incl. secretary/ admin. asst) QC * labeler, barcode * ink jet operator * executive assistant * documentation technician * clerk/typist * barcode labeler * assistant, executive * assistant, administrative	Kettle & Oven Operators	25
1229	Tank Room - PCB Exposure. Impregnation and Pump Mech.	worker, tank * tankman * tankman * tank worker * operator, dipp. * dipp. operator (?) [tankman]	Kettle & Oven Operators	25
1239	Tank Room - PCB Exposure. Impregnation and Pump Mech.	impregnation/filter * filter/impregnation / operator	Kettle & Oven Operators	25
1241	Tank Room - PCB Exposure. Impregnation and Pump Mech.	filterman? grade 8	Kettle & Oven Operators	25
1244	Tank Room - PCB Exposure. Impregnation and Pump Mech.	worker, general * production * helper, general * general worker * general helper	Kettle & Oven Operators	25
12C9	Tank Room - PCB Exposure. Impregnation and Pump Mech.	impregnator	Kettle & Oven Operators	25
12G7	Tank Room - PCB Exposure. Impregnation and Pump Mech.	processing control	Kettle & Oven Operators	25
1329	Paper I Assembly	worker, tank * tankman * tankman * tank worker * operator, dipp. * dipp. operator (?) [tankman]	Kettle & Oven Operators	25
2029	Paper II Winding	worker, tank * tankman * tankman * tank worker * operator, dipp. * dipp. operator (?) [tankman]	Kettle & Oven Operators	25
2129	Paper II Assembly & Final test - PCB exposure	worker, tank * tankman * tankman * tank worker * operator, dipp. * dipp. operator (?) [tankman]	Kettle & Oven Operators	25
2929	Preform and Anodes	worker, tank * tankman * tankman * tank worker * operator, dipp. * dipp. operator (?) [tankman]	Kettle & Oven Operators	25
32Q3	Electrical Impregnation and Winding	soak cycle op	Kettle & Oven Operators	25
4329	Mica	worker, tank * tankman * tankman * tank worker * operator, dipp. * dipp. operator (?) [tankman]	Kettle & Oven Operators	25
5229	Materials, Stock Rooms	worker, tank * tankman * tankman * tank worker * operator, dipp. * dipp. operator (?) [tankman]	Kettle & Oven Operators	25

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

6629	Firemen and Porters	worker, tank * tankman * tankman * tank worker * operator, dipp. * dipp. operator (?) [tankman]	Kettle & Oven Operators	25
3800		no listed	Unknown	26
8300		no listed	Unknown	26
8400		no listed	Unknown	26
8900		no listed	Unknown	26
9000		no listed	Unknown	26
J 00		no listed	Unknown	26
K 00		no listed	Unknown	26
M 00		no listed	Pre-assembly	18
O 00		no listed	Unknown	26
Q 00		no listed	Unknown	26
X 00		no listed	Unknown	26
Y 00		no listed	Unknown	26
1100		no listed	Unknown	26
1500		no listed	Unknown	26
2600		no listed	Unknown	26
3600		no listed	Unknown	26
3700		no listed	Unknown	26
4100		no listed	Unknown	26
4400		no listed	Unknown	26
4500		no listed	Unknown	26
7600		no listed	Unknown	26
200			Unknown	26
400			Electrical Worker	5
J00	Mica		Unknown	26
K00			Unknown	26
29				26
52				26
66				26
99				26
O00				26
Q00				26
X00	Accounting /Personnel			26
Y00				26
YN6			Dry operator	4
0		no listed		26
76		welder?tab/cover * welder/solderer * welder, T?line * welder, rotary * welder * T?line welder * tab welder * solderer, welder * solderer, fill hole * solderer, base * solderer * rotary welder * fill hole solderer * cover Welder * base solderer	Welder	27

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

1076	Paper I Winding	welder?tab/cover * welder/solderer * welder, T?line * welder, rotary * welder * T?line welder * tab welder * solderer, welder * solderer, fill hole * solderer, base * solderer * rotary welder * fill hole solderer * cover Welder * base solderer	Welder	27
1176		welder?tab/cover * welder/solderer * welder, T?line * welder, rotary * welder * T?line welder * tab welder * solderer, welder * solderer, fill hole * solderer, base * solderer * rotary welder * fill hole solderer * cover Welder * base solderer	Welder	27
1376	Paper I Assembly	welder?tab/cover * welder/solderer * welder, T?line * welder, rotary * welder * T?line welder * tab welder * solderer, welder * solderer, fill hole * solderer, base * solderer * rotary welder * fill hole solderer * cover Welder * base solderer	Welder	27
2076	Paper II Winding	welder?tab/cover * welder/solderer * welder, T?line * welder, rotary * welder * T?line welder * tab welder * solderer, welder * solderer, fill hole * solderer, base * solderer * rotary welder * fill hole solderer * cover Welder * base solderer	Welder	27
2476	Spec. Products	welder?tab/cover * welder/solderer * welder, T?line * welder, rotary * welder * T?line welder * tab welder * solderer, welder * solderer, fill hole * solderer, base * solderer * rotary welder * fill hole solderer * cover Welder * base solderer	Welder	27
2576	Sub-Assembly	welder?tab/cover * welder/solderer * welder, T?line * welder, rotary * welder * T?line welder * tab welder * solderer, welder * solderer, fill hole * solderer, base * solderer * rotary welder * fill hole solderer * cover Welder * base solderer	Welder	27
25U7	Sub-Assembly	welder & general worker	Welder	27
2976	Preform and Anodes	welder?tab/cover * welder/solderer * welder, T?line * welder, rotary * welder * T?line welder * tab welder * solderer, welder * solderer, fill hole * solderer, base * solderer * rotary welder * fill hole solderer * cover Welder * base solderer	Welder	27
3376	Electrical Assembly and Final testing	welder?tab/cover * welder/solderer * welder, T?line * welder, rotary * welder * T?line welder * tab welder * solderer, welder * solderer, fill hole * solderer, base * solderer * rotary welder * fill hole solderer * cover Welder * base solderer	Welder	27
3476	Electrolysis	welder?tab/cover * welder/solderer * welder, T?line * welder, rotary * welder * T?line welder * tab welder * solderer, welder * solderer, fill hole * solderer, base * solderer * rotary welder * fill hole solderer * cover Welder * base solderer	Welder	27
4376	Mica	welder?tab/cover * welder/solderer * welder, T?line * welder, rotary * welder * T?line welder * tab welder * solderer, welder * solderer, fill hole * solderer, base * solderer * rotary welder * fill hole solderer * cover Welder * base solderer	Welder	27

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

5276	Materials, Stock Rooms	welder?tab/cover * welder/solderer * welder, T?line * welder, rotary * welder * T?line welder * tab welder * solderer, welder * solderer, fill hole * solderer, base * solderer * rotary welder * fill hole solderer * cover Welder * base solderer	Welder	27
5876	Guards, Security	welder?tab/cover * welder/solderer * welder, T?line * welder, rotary * welder * T?line welder * tab welder * solderer, welder * solderer, fill hole * solderer, base * solderer * rotary welder * fill hole solderer * cover Welder * base solderer	Welder	27
6676	Firemen and Porters	welder?tab/cover * welder/solderer * welder, T?line * welder, rotary * welder * T?line welder * tab welder * solderer, welder * solderer, fill hole * solderer, base * solderer * rotary welder * fill hole solderer * cover Welder * base solderer	Welder	27
7576	Maintenance	welder?tab/cover * welder/solderer * welder, T?line * welder, rotary * welder * T?line welder * tab welder * solderer, welder * solderer, fill hole * solderer, base * solderer * rotary welder * fill hole solderer * cover Welder * base solderer	Welder	27
2150	Paper II Assembly & Final test - PCB exposure	QA inspector / (AF PT inspection) * inspector, heat test * inspector * heat test inspector	Wet Inspector	28
1050	Paper I Winding	QA inspector / (AF PT inspection) * inspector, heat test * inspector * heat test inspector	Wet inspector	28
1250	Tank Room - PCB Exposure. Impregnation and Pump Mech.	QA inspector / (AF PT inspection) * inspector, heat test * inspector * heat test inspector	Wet inspector	28
1283	Tank Room - PCB Exposure. Impregnation and Pump Mech.	work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inspector/leader, work	Wet inspector	28
12J8	Tank Room - PCB Exposure. Impregnation and Pump Mech.	inspector-tester	Wet inspector	28
1350	Paper I Assembly	QA inspector / (AF PT inspection) * inspector, heat test * inspector * heat test inspector	Wet inspector	28
2183	Paper II Assembly & Final test - PCB exposure	work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inspector/leader, work	Wet inspector	28
21J8	Paper II Assembly & Final test - PCB exposure	inspector-tester	Wet inspector	28
21S5	Paper II Assembly & Final test - PCB exposure	inspector & stamper	Wet inspector	28
2450	Spec. Products	QA inspector / (AF PT inspection) * inspector, heat test * inspector * heat test inspector	Wet inspector	28
2950	Preform and Anodes	QA inspector / (AF PT inspection) * inspector, heat test * inspector * heat test inspector	Wet inspector	28

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

4350	Mica	QA inspector / (AF PT inspection) * inspector, heat test * inspector * heat test inspector	Wet inspector	28
5250	Materials, Stock Rooms	QA inspector / (AF PT inspection) * inspector, heat test * inspector * heat test inspector	Wet inspector	28
5650	Engineers - Industrial or Product	QA inspector / (AF PT inspection) * inspector, heat test * inspector * heat test inspector	Wet inspector	28
5850	Guards, Security	QA inspector / (AF PT inspection) * inspector, heat test * inspector * heat test inspector	Wet inspector	28
5950	QC (Quality Control)	QA inspector / (AF PT inspection) * inspector, heat test * inspector * heat test inspector	Wet inspector	28
6150	QC (Quality Control)	QA inspector / (AF PT inspection) * inspector, heat test * inspector * heat test inspector	Wet inspector	28
6650	Firemen and Porters	QA inspector / (AF PT inspection) * inspector, heat test * inspector * heat test inspector	Wet inspector	28
7250	Process control	QA inspector / (AF PT inspection) * inspector, heat test * inspector * heat test inspector	Wet inspector	28
7350	QC	QA inspector / (AF PT inspection) * inspector, heat test * inspector * heat test inspector	Wet inspector	28
K 50		QA inspector / (AF PT inspection) * inspector, heat test * inspector * heat test inspector	Wet inspector	28
M 50		QA inspector / (AF PT inspection) * inspector, heat test * inspector * heat test inspector	Wet inspector	28
K50			Wet inspector	28
M50	Tantalum		Wet inspector	28
21M2	Paper II Assembly & Final test - PCB exposure	assembler & misc. Operator	Wet operator	28
6.60E+10	Firemen and Porters	dip sealant machine operator	Wet operator	28
66K8	Firemen and Porters	pitch pub operator	Wet operator	28
1056	Paper I Winding	tester, foil * slitter, foil * slitter * set?up, power press * riveter * power press set?up * power press * operator, machine * machinist * machine operator / ballast cover * foil tester * foil slitter * ballast Cover / machine operator	Foil	29
10J6	Paper I Winding	foil respooler	Foil	29
1356	Paper I Assembly	tester, foil * slitter, foil * slitter * set?up, power press * riveter * power press set?up * power press * operator, machine * machinist * machine operator / ballast cover * foil tester * foil slitter * ballast Cover / machine operator	Foil	29
2056	Paper II Winding	tester, foil * slitter, foil * slitter * set?up, power press * riveter * power press set?up * power press * operator, machine * machinist * machine operator / ballast cover * foil tester * foil slitter * ballast Cover / machine operator	Foil	29
2156	Paper II Assembly & Final test - PCB exposure	tester, foil * slitter, foil * slitter * set?up, power press * riveter * power press set?up * power press * operator, machine * machinist * machine operator / ballast cover * foil tester * foil slitter * ballast Cover / machine operator	Foil	29

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

2556	Sub-Assembly	tester, foil * slitter, foil * slitter * set?up, power press * riveter * power press set?up * power press * operator, machine * machinist * machine operator / ballast cover * foil tester * foil slitter * ballast Cover / machine operator	Foil	29
25G9	Sub-Assembly	auto revitted insul machine operator	Foil	29
2956	Preform and Anodes	tester, foil * slitter, foil * slitter * set?up, power press * riveter * power press set?up * power press * operator, machine * machinist * machine operator / ballast cover * foil tester * foil slitter * ballast Cover / machine operator	Foil	29
29J6	Preform and Anodes	foil respooler	Foil	29
3256	Electrical Impregnation and Winding	tester, foil * slitter, foil * slitter * set?up, power press * riveter * power press set?up * power press * operator, machine * machinist * machine operator / ballast cover * foil tester * foil slitter * ballast Cover / machine operator	Foil	29
3356	Electrical Assembly and Final testing	tester, foil * slitter, foil * slitter * set?up, power press * riveter * power press set?up * power press * operator, machine * machinist * machine operator / ballast cover * foil tester * foil slitter * ballast Cover / machine operator	Foil	29
33U5	Electrical Assembly and Final testing	assembler & riveter	Foil	29
3556	Electrolysis	tester, foil * slitter, foil * slitter * set?up, power press * riveter * power press set?up * power press * operator, machine * machinist * machine operator / ballast cover * foil tester * foil slitter * ballast Cover / machine operator	foil	29
4356	Mica	tester, foil * slitter, foil * slitter * set?up, power press * riveter * power press set?up * power press * operator, machine * machinist * machine operator / ballast cover * foil tester * foil slitter * ballast Cover / machine operator	Foil	29
5256	Materials, Stock Rooms	tester, foil * slitter, foil * slitter * set?up, power press * riveter * power press set?up * power press * operator, machine * machinist * machine operator / ballast cover * foil tester * foil slitter * ballast Cover / machine operator	Foil	29
52G9	Materials, Stock Rooms	auto revitted insul machine operator	Foil	29
52J6	Materials, Stock Rooms	foil respooler	Foil	29
5656	Engineers - Industrial or Product	tester, foil * slitter, foil * slitter * set?up, power press * riveter * power press set?up * power press * operator, machine * machinist * machine operator / ballast cover * foil tester * foil slitter * ballast Cover / machine operator	Foil	29
6056	Machine Shop	tester, foil * slitter, foil * slitter * set?up, power press * riveter * power press set?up * power press * operator, machine * machinist * machine operator / ballast cover * foil tester * foil slitter * ballast Cover / machine operator	Foil	29

Industrial hygiene summary report for workers exposed to polychlorinated biphenyls (PCB) in a capacitor manufacturing plant (plant 2; 1938-1977)

6156	QC (Quality Control)	tester, foil * slitter, foil * slitter * set?up, power press * riveter * power press set?up * power press * operator, machine * machinist * machine operator / ballast cover * foil tester * foil slitter * ballast Cover / machine operator	Foil	29
6256	Office/Office services, Sales*, data processing* Accounting and Finance, General Administrative	tester, foil * slitter, foil * slitter * set?up, power press * riveter * power press set?up * power press * operator, machine * machinist * machine operator / ballast cover * foil tester * foil slitter * ballast Cover / machine operator	Foil	29
6656	Firemen and Porters	tester, foil * slitter, foil * slitter * set?up, power press * riveter * power press set?up * power press * operator, machine * machinist * machine operator / ballast cover * foil tester * foil slitter * ballast Cover / machine operator	Foil	29
7256	Process control	tester, foil * slitter, foil * slitter * set?up, power press * riveter * power press set?up * power press * operator, machine * machinist * machine operator / ballast cover * foil tester * foil slitter * ballast Cover / machine operator	Foil	29
7356	QC	tester, foil * slitter, foil * slitter * set?up, power press * riveter * power press set?up * power press * operator, machine * machinist * machine operator / ballast cover * foil tester * foil slitter * ballast Cover / machine operator	Foil	29
J 56		tester, foil * slitter, foil * slitter * set?up, power press * riveter * power press set?up * power press * operator, machine * machinist * machine operator / ballast cover * foil tester * foil slitter * ballast Cover / machine operator	Foil	29
M 56		tester, foil * slitter, foil * slitter * set?up, power press * riveter * power press set?up * power press * operator, machine * machinist * machine operator / ballast cover * foil tester * foil slitter * ballast Cover / machine operator	Foil	29
J56	Mica		Foil	29
M56	Tantalum		Foil	29
3395	Electrical Assembly and Final testing	winder? all types * respooler * Hunt machine (winder) * Hilton machine (winder) * clincher	Winding	29
3495	Electrolysis	winder? all types * respooler * Hunt machine (winder) * Hilton machine (winder) * clincher	Winding	29
3595	Electrolysis	winder? all types * respooler * Hunt machine (winder) * Hilton machine (winder) * clincher	Winding	29
3795		winder? all types * respooler * Hunt machine (winder) * Hilton machine (winder) * clincher	Winding	29
5203	Materials, Stock Rooms	hilton set up	Winding	29
95		winder? all types * respooler * Hunt machine (winder) * Hilton machine (winder) * clincher	Winding	29
1095	Paper I Winding	winder? all types * respooler * Hunt machine (winder) * Hilton machine (winder) * clincher	Winding	29
10B1	Paper I Winding	worker, bench * bench worker	Winding	29
10N2	Paper I Winding	capacity control	Winding	29

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1395	Paper I Assembly	winder? all types * respooler * Hunt machine (winder) * Hilton machine (winder) * clincher	Winding	29
2095	Paper II Winding	winder? all types * respooler * Hunt machine (winder) * Hilton machine (winder) * clincher	Winding	29
20J5	Paper II Winding	material handler, winder, service operator	Winding	29
20O3	Paper II Winding	hilton set up	Winding	29
2195	Paper II Assembly & Final test - PCB exposure	winder? all types * respooler * Hunt machine (winder) * Hilton machine (winder) * clincher	Winding	29
2295		winder? all types * respooler * Hunt machine (winder) * Hilton machine (winder) * clincher	Winding	29
2595	Sub-Assembly	winder? all types * respooler * Hunt machine (winder) * Hilton machine (winder) * clincher	Winding	29
2995	Preform and Anodes	winder? all types * respooler * Hunt machine (winder) * Hilton machine (winder) * clincher	Winding	29
3295	Electrical Impregnation and Winding	winder? all types * respooler * Hunt machine (winder) * Hilton machine (winder) * clincher	Winding	29
3695		winder? all types * respooler * Hunt machine (winder) * Hilton machine (winder) * clincher	Winding	29
36H7		QE general winder & service op	Winding	29
4395	Mica	winder? all types * respooler * Hunt machine (winder) * Hilton machine (winder) * clincher	Winding	29
4495		winder? all types * respooler * Hunt machine (winder) * Hilton machine (winder) * clincher	Winding	29
5295	Materials, Stock Rooms	winder? all types * respooler * Hunt machine (winder) * Hilton machine (winder) * clincher	Winding	29
52L5	Materials, Stock Rooms	winder & production service operator	Winding	29
5895	Guards, Security	winder? all types * respooler * Hunt machine (winder) * Hilton machine (winder) * clincher	Winding	29
6695	Firemen and Porters	winder? all types * respooler * Hunt machine (winder) * Hilton machine (winder) * clincher	Winding	29
M 95	Tantalum	winder? all types * respooler * Hunt machine (winder) * Hilton machine (winder) * clincher	Winding	29
M95	Tantalum		Winding	29
5293	Materials, Stock Rooms	illness/ other leave/ vacation	illness/ other leave/ vacation	31
1299	Tank Room - PCB Exposure. Impregnation and Pump Mech.	school * layoff/ leave/ quit/ leave for school / child care	layoff/ leave/ quit/ leave for school / child care	32
5298	Materials, Stock Rooms	pregnancy	pregnancy	33
5299	Materials, Stock Rooms	school * layoff/ leave/ quit/ leave for school / child care	school * layoff/ leave/ quit/ leave for school / child care	34
8358		manager/ service (sales/ accounting/ benefits/ marketing/ mis) * service manager * sales manager * marketing manager * market analyst * benefits manager * analyst, market * accounting manager		22
T91	Guards, Security	tubular line * line, tubular		27

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		work leader/inspector * work group leader * team member * team leader, manuf. areas * member, team * manufacturing team leader * leader, work group * leader, team, manufacturing * leader * inspector/leader, work	
D83	Paper I Winding		4
R04	Materials, Stock Rooms	Assembler	18
D10	Paper I Winding	ball plug	18
LS6	Firemen and Porters	Tab folder	27
L00	Firemen and Porters	Unknown	7

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