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of Transportation
**Urban Mass
Transportation
Administration**

Polychlorinated Biphenyls (PCBs) in Transit System Electrical Equipment

Transportation Systems Center
Cambridge MA 02142

May 1984
Final Report

Technical Assistance - an UMTA Program

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16. Abstract

This report presents the legislative history and current regulatory requirements concerning the continued use of Polychlorinated Biphenyls (PCBs) in transit system electrical equipment. Recent rule-making promulgated by the Environmental Protection Agency (EPA) is presented in summary form to aid the reader in following the chronology of requirements affecting the continued operation, servicing, marking, and disposal of transit system electrical equipment which contains PCB materials.

Types of transit system electrical equipment regulated by the EPA are identified and future regulatory requirements concerning allowable PCB concentration levels for specific electrical equipment are outlined. Transit system procedures for the handling of electrical equipment containing PCBs are presented. Recommendations to assist transit systems in eliminating PCBs from electrical equipment are provided.

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PREFACE

Until recently, fluids containing Polychlorinated Biphenyls (PCBs) were widely used as an insulating medium in electrical equipment because of their excellent dielectric, heat absorption and fire resistant characteristics. The Toxic Substance Control Act of 1976, however, prohibited further manufacture of PCBs and mandated the elimination of PCB use in the United States.

This report, sponsored by the Urban Mass Transportation Administration Office of Technical Assistance, Safety and Security Staff, presents a review of Federal regulatory requirements and restrictions for the use, servicing and disposal of certain transit system electrical equipment which may contain PCBs. It is intended to serve as a reference resource for transit systems that utilize railroad (on-board) transformers, stationary transformers, capacitors and other electrical equipment.

The report was prepared by the Safety and Security Division Staff of the Transportation Systems Center (TSC). TSC staff members participating in the preparation of the report included William T. Hathaway, Jason B. Baker, Stephanie H. Markos and Lesley A. Darling. Other TSC staff contributions were made by Irving Litant and Carol Dempkowski.

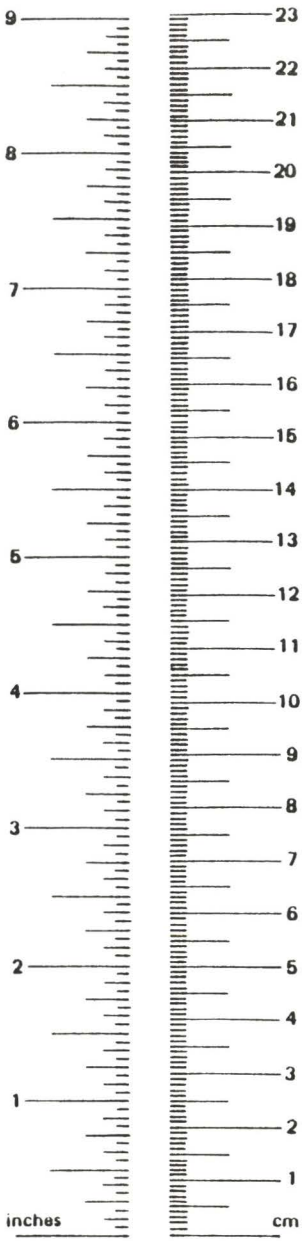
The authors would like to acknowledge the following individuals and their respective staffs: Lloyd G. Murphy, Director of UMTA's Safety and Security Staff, who provided valuable guidance and comments during the course of the work task; Edward Stickel of SEPTA, Edward Farrelly of PATH and Ralph Weule of BART, who assisted in the collection and verification of data and who provided review and comments on the final draft.

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

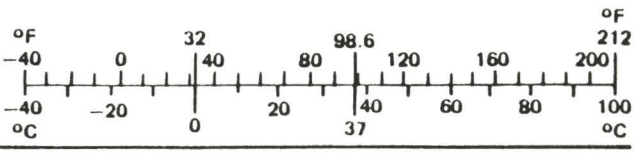
Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 In. = 2.54 cm (exactly). For other exact conversions and more detail tables see NBS Misc. Publ. 286, Units of Weight and Measures. Price $2.25 SD Catalog No. C13 10 286.



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	36	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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1. INTRODUCTION

1.1 BACKGROUND

This study of the use of Polychlorinated Biphenyls (PCBs) in transit system electrical equipment was undertaken as a result of initial legislation passed in 1976, and subsequent final rules and regulations promulgated by the Environmental Protection Agency (EPA). The final regulatory requirements directly affect the continued use, operation, servicing and disposal of electrical equipment which may contain PCB materials.

Polychlorinated Biphenyls belong to a family of organic chemicals known as chlorinated hydrocarbons. Used commercially in the United States since 1929, the manufacture of PCBs was prohibited by passage of the Toxic Substance Control Act (TSCA) in 1976. Under TSCA's mandate, the Environmental Protection Agency (EPA) has promulgated regulations severely restricting the processing, distribution, use, and disposal of PCB-containing materials.

Over the years, PCB-containing fluids have been widely used as an insulating medium in electrical equipment because of their excellent dielectric, heat absorption, and fire resistant characteristics. It has been estimated that most of the PCBs produced in the United States from 1971 until manufacturing ceased in 1977 were used in electrical capacitors (70%) and transformers (30%). Transit systems depend heavily on electricity for propulsion power. Consequently, some transformers, capacitors, and other electrical equipment found in transit systems may contain PCB fluids. Transit systems are therefore directly affected by legislated requirements restricting the use and eventual elimination of PCB-containing fluids.

1.2 PURPOSE AND SCOPE

The purpose of this report is to present the legislative history and current regulatory requirements concerning the use of

PCBs found in transit system electrical equipment. This report is intended to assist transit systems in formulating guidelines for

- the identification of electrical equipment which may be subject to regulation;
- the safe use of "PCB Electrical Equipment" as defined in the Code of Federal Regulations (CFR);
- identifying EPA approved substitute dielectric fluids for the servicing of PCB Railroad (on-board) Transformers;
- identifying EPA approved retrofilling processes for PCB Railroad (on-board) Transformers;
- describing alternative disposal methods for PCB-Contaminated Electrical Equipment.

The history of federal regulation concerning PCBs is reviewed in Chapter 3. Present and future EPA compliance requirements regarding permissible PCB concentration levels in certain types of transit system electrical equipment; research and development; transit system compliance alternatives; and PCB cleanup and disposal procedures are discussed in Chapter 4. Chapter 5 presents recommendations to assist transit systems in the elimination of PCBs from electrical equipment. The appendices include: EPA regulatory terminology; summaries of PCB rules and regulations which have appeared in the Federal Register; transit system procedures for the handling of PCBs; and countermeasure plans for PCB spills and exposure incidents.

2. LITERATURE SEARCH AND SUMMARY

As the initial effort in this study, a literature search was conducted by the Transportation Systems Center to identify pertinent PCB literature, with specific attention focusing on PCB-related reports directly applicable to mass transit systems.

The literature search was undertaken utilizing the Lockheed Information Systems, Dialog Information Retrieval Service. Nine data bases were accessed and searched using the automated retrieval service. Below is a list of nine data bases searched and the time period dates for each search:

- o American Chemical Society, CASESEARCH, 1973-1979; 1980-1983;
- o Chemical Industry Notes, CIN, 1974-1983;
- o Conference Papers Index, 1973-1983;
- o Engineering Information Inc., COMPENDEX, 1970-1983;
- o Institute for Scientific Information, SCISEARCH, 1974-1983;
- o National Technical Information Service, NTIS, 1964-1983;
- o Pollution Abstracts, 1970-1983;
- o Smithsonian Science Information Exchange, SSIE, 1978-1983;
- o Transportation Research Information Service, TRIS, 1970-1983.

Initially, the search attempted to identify all PCB literature. As a result, a broad range of "key words" were employed to determine the amount of published material available on an across-the-board, industrywide basis. The descriptors employed included "PCB," "PCBs," "polychlorinated biphenyl(s)," "Askarel-cooled transformers," "aroclor," and "electrical equipment." This pattern was repeated for each of the data bases and approximately 11,000 reports, journal articles, etc., were identified.

Added to the primary list of key words were identifiers and combinations of identifiers that included but were not limited to the following:

- o mass transit/electrical equipment/PCB;
- o mass transit; transit;
- o mass transit/PCBs;
- o transformer; railroad transformer;
- o capacitor; railroad capacitor;
- o transformer fluid; PCB transformer fluid;
- o askarel/cooled/transformer;
- o insulating fluid; electrical equipment;
- o PCB contaminated transformer;
- o PCB/retrofilling/transformer;
- o regulations/legislation.

Each data base was searched with the same selection of key-words. Approximately 200 reports, journal articles and related documents were identified as applicable to PCBs in transit systems.

In addition to the automated literature search, a manual literature search of all documents pertaining to the use of PCB fluids used in electrical equipment was performed at TSC and the EPA Region 1 Library. Also reviewed were the Code of Federal Regulations and applicable Federal Register citations relating to PCBs. The bibliography resulting from the literature search is contained in Appendix G.

3. FEDERAL REGULATORY REQUIREMENTS

3.1 HISTORICAL OVERVIEW

The legislative history concerning the regulation of PCBs used in industry began in March 1976 when Senator Gaylord Nelson of Wisconsin introduced into the U.S. Senate an amendment to the Toxic Substance Control Act (TSCA) that required the eventual elimination of the use of PCBs in the United States. At this time, a genuine concern arose within certain segments of U.S. industry where PCBs were used as an integral component of electrical equipment operations. Specifically, the industries affected by proposed PCB regulations included utilities, railroads, and the mass transit systems - all of which utilized dielectric fluids including PCBs in capacitors, transformers and other electrical equipment which contained varying concentrations of PCBs.

In July 1976, the Environmental Protection Agency (EPA) proposed toxic pollutant effluent standards for PCBs under Section 307(a) of the Federal Water Pollution Control Act. Following extensive hearings, the proposed standards became law on February 2, 1977.[1] The standards directed EPA to regulate, for the first time, the amount of PCBs discharged into U.S. waterways by transformer and capacitor manufacturers.

At present, there are three federal agencies which govern and monitor PCB usage in industry. They are: 1) the Environmental Protection Agency (EPA); 2) the Occupational Safety and Health Administration (OSHA); and 3) the National Institute for Occupational Safety and Health (NIOSH). This section presents a discussion of each agency's role in regulating and otherwise monitoring PCBs used in industry and the health hazards associated with PCB exposure in the workplace through industry reporting requirements, standards, and research and development.

While EPA has overall statutory authority under TSCA to promulgate rules regulating the use of PCBs, OSHA and NIOSH, as independent agencies, work together closely to develop standards to minimize

the threat of toxic and hazardous substance accidents and to minimize exposure involving employees in the workplace. To ensure that employers institute adequate safety precautions to prevent "occupational injuries", OSHA monitors businesses and promulgates regulations for the protection of employees in the work environment. NIOSH conducts research and development in employee safety and health, assists OSHA in the development of criteria for employee safety, and has published a "proposed standard"[2] concerning occupational exposure to PCBs.

3.2 EPA

The Environmental Protection Agency (EPA) was established on December 2, 1970, as an independent agency of the U.S. Government to consolidate overall environmental efforts of federal agencies into one umbrella regulatory authority. Empowered by Congress to set and enforce national pollution standards, EPA has grown into the largest federal regulatory agency in existence today.

To ensure preservation of the environment, EPA regulates chemicals and toxic substances considered hazardous to humans. PCBs were categorized in the Toxic Substance Control Act (TSCA) of 1976[3] as a hazardous chemical substance. TSCA directed the Administrator of the EPA to promulgate rules prohibiting the manufacture, processing, distribution and use of PCBs. Presently, EPA has established rules for the following:

1) Marking and disposal of PCBs - 1978.
2) Manufacturing prohibition - 1979.
3) Continued use of PCBs in electrical equipment (with certain exceptions) - 1979.
4) Continued use of PCB transformers (non-railroad transformers) and other electrical equipment in restricted concentration levels - 1982.

5) Exclusion from regulation of certain closed and controlled waste manufacturing processes that produce low levels of PCBs - 1982.

6) Performance deadlines for the reduction of PCB levels used in railroad transformers - 1983.

7) Responsibility for approval of certain disposal facilities - 1983.

The following discussion presents in more detail the history of EPA's rulemaking concerning the regulation of PCBs.

In response to growing concerns about the release of toxic materials into the environment, particularly the threat posed by possible PCB contamination, Congress enacted the Toxic Substance Control Act (TSCA) in October 1976. This Act required EPA to regulate all chemical substances posing "an unreasonable risk of injury to health or the environment." In addition, the eventual ban on the manufacture, processing, use, and distribution of PCBs became a legislated requirement after January 1, 1978, with the exception of certain activities specifically exempted by the EPA Administrator (i.e., the continued use of PCBs permitted in a "totally enclosed manner").

As required in Section 6(e)(1) of TSCA, EPA promulgated marking and disposal regulations for PCBs in Feburary 1978.

EPA promulgated the Final Rule governing the use of PCBs in May 1979 which implemented Section 6(e)(2) and 6(e)(3) of TSCA by

1) prohibiting the manufacturing, processing, distribution and use of PCBs other than in a "totally enclosed manner" after January 1, 1978;

2) prohibiting the manufacture of PCBs after July 1, 1979;

3) clarifying the PCB Disposal and Marking Rule of 1978.

The Final Rule exempted from regulation PCBs in concentrations below 50 parts per million (ppm). The only exception to the Final Rule is the use of PCBs in dust control agents where the concentration level is below 50 ppm. This use is prohibited, regardless of the concentration.

Subsequent to this rulemaking, a lawsuit was initiated by the Environmental Defense Fund against EPA. On October 30, 1980, the U.S. Court of Appeals for the District of Columbia invalidated the 50-ppm regulatory exclusion and EPA's designation on the use of intact, non-leaking, capacitors, electromagnets and transformers (other than railroad transformers) as "totally enclosed." The Court ordered EPA to further consider these issues with industry groups for future rulemaking consistent with its opinion. The Court also granted EPA and other parties to the Environmental Defense Fund lawsuit a "stay" of the Court's mandate. This "stay," in effect, allowed the continued use of PCBs under existing provisions of TSCA, and prevented severe disruption of operations in the utility, electrical, railroad, and mass transit industries.

Prior to final rulemaking regarding PCB-containing electrical equipment, the EPA added additional requirements to the May 1979 Final Rule by instituting the Interim Measures Program in March 1981. The Program required owners and users of transformers containing PCBs in concentrations of 50 ppm or more to initiate inspection and maintenance procedures. Under this rule, strict inspection requirements were imposed on PCB Transformers; "moderate leaks" of PCB Transformers had to be repaired and cleaned up within 48 hours after discovery; and detailed inspection records of each PCB Transformer subject to the rule were required.

In August 1982, EPA promulgated a Final Rule regarding PCBs used in electrical equipment. These use authorizations and prohibitions applied to "Non-Railroad Transformers," "Large PCB Capacitors," "Mineral Oil-filled PCB-Contaminated Electrical Equipment," and other forms of electrical equipment. The Final Rule

1) clarified the definition of PCB-Containing Electrical Equipment posing an exposure risk to food or feed, and prohibited its use after October 1, 1985;

2) authorized the use of all other PCB Transformers for the remainder of their useful lives;

3) authorized the use of Large PCB Capacitors for the remainder of their useful lives within certain location restrictions; prohibited use of all other Large PCB Capacitors after October 1, 1988;

4) allowed non-leaking PCB Large High Voltage Capacitors and PCB-Contaminated Electrical Equipment to be stored for disposal outside approved storage facilities after January 1, 1983;

5) required detailed inspection and maintenance records to be maintained on PCB Transformers for 3 years after disposal;

6) included the term "leak" and "leaks" of PCBs in the definition of "disposal."

The EPA exempted from Section 6(e) of TSCA, "closed and controlled waste manufacturing processes" using PCBs in its October 1982 Final Rule. In addition, the EPA

1) defined numerical cutoffs for the "absence" of PCBs released by "closed and controlled waste manufacturing processes";

2) added to the list of approved disposal mechanisms for these wastes;

3) added additional recordkeeping requirements for such disposal.

On January 3, 1983, the EPA postponed the deadlines relating to the use of PCB Railroad Transformers as contained in the May 1979 Final Rule and extended the use of PCB Railroad Transformers. This Final Rule also permits the servicing (retrofilling) of railroad transformers to lower PCB concentrations to approved limits cited below, thereby reducing the costs of disposal and eventual replacement. The Final Rule establishes two sets of performance deadlines for railroad organizations to comply with reduced concentration levels of PCBs in railroad transformers.* They are: 1) 60,000 ppm by July 1, and 2) 1000 ppm by July 1, 1986.

*On July 6, 1983, SEPTA and Metro-North reached a settlement Agreement and Compliance Schedule with EPA. As a result, SEPTA and Metro-North are exempted from the provisions as set forth in 40 CFR Part 761.30(b)(1)(i). Railroad Organizations not a party to this

The EPA also established Interim Performance Deadlines for railroad organizations to meet regarding the set limits of reduced PCB concentration levels. Railroad organizations must comply with the 60,000-ppm PCB concentration level in three stages:

1) one-third of the transformers in active service by July 1, 1983;

2) two-thirds of the transformers in active service by January 1, 1984;

3) all transformers by July 1, 1984.

The 1000-ppm PCB concentration level compliance schedule is as follows:

1) one-third of transformers in active service by July 1, 1985;

2) two-thirds of transformers in active service by January 1, 1986;

3) all transformers by July 1, 1986.

The Final Rule permits the continued use of PCB Railroad Transformers at or below 1000 ppm for the remainder of their useful lives.

Table 3-1 contains a summary of the regulatory deadlines established for Railroad (on-board) Transformers, all other transformers, and other electrical equipment.

Appendix A contains a list of terms and definitions created by EPA for the PCB Rules and Regulations.

Summaries of Federal Register citations highlighted in this section may be found in Appendix B of this report.

3.3 OSHA

The Occupational Safety and Health Administration (OSHA) was created in 1970 as an agency within the Department of Labor, under a provision of the OSHA Act of 1970. A provision in the OSHA Act

out-of-court settlement must still conform to the "Use Restrictions" for Railroad Transformers, as summarized in section 4.1.1.

TABLE 3-1. EPA FUTURE REGULATORY REQUIREMENTS

July 1, 1983	PCB RAILROAD TRANSFORMERS containing dielectric fluid used by a railroad organization with PCB concentrations greater than 60,000 ppm (6% on dry weight basis) may not exceed two thirds of the total in use by the organization on January 1, 1982.
January 1, 1984	PCB RAILROAD TRANSFORMERS containing dielectric fluid with PCB concentrations greater than 60,000 ppm may not exceed one third of the total in use on January 1, 1982.
July 1, 1984	PCB RAILROAD TRANSFORMERS containing dielectric fluid with PCB concentrations greater than 60,000 ppm will be prohibited.
July 1, 1985	PCB RAILROAD TRANSFORMERS containing dielectric fluid used by a railroad organization with PCB concentrations greater than 1,000 ppm may not exceed two thirds of the total in use by that organization on July 1, 1984.
October 1, 1985	Use of PCB TRANSFORMERS and ELECTROMAGNETS containing dielectric fluid with concentrations of PCBs greater than 500 ppm exposed to food or feed is prohibited.
January 1, 1986	PCB RAILROAD TRANSFORMERS containing dielectric fluid used by a railroad organization with PCB concentrations greater than 1,000 ppm may not exceed one third of the total in use on July 1, 1984.
July 1, 1986	PCB RAILROAD TRANSFORMERS containing dielectric fluid with PCB concentrations greater than 1,000 ppm will be prohibited.
October 1, 1988	Use of LARGE PCB CAPACITORS containing more than 3 lbs. PCB fluid exposed to food or feed is prohibited and Large PCB Capacitors must have their access restricted.
January 1, 1999	PCB RAILROAD TRANSFORMERS must be retrofilled and serviced according to EPA rules. Concentrations must be measured immediately after servicing and 12-24 months after each servicing. The records must be retained until January 1, 1999.

makes it the "duty" of all employers to provide a safe and healthy workplace for employees. OSHA's major task is to develop standards to protect workers from potential workplace hazards.

OSHA regulates businesses employing 11 or more people and requires employers to maintain records of occupational injuries and illnesses. OSHA also has the authority to conduct workplace inspections and investigations to identify potential safety hazards, including possible exposure to toxic chemical substances. To date, OSHA standards concerning PCBs include maximum airborne concentration levels for PCB fluids containing between 42 and 52 percent chlorine. The maximum limits are 1 mg/m^3 for PCB fluid containing 42 percent chlorine, and 0.5 mg/m^3 for PCB fluid containing 54 percent chlorine.[4]

3.4 NIOSH

The National Institute for Occupational Safety and Health (NIOSH) is an independent federal agency which "conducts research and evaluation studies of occupational injuries and hazardous substances in the workplace."[5] Although NIOSH and OSHA are separate agencies, both agencies coordinate their efforts to develop criteria that can be used as a basis for each agency's standards development process.

In 1977, NIOSH published "Criteria for a Recommended Standard... Occupational Exposure to Polychlorinated Biphenyls (PCBs)."[2] This document recommends standards which address the health and safety of workers who may be exposed to PCBs found in the workplace. Table 3-2 presents the NIOSH-developed PCB terminology applicable to its proposed standard. The criteria used to develop the standards concerning PCB exposure were based on documented health problems resulting from PCB exposure (i.e., ingestion, inhalation and skin contact). Health problems directly traceable to PCB exposure in the workplace include "eye, nose, and throat irritation; skin rash; gastro-intestinal disturbances; nausea; dizziness; headache; and elevated blood pressures."

TABLE 3-2. NIOSH PCB TERMINOLOGY

Included in NIOSH's recommended PCB exposure standard are terms defined to apply to the proposed standard only, and are not included in 40 CFR, Part 761.

(1) "PCB"	Commercial preparations of chlorinated biphenyl compounds, including those preparations which may be described as single isomers or classes of isomers, such as Decachlorodipheny1. Biphenyl and its monochlorinated derivatives occurring in commercial preparations of PCBs shall be measured along with the polychlorinated derivatives, and shall be treated in this standard as the polychlorinated components of the preparations.
(2) "Occupational Exposure to PCBs"	Working with PCBs or with equipment containing PCBs that can become airborne or that can spill or splash on the skin or into the eyes, or the handling of any solid products that may result in exposure to PCBs by skin contact or by inhalation.
(3) "PCB Work Area"	An area where there is occupational exposure to PCBs.

NIOSH's recommended PCB exposure standard details procedures to be followed in the workplace where there exists a potential for PCB exposure, including

1) restrictions on airborne concentrations of PCBs;

2) labeling and posting of warning signs where PCBs are present;

3) protective equipment and clothing to be worn when handling PCBs;

4) employee education regarding the potential hazard of PCBs

5) work practices and engineering controls for handling PCBs on a daily basis and during emergencies;

6) sanitation practices for employees "occupationally exposed" to PCBs, including separate changing areas and storage of work clothes, shower facilities, and restrictions on food and drink allowed in areas where PCBs are present;

7) recordkeeping requirements for employers to follow when PCBs are present in the workplace. Annual industrial hygiene surveys shall be conducted by employers for employees exposed to PCBs.

Section 6, part (b) of the NIOSH recommended standard outlines procedures to consider in the handling of PCBs.

" (b) Handling of PCBs and General Work Practices

(1) Operating instructions shall be formulated and posted where PCBs are handled or used.

(2) Transportation and use of PCBs shall comply with all applicable local, state, and federal regulations.

(3) PCBs shall be stored in tightly closed containers in well-ventilated areas.

(4) When PCB storage containers are being moved, or when they are not in use and are disconnected, valve protection covers shall be in place. Containers shall be moved only with the proper equipment and shall be secured to prevent dropping or loss of control during transport.

(5) Storage facilities shall be designed to contain spills completely within surrounding dikes and to prevent contamination of workroom air.

(6) Ventilation switches and emergency respiratory equipment shall be located outside storage areas in readily accessible locations which will remain minimally contaminated with PCBs in an emergency.

(7) Process valves and pumps shall be readily accessible and shall not be located in pits or congested areas.

(8) Containers and systems shall be handled and opened with care. Approved protective clothing shall be worn by employees engaged in opening, connecting, and disconnecting PCB containers and systems. Adequate ventilation shall be provided to minimize exposure of such employees to airborne PCBs.

(9) PCB-operating and storage equipment and systems shall be inspected daily for signs of leaks. All equipment, including valves, fittings, and connections shall be checked for leaks immediately after PCBs are introduced therein.

(10) When a leak is found, it shall be repaired or otherwise corrected immediately. Work shall resume normally only after necessary repair or replacement has been completed, the area has been ventilated, and the concentration of PCBs has been determined by monitoring to be at or below the recommended concentration limit." [2]

4. TRANSIT SYSTEM RESPONSE TO REGULATORY REQUIREMENTS

4.1 TRANSIT SYSTEM ELECTRICAL EQUIPMENT AFFECTED BY EPA REGULATIONS

Transit systems own a variety of electrical equipment which contain PCB dielectric fluids. This equipment includes railroad (on-board) transformers, stationary (substation) transformers, large and small capacitors and other electrical equipment.

Approximately 756 rail vehicles (self-propelled cars and locomotives) were in operation as of January 1, 1982, containing approximately 64,400 gallons of PCB dielectric fluid.[6] However, to determine the exact quantity of PCB fluids contained in all electrical equipment owned by each transit system is beyond the scope of this study. Estimates for certain transit systems having electrical equipment (other than transformers) which contain PCB fluids are discussed in Section 4.3 of this document. The following section describes affected electrical equipment and summarizes applicable EPA requirements.*

4.1.1 Railroad (On-board) Transformers

The category of electrical equipment most stringently regulated by EPA is Railroad (on-board) Transformers. Table 4-1 contains a list of Railroad Transformers owned by railroad organizations.

In addition to complying with marking requirements listed in 40 CFR, Part 761.40, Railroad Transformers containing PCB dielectric fluid must comply with the following summarized provisions.

USE RESTRICTIONS:

- o All owners of Railroad Transformers containing PCB dielectric fluid must reduce the PCB concentration levels contained therein according to timetables established by EPA in January, 1983.

  a) PCB concentrations must be reduced to 60,000 ppm by July 1, 1984.

*Applicable regulations in effect as of February 2, 1983.

TABLE 4-1. RAILROAD ORGANIZATIONS AFFECTED BY EPA REGULATIONS CONCERNING PCB RAILROAD TRANSFORMERS (ON BOARD)

		NO. OF VEHICLES	
		SELF-PROPELLED CARS	LOCOMOTIVES
Southeastern Pennsylvania Transportation Authority (SEPTA)		310 plus 22 spares*	
New Jersey Transit Corporation		106	11
New York Metropolitan Transit Authority	Joint Ownership	244	
Connecticut Department of Transportation	Joint Ownership		
AMTRAK		75[a]	26[b]
Maryland Department of Transportation		**	
CONRAIL		**	

*As of December 1, 1983.

**Maryland DOT and CONRAIL own equipment that have transformers containing PCBs which have been retired from active service.

[a]AMTRAK has completed the initial retrofills of all cars and those cars meet the PCB concentration levels specified for January 1, 1982, only.

[b]AMTRAK locomotives were not in compliance with the January 1, 1982 deadline.

SOURCE: Reference 6

b) PCB concentrations must be reduced to 1000 ppm by July 1, 1986.

c) Interim performance deadlines to meet a) and b) above are established for a portion of each railroad organization's fleet.

SERVICING RESTRICTIONS:

- Prohibits the use of dielectric fluid containing more than 50 ppm PCB for refilling of rebuilt transformers.
- Provides that railroad transformers may only be serviced with dielectric fluid containing less than 1000 ppm PCB after January 1, 1984, except for rebuilt transformers (see above).
- Allows the filtration of other industrial process of dielectric fluid to lower PCB concentration levels.
- Specifies that PCB dielectric fluid used to service PCB railroad transformers be stored in accordance with 40 CFR, Part 761.42.
- Restricts processing and distribution of PCBs for purposes of servicing railroad transformers to persons granted an exemption according to TSCA, Section 6(e)(3)(B).
- Permits the conversion and reclassification of PCB Transformers by draining, refilling and/or otherwise servicing so that after 3 months they contain:

  a) PCB-Contaminated Transformer: less than 500 ppm PCB or,

  b) Non-PCB Transformer: less than 50 ppm PCB.

DISPOSAL RESTRICTIONS:

PCB Transformers shall be disposed in:

- An incinerator that complies with 40 CFR, Part 761.70; or
- A chemical waste landfill that complies with 40 CFR, Part 761.75, provided that the transformer is first drained of all free flowing liquid, filled with solvent, allowed to stand for at least 10 hours, and then drained thoroughly. PCB liquids that are removed shall be disposed of in accordance with 40 CFR, Part 761.60, paragraph (a).

4.1.2 Stationary Transformers

Stationary transformers containing PCB dielectric fluid have in the past been widely used in transit system power substations. Continued use of marked stationary transformers, with the exception of those posing an exposure risk to food or feed, is permitted by EPA for the remainder of their useful lives under the following summarized provisions.

USE RESTRICTIONS:

- Prohibits the use of PCB Transformers posing an exposure risk to food or feed after October 1, 1985, and mandates weekly inspections until that date.

- A visual inspection of each PCB Transformer shall be performed at least once every three months. A minimum of 30 days is required between inspections. The visual inspection must include investigation for any leak of dielectric fluid on or around the transformer. The extent of the visual inspection will depend on the physical constraints of each transformer being inspected.

- If a PCB Transformer is found to have a leak which results in any quantity of PCBs running off, or about to run off the external surface of the transformer, then the transformer must be repaired or replaced to eliminate the source of the leak. In all cases any leaking material must be cleaned up and properly disposed of according to the disposal requirements of 40 CFR, Part 761.60. Cleanup of the released PCBs must be initiated as soon as possible, but in no case later then 48 hours after its discovery. Until appropriate action is completed, any active leak of PCBs must be contained to prevent exposure to humans or the environment and inspected daily to verify containment of the leak. Trenches, dikes, buckets, and pans are examples of proper containment measures.

- Records of inspection and maintenance history shall be maintained for at least 3 years after disposing of each transformer and shall be made available for inspection, upon request, by EPA.

- Such records shall contain the following information for each PCB Transformer: location, date of visual inspection, person performing inspection, location of leaks, estimated amount of fluid leak, date and description of cleanup, and results of containment and inspection for uncontrolled leaks.

- Applies a reduced visual inspection schedule (at least once a year as long as there is a minimum of 180 days between inspections) if the transformer:

  a) has impervious undrained secondary containment capacity of at least 100 percent of the total dielectric fluid volume of each transformer so contained, or

  b) has been tested and found to contain less than 60,000 ppm PCB (after three months of inservice use).

SERVICING RESTRICTIONS:

- Transformers classified as PCB-Contaminated Electrical Equipment (as defined in 40 CFR, Part 761.3 (z)) may be serviced (including rebuilding) only with dielectric fluid containing less than 500 ppm PCB.

- Any servicing (including rebuilding) of PCB Transformers (as defined in 40 CFR, Part 761.3(y)) that requires the removal of the transformer coil from the transformer casing is prohibited. PCB Transformers may be serviced (including topping off) with dielectric fluid at any PCB concentration.

- PCBs removed during any servicing activity must be captured and either reused as dielectric fluid or disposed of in accordance with the requirements of 40 CFR, Part 761.60. PCB fluids from PCB Transformers must not be mixed with or added to dielectric fluid from PCB-Contaminated Electrical Equipment.

- Regardless of its PCB concentration, dielectric fluids containing less than 500 ppm PCB that are mixed with fluids that contain 500 ppm PCB or greater must not be used as dielectric fluid in any electrical equipment. The entire mixture of dielectric fluid must be considered to be greater than 500 ppm PCB and must be disposed of in an incinerator that meets the requirements in 40 CFR, Part 761.70.

- PCB Transformers may be converted to PCB-Contaminated Equipment (50 ppm PCB or less) or non-PCB Transformers by undergoing the same process as Railroad Transformers. Reclassification is possible if ppm levels are less than 500 ppm or 50 ppm PCB after a minimum of three months of inservice use subsequent to the last servicing conducted for the purpose of reducing the PCB concentration in the transformer. Inservice means that the transformer is used under electrically loaded conditions that raise the temperature of the dielectric fluid to at least 50° centigrade.

- Restricts processing and distribution of PCBs for the purpose of servicing Stationary Transformers to persons who are granted an exemption according to TSCA, Section 6(e)(3)(B).

- Processing and distribution of PCBs for purposes of servicing these types of Electrical Equipment is limited to those persons who are granted an exemption under TSCA.

DISPOSAL RESTRICTIONS:

- Stationary Transformers are to be disposed of in the same way as Railroad (on-board) Transformers (See Section 4.1.1).

4.1.3 Capacitors

Capacitors are devices used to regulate electrical charges to distribute power surges and prevent arcing. Uses in transit vehicles include chopper propulsion systems, air brake control circuits, and interior lighting. The General Electric Company estimates approximately twenty small capacitors and three large capacitors are used per rail car. In addition to marking requirements, the following summarized EPA requirements are applicable for use, servicing and disposal.

USE RESTRICTIONS:

- Prohibits the use and storage for reuse of Large High Voltage PCB Capacitors and Large Low Voltage PCB Capacitors which pose an exposure risk to food or feed after October 1, 1988.

- Prohibits the use of Large Low Voltage PCB Capacitors unless they are contained within a restricted-access electrical substation or in a contained and restricted-access indoor installation after October 1, 1988. A restricted-access electrical substation is an outdoor, fenced, or walled-in facility that restricts public access and is used in the transmission or distribution of electric power. A contained and restricted-access indoor installation does not have public access and has adequate roof, walls, and floor to contain any release of PCBs within the indoor location.

- Permits the use of Small Capacitors for the remainder of their useful lives.

SERVICING RESTRICTIONS:

- Capacitors are considered "totally enclosed" electrical equipment. When ruptures or failures occur, the entire piece of equipment is simply replaced. Therefore, no servicing restrictions or conditions have been promulgated by EPA.

DISPOSAL RESTRICTIONS:

- Any person may dispose of Small PCB Capacitors as municipal solid waste, except if that person was engaged in the manufacturing of capacitors.

- Any Large High or Low Voltage PCB Capacitor owned by any person shall be disposed of in accordance with either of the following:

  a) disposal in an incinerator that complies with 40 CFR, Part 761.70, or

  b) until January 1, 1980, disposal in a chemical waste landfill that complies with 40 CFR, Part 761.75.

4.1.4 All Other Electrical Equipment

Other electrical equipment defined by EPA which could contain PCB fluids and are used in transit systems include: electromagnets, voltage regulator switches, circuit breakers, reclosers and cable. In addition to marking requirements, the following summarized EPA requirements must be complied with.

USE RESTRICTIONS:

- The use of any electromagnet with a PCB concentration of 50 ppm or more which poses an exposure risk to food or feed is prohibited after October 1, 1988, and is subject to weekly inspections until that date.

- The use of all other PCB-Contaminated Mineral Oil-Filled Electrical Equipment is permitted for the remainder of their useful life.

- Allows the assumption that oil-filled cable contains less than 50 ppm PCB if the actual concentration is unknown.

- Processing and distribution of PCBs for purposes of servicing these types of electrical equipment is limited to persons who are granted an exemption under TSCA.

SERVICING RESTRICTIONS:

- Servicing of this electrical equipment may be performed with dielectric fluid containing any concentration of PCBs, with the exception of circuit breakers, reclosers and cable which may be serviced only with dielectric fluid containing less than 50 ppm PCB.

- PCBs removed during servicing must be captured and reused according to requirements of 40 CFR, Part 761.60.

- Electromagnets and other electrical equipment with a concentration of at least 500 ppm PCB described above may be converted to PCB-Contaminated or Non-PCB Electrical Equipment by undergoing servicing (as described in Section 4.1). This reclassification is attainable if the dielectric fluid is tested after three months, and is found to contain less than 500 ppm PCB (to be reclassified as PCB-Contaminated Electrical Equipment), or less than 50 ppm PCB (to be reclassified as Non-PCB Electrical Equipment).

DISPOSAL RESTRICTIONS:

- Mixing of dielectric fluid containing less than 50 ppm with that of dielectric fluid containing more than 500 ppm of PCB is prohibited. If it occurs, this fluid must be disposed of according to 40 CFR, Part 761.60.

4.2 RESEARCH AND DEVELOPMENT

Due to the mandate of the TSCA to phase out the use of PCBs, extensive research has been performed investigating alternative methods of complying with the regulations promulgated by the Environmental Protection Agency. Electrical utility companies, the Federal Railroad Administration (FRA), and transit systems have all sponsored and/or conducted research directed at lowering the quantity of PCBs used in electrical equipment. Research efforts have addressed retrofilling processes, replacement fluids and alternative disposal methods.

4.2.1 Retrofilling Processes

The January 1983 EPA rule contains a specific time schedule for the gradual reduction of PCB concentrations in dielectric fluids for Railroad Transformers. In addition, lowering the

PCB concentrations permits more flexibility in the servicing, repair and disposal of these transformers as well as Stationary Transformers.

The reduction in PCB content may be accomplished in one of two ways: retrofilling of the dielectric fluid or replacement of the entire transformer. This section reviews the research addressing the retrofilling processes. (Note: Due to the hermetically sealed nature of capacitors and the small amounts of PCBs contained in capacitors, retrofilling of these items is not generally considered feasible and is not discussed here.)

The most efficient retrofilling process consists of draining all PCB dielectric fluid from the transformers, circulating a liquid solvent through the transformer and then filling the transformer with a non-PCB replacement dielectric fluid. Multiple flushing and retrofilling is usually necessary to lower the PCB concentration levels to below 500 ppm. [7]

Southeastern Pennsylvania Transit Authority (SEPTA), a transit system operating a fleet of 332 commuter railcars, the majority of which contain PCB transformers, has conducted extensive research[8] concerning various methods of flushing PCBs from Railroad (on-board) Transformers. This work has included performing the draining and flushing while the transformers are attached to the vehicle and also removed from the vehicle. In addition, tests were made to determine PCB concentration levels after multiple flushings. Based on the test results, SEPTA has developed a recommended flushing procedure (see Appendix C) which it intends to use in the retrofilling of the remainder of its Railroad Transformers, while they are still in place on the vehicles.

4.2.2 Replacement Fluids

Alternative non-PCB dielectric fluids for retrofilling of transformers and new electrical equipment include high temperature hydrocarbons, mineral oil, silicone oil and aromatic esters. Suitability of these replacement fluids is dependent on a variety of design factors.

SEPTA has conducted extensive research with the goal of finding non-PCB replacement fluids which possess the following characteristics:

1) nontoxic or exhibiting a low level of toxicity;
2) biodegradable;
3) non-bioaccumulating;
4) low flammability characteristics (with nonflammability being preferred);
5) good heat transfer capabilities;
6) good dielectric properties;
7) long life and compatibility with the transformer material of construction;
8) readily available at reasonable prices.[8]

Factors discussed in this section will include chemical compatability, fire safety, equipment design, and the environment in which the electrical equipment is located.

Chemical compatibility between the liquid, insulation, and solid core dielectric is essential for proper operation and long-term life of the transformers. The liquid dielectric must not cause swelling, shrinkage or dissolving of the solid core, or the existence of high electrical stress concentrations. Moreover, the dielectric liquid must be chemically compatible with gaskets, fittings, etc., of the electrical equipment, in order to avoid deterioration and possible failure.[9] The design of many transformers already in existence precludes use of some of these alternative fluids as replacements for retrofill purposes. However, new transformers may be successfully designed to operate with alternative non-PCB fluids such as silicone.

The superior fire safety characteristics of PCBs have contributed to their wide usage as dielectric fluids in transformers and other electrical equipment.[10] PCBs are fire resistant and do not produce combustible gases when heated. This permitted the

installation of transformers and electrical equipment indoors and next to buildings with fewer restrictions than mineral oil-filled transformers and electrical equipment.[11] Almost all on-board railroad transformers (including locomotives and self-propelled vehicles) and other electrical equipment (capacitors, etc.) were also designed for use with PCB dielectric fluids because of these factors. The FRA has sponsored a number of studies concerning the fire safety characteristics of particular non-PCB candidates for dielectric fluid replacement. An FRA sponsored study[12] conducted by Factory Mutual Research Corporation (Factory Mutual) examined the fire behavior of two types of replacement fluids [e.g., high temperature hydrocarbon fluids and a dimethyl siloxane fluid (silicone)]. These fluids were rated according to ignition/surface flame spread, heat release rate and generation of CO and CO_2. The conclusion was that silicone presented the lesser fire hazard. Two other studies[13,14] by Westinghouse Electric Corporation and General Electric Corporation (GE) assessed and evaluated the use of silicone fluid for replacement of PCB fluids in the railway industry (on-board) transformers. The findings were that silicone has a relatively high flash point; meets criteria for heat transfer, insulating capacity and thermal stability; but does produce combustible gases (hydrogen and methane) in the presence of an electrical arc. However, the reader should note that silicone-filled transformers overheated and failed during SEPTA tests.[7] The GE report also presented an evaluation of the retrofill method used. The performance of fire extinguishing agents to control fires involving non-PCB replacement fluids (Midel, Dow Corning 561 and RTemp) were studied in two other investigations conducted by Factory Mutual.[15,16]

Equipment modifications may be necessary if a non-PCB dielectric fluid with a lower flashpoint is used. For example, BART is currently replacing its PCB capacitors on vehicles with non-PCB capacitors. Since this process began, BART has deemed it necessary to add fire prevention devices. Pressure sensitive switches are being installed which remove electrical power from the capacitors and shutdown propulsion blowers when swelling, prior to rupture of capacitors, occurs.[17]

Performance capability (to prevent overheating or other failure) of electrical equipment used is also dependent on equipment design. The GE and Westinghouse studies previously cited and sponsored by FRA, as well as SEPTA research, note that substitution of non-PCB dielectric fluids on a one-to-one basis in existing transformers cannot be assumed to be successful. Rather, individual transformer designs must be analyzed to determine compatibility in terms of load capacity and reliability.

Environmental considerations are related to all of the elements described above. This is particularly true in relating environment to fire safety. Although mineral oil possesses superior dielectric properties, its use in electrical equipment located inside or next to buildings has been restricted by the National Electrical Code because of its low flash point.[11] This low flash point could present a potential danger to rail transit system passengers because of the closed tunnel environment.

SEPTA has tested a number of non-PCB substitute dielectric fluids during their efforts to find a suitable replacement for use in their Railroad (on-board) Transformers. Fluids tested include silicone, three varieties of RTEmp, Midel, and IRA-LEC T1/FR-15 Low-Temp. Their findings indicate the following: 1) Silicone may be used successfully only in new transformers; 2) the viscosity of the RTEmp is not satisfactory at low temperatures; 3) Midel's flash point is too low (310°F); and 4) IRA LEC/FR-15 are the only completely acceptable fluids for the retrofilling of their railway transformers. (However, SEPTA expresses concern that EPA could decide to restrict the use of IRA LEC/FR-15 because these fluids contain benzenes.)

4.2.3 Alternative Disposal Methods

Burial in chemical waste landfills and high temperature incineration were initially the only EPA approved methods of disposing of PCB fluids and equipment. Popular controversy over toxic waste dumps makes it unlikely that additional landfills for toxic wastes will be available soon. Futhermore, the EPA closed all chemical waste fills to PCB Capacitor disposal in March 1981.[18]

High temperature (2500°F) incineration was until recently the only known way to eliminate PCBs permanently from the environment. Major difficulties in disposing of PCBs through incineration have been the limited capacity of the incinerators, the requirement that 99.99 percent of the PCB is destroyed, and that no more than 10 percent by volume of the waste burned may contain PCBs.

Research to develop disposal options other than high-temperature incineration and chemical waste landfills has led to EPA approval of alternative PCB disposal methods. One such disposal method is the dechlorination process originally developed by Goodyear.[19] This process is capable of reducing PCB concentrations to less than 10 ppm. PCBs have a molecular chemical composition of two phenyl rings with various numbers of chlorine atoms attached. The dechlorination process strips the chlorine from the phenyl rings using a metallic sodium agent and thereby reduces the toxicity of the PCB molecule. (The lower the number of chlorine atoms in the biphenyl structure, the less the degree of toxicity.[20]) The by-products, sodium chloride and non-halogenated polyphenyls, can then be safely disposed of in conventional incinerators.

There are major advantages in the use of this method to reduce PCB contamination. Costs of the chemical treatment are significantly less than incineration. The chemical dechlorination process costs about $3.00 per gallon versus $6-12 per gallon for incineration.[20] Moreover, valuable transformer oil free of PCB contamination can then be recycled and reused instead of being burned as waste. Another advantage is that chemical treatment can be performed on-site through the use of mobile treatment units. This eliminates costly transportation and packaging costs.

Other organizations undertaking research into chemical processes for PCB destruction have included SUN OHIO,[21] ACUREX,[22] Franklin Institute,[23] Vertac Chemical Corporation, Atlantic Research Corporation, and Lockheed Missile and Space Company.[24] New incineration and pyrolysis processes are being investigated by the Midland Ross Company and Los Alamos Scientific Laboratories. Processes for disposal of PCB-contaminated soil and sediments are

being researched by the Thagard Research Corporation and the Baird Corporation.

An unusual method of breaking down PCBs has been developed by scientists at the University of California-Riverside.[25] "Exotic" soil bacteria were supplied with a specialized food that only they could eat. A ten-fold to 100-fold improvement was obtained in the degradation of Aroclor.

4.3 TRANSIT SYSTEM COMPLIANCE ALTERNATIVES

As discussed in Section 4.2, extensive research has been conducted to reduce PCB concentration levels in electrical equipment. To comply with EPA regulations, transit systems may, depending on the type of regulated electrical equipment in use:

1) adopt retrofilling processes that include choosing acceptable replacement fluids (e.g., in PCB Transformers);

2) continue to use regulated electrical equipment for the remainder of its useful life(s) (e.g., non-railroad transformers, small capacitors), subject to certain inspection and record-keeping requirements;

3) dispose of regulated electrical equipment and purchase new equipment.

Issues that must be examined by transit systems prior to making a decision to retrofill, continue to use, or replace regulated electrical equipment are compatability, both of system design and component design; costs associated with each available alternative; the cost of downtime as a result of vehicles being removed from service; and other incremental costs.

4.3.1 Retrofill

The retrofilling process for transformers, which consists of draining, flushing with solvent, and refilling the transformer with a non-PCB dielectric fluid, has been successfully employed to reduce PCB concentrations to levels in compliance with EPA regulations. Thorough testing of non-PCB replacement fluids under controlled conditions should precede the actual

retrofilling process to ensure the compatability of the dielectric with the design of the transformer. Testing should also eliminate potential revenue service failure of the transformer. Equipment modifications may be necessary to accommodate the increased fire hazards of certain non-PCB replacement fluids. Due to the reduced level of PCBs contained in retrofilled transformers, EPA disposal regulations are less stringent than for other types of PCB electrical equipment. Therefore, transit systems should realize a cost savings when disposing of retrofilled transformers.

As discussed in Section 4.2, SEPTA has conducted and participated in extensive research involving retrofilling processes using various substitute non-PCB replacement fluids. Twenty-seven of SEPTA's on-board railroad transformers have been retrofilled to date. SEPTA has decided to retrofill its remaining 283 on-board transformers (one transformer per car). SEPTA estimates that the cost per retrofill will be $15,000, compared to the cost of a new transformer of $100,000. Materials cost per gallon of replacement fluid averages between $11 and $13 per gallon.[8]

An additional method now employed in the retrofilling process is chemical dechlorination[19] of transformers. PCB toxicity is removed and the decontaminated fluid is reuseable. The advantages of using this method for retrofilling are its effectiveness, cost ($3.00 per gallon of recovered fluid) and cost savings resulting from fluid re-use.

4.3.2 Continued Use

The second compliance alternative available to transit systems is to continue use of certain electrical equipment which contains less than 500 ppm PCB. Railroad Transformers containing an average of 550,000 ppm PCB are exempted from the EPA rule which limits PCB concentrations to less than 500 ppm. However, the EPA is requiring that railroad organizations attain 1000 ppm PCB by July 1, 1986. Because of the magnitude of reduction in the concentration levels, the term "continued use", which implies

"no change", is not an appropriate term to use concerning Railroad Transformers. In order to meet the EPA deadlines, railroad organizations must eventually retrofill or replace these transformers.

Certain PCB-Contaminated Electrical Equipment can continue in service for the remainder of its useful life provided that it does not pose an exposure risk to food or feed, and is inspected regularly. This equipment includes non-railroad transformers, capacitors, circuit breakers, reclosers, voltage regulators, switches and cable. Records of inspection must be kept for transformers. Intervals between inspections may be lengthened if secondary containment methods are employed.

4.3.3 New Equipment

The third alternative available to transit systems is the purchasing of new equipment to replace PCB Railroad Transformers, PCB Capacitors, and other PCB Electrical Equipment. This can be an expensive alternative since transit systems estimate the cost of buying new equipment to meet regulatory deadlines is at least double the cost of retrofilling, where feasible.[26]

4.4 PCB CLEANUP AND DISPOSAL PROCEDURES

The EPA is in the process of assembling information on PCB cleanup which will be available in the future, but presently they have no official cleanup procedures. The EPA specifies that cleanup of a PCB Transformer leak must begin within 48 hours of when it is discovered and that the leak must be contained and inspected daily until it is fixed. PCB leaks and spills are defined by the EPA as "improper disposal" unless cleaned up within the 48-hour time period.

Protection of workers should be a prime consideration during cleanup operations. The National Institute for Occupational Safety and Health (NOISH) has evaluated materials for penetration

of the PCB fluid, Aroclor 1254, and recommends that protective garments be made of Viton elastomer. NIOSH has formulated the following leakage and spill procedures:

> "PCB spills are to be cleaned up promptly, either by the use of sorbent materials, such as sawdust, or by trapping and removal through pumping or other suitable means. In case of spillage of PCBs on clothing, the contaminated clothing should be removed as soon as practical, the skin should be thoroughly washed, and the clothing should be laundered or disposed of properly. Facilities and procedures for such cleanup must be provided at manufacturing facilities producing capacitors and transformers, because spills of PCBs are quite likely to occur during the filling and handling of such devices. Users of PCB-filled transformers should inspect them periodically for leakage. If leakage is found, the cause should be corrected and the spillage should be soaked up with sawdust or other absorpent material. The leak area should be cleaned finally with rags soaked with an appropriate safe solvent. Leaky transformer gaskets can be sealed temporarily by painting over the leaky area with epoxy cement."[2]

BART and MBTA have formulated extensive sets of PCB spill cleanup procedures for their employees to use. Both sets of procedures are contained in Appendix D. The PCB cleanup procedures established by NIOSH, BART and the MBTA can be used as a basis and adapted to formulate a PCB cleanup procedure that will provide adequate protection for workers at individual transit systems.

EPA has approved hazardous material handling companies (state approval and licenses are also required) to perform tasks that include PCB inspection, spill containment and cleanup procedures, packaging, labeling, transporting and hauling of PCB-Contaminated fluids and electrical equipment to disposal facilities. Appendix E contains an example of cleanup procedures developed by a toxic waste materials transporting company.

To meet all regulatory requirements for PCB-Contaminated fluids used in electrical equipment, transit systems will ultimately face the issue of disposal. As contained in Appendix F, EPA has approved 10 disposal companies located across the nation, only two of which provide mobile units that will perform on-site PCB decontamination procedures. For transit systems not located

near disposal facilities, problems arise concerning the removal of PCB-contaminated fluids and equipment from the transit property to disposal facilities. Often, transit systems do not have the resources (e.g., manpower, approved transport vehicles, etc.) to conduct removal themselves and must rely on outside contractors to accomplish disposal.

5. RECOMMENDATIONS FOR ELIMINATING PCBs FROM TRANSIT SYSTEM ELECTRICAL EQUIPMENT TO COMPLY WITH FEDERAL REGULATIONS

Since TSCA was passed in 1976, resulting in the promulgation of regulations by EPA to restrict and eventually eliminate the use of PCB fluids in electrical equipment, mass transit systems have been working to comply with the intent of the law. However, genuine concern has been expressed by mass transit systems because of difficulties in meeting certain regulatory requirement deadlines.

Transformers, capacitors, and other regulated electrical equipment are integral components which enable all mass transit systems to provide continuous, safe movement of people. By limiting the use of these components through the regulation of PCBs, mass transit system operations may be jeopardized if compliance schedules are not met. The responsibility of regulatory compliance is directed toward individual mass transit systems. Consequently, the guidelines which appear below should serve as an aid to mass transit systems in evaluating their present "PCB Problem" and in formulating plans to meet regulatory requirements and deadlines.

1) Review federal regulatory requirements and determine applicability to transit system.

2) Identify through inspection all PCB Transformers.

3) Decide whether it is more cost effective to test equipment or assume that all equipment contains more than 50 ppm.

4) Test PCB Transformers for PCB concentration levels.

5) Determine electrical load requirements of each PCB Transformer.

6) Determine acceptable non-PCB replacement fluid.

7) For PCB Railroad (on-board) Transformers, determine which can meet the July 1, 1986, EPA regulation deadline to reduce the PCB concentration level to 1000 ppm PCB or below

by retrofilling, and tolerate electrical load requirements (need load vs. concentration data).

8) Determine which PCB Transformers should be replaced.

9) Identify a convenient and EPA-approved disposal company.

10) Develop a disposal, retrofill, and replacement plan to meet EPA timetable requirements concerning the lowering and elimination of PCB concentration levels in dielectric fluids and electrical equipment.

11) Implement plan.

12) Repeat 1) through 10) for Large PCB Capacitors.

13) Repeat 1) through 10) for other regulated electrical equipment.

APPENDIX A

EPA REGULATORY TERMINOLOGY
(40 CFR, PART 761)

TERM	
"PCB, PCBs"	Any chemical substance that is limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances that contain 50 parts per million (ppm) (on a dry weight basis) or greater of PCBs.
"PCB Article"	Any manufactured article, other than a PCB Container, that contains PCBs and whose surface(s) has been in direct contact with PCBs. "PCB Article" includes capacitors, transformers, electric motors, pumps, pipes, and any other manufactured item, (1) which is formed to a specific shape or design during manufacture, (2) which has end use function(s) dependent in whole or in part upon its shape or design during end use, and (3) which has either no change of chemical composition during its end use or only those changes of composition which have no commercial purpose separate from that of the PCB Article.
"PCB Article Container"	Any package, can, bottle, bag, barrel, drum, tank or other device used to contain PCB Articles or PCB Equipment, and whose surface(s) has not been in direct contact with PCBs.
"PCB Container"	Any package, can, bottle, bag, barrel, drum, tank, or other device that contains PCBs or PCB Articles and whose surface(s) has been in direct contact with PCBs.
"PCB Item"	Any PCB Article, PCB Article Container, PCB Container, or "PCB Equipment" that deliberately or unintentionally contains or has as a part of it any PCB or PCBs at a concentration of 50 ppm or greater.
"PCB Equipment"	Any manufactured item, other than a PCB Container or a PCB Article Container, which contains a PCB Article or other PCB Equipment, and includes microwave ovens, electronic equipment, and fluorescent light ballast and fixtures.
"PCB Transformer"	Any transformer that contains 500 ppm PCB or greater.

EPA REGULATORY TERMINOLOGY (CONT.)

TERM	DEFINITION
"Non-PCB Transformer"	Any transformer that contains less than 50 ppm of PCB (this term is not defined in TSCA regulations).
"PCB-Contaminated Electrical Equipment"	Any electrical equipment, including but not limited to transformers (including those used in railway locomotives and self-propelled cars), capacitors, circuit breakers, reclosers, voltage regulators, switches (including sectionalizers and motor starters), electromagnets, and cable that contain 50 ppm or greater PCB, but less than 500 ppm PCB. o Oil-filled electrical equipment other than circuit breakers, reclosers, and cable whose PCB concentration is unknown must be assumed to be "PCB-Contaminated Electrical Equipment."
"Capacitor"	A device for accumulating and holding a charge of electricity and consisting of conducting surfaces separated by a dielectric.
"Small Capacitor"	A capacitor which contains less than 1.36 kg (3 lbs.) or (1 qt.) of dielectric fluid.
"Large High Voltage Capacitor"	A capacitor which contains 1.36 kg (3 lbs.) or more of a dielectric fluid and which operates at 2000 volts (a.c. or d.c.) or above.
"Large Low Voltage Capacitor"	A capacitor which contains 1.36 kg (3 lbs.) or more of a dielectric fluid and which operates below 2000 volts (a.c. or d.c.).
"Leak" or "Leaking"	Any instance in which a PCB Article, PCB Container, or PCB Equipment has any PCBs on any portion of its external surface.
"Disposal"*	To intentionally or accidentally discard, throw away, or otherwise complete or terminate the useful life of PCBs and PCB Items. Disposal includes spills, leaks, and other uncontrolled discharges of PCBs as well as actions related to containing, transporting, destroying, degrading, decontaminating, or confining PCBs and PCB Items.

*Where the responsible party shows that: (1) the spill, leak, or uncontrolled discharge occurred during authorized use of electrical equipment and (2) adequate cleanup measures were initiated within 48 hours, the EPA will not charge the party with a disposal violation.

TERM	DEFINITION
"Storage for Disposal"	Temporary storage of PCBs that have been designated for disposal.
"Flourescent Light Ballast"	A device that electronically controls fluorescent light fixtures and that includes a capacitor containing 0.1 kg or less of dielectric.
"Waste Oil"	Used products primarily derived from petroleum, which include, but are not limited to, fuel oils, motor oils, gear oils, cutting oils, transmission fluids, hydraulic fluids, and dielectric fluids.
"Mark"	The descriptive name, instructions, cautions, or other information applied to PCBs and PCB Items, or other objects subject to these regulations.
"Marked"	The marking of PCB Items and PCB storage areas and transport vehicles by means of applying a legible mark by painting, fixation of an adhesive label, or by any other method that meets the requirements of these regulations.
"Totally Enclosed Manner"	Any manner that will ensure that any exposure of human beings or the environment to any concentration of PCBs will be insignificant; that is, not measurable or detectable by any scientifically acceptable analytical method.
"Posing an Exposure Risk to Food or Feed"	Any location where human food or animal feed products could be exposed to PCBs released from a PCB Item. A PCB Item poses an exposure risk to food or feed if PCBs released in any way from the PCB Item have a potential pathway to human food or animal feed.
"Significant Exposure"	Any exposure of human beings or the environment to PCBs as measured or detected by any scientifically acceptable analytical method.
"Incinerator"	An engineered device using controlled flame combustion to thermally degrade PCBs and PCB Items. Examples of devices used for incineration include rotary kilns, liquid injection incinerators, cement kilns, and high temperature boilers.

EPA REGULATORY TERMINOLOGY (CONT.)

TERM	DEFINITION
"Chemical Waste Landfill"	A landfill at which protection against risk or injury to health or the environment from migration of PCBs to land, water, or the atmosphere is provided for PCBs and PCB Items deposited therein by locating, engineering, and operating the landfill.
"PCB Liquid, Fluid"	Any liquid or fluid containing more than 500 ppm PCB.
"PCB Contaminated Liquid, Fluid"	Any liquid or fluid containing less than 500 ppm but more than 50 ppm PCB.
"Spill Event"	Significant leaks of PCB dielectric fluid that can be identified during normal operational practices.
"Retrofill"	The entire process of draining, flushing and refilling a transformer with non-PCB fluid.
"Servicing"	See Retrofill.

SOURCES: 40 CFR PART 761, July 1982,
Federal Register, Vol. 48, No.1, January 3, 1983.

APPENDIX B

EPA PCB REGULATIONS: SUMMARIES OF RULES AND REGULATIONS WHICH HAVE APPEARED IN THE FEDERAL REGISTER

This Appendix contains summaries of final rules and regulations relating to PCBs that are codified in the Code of Federal Regulations (40 CFR, Part 761). These summaries are presented in reverse order according to the issue of the Federal Register in which they first appeared:

March 30, 1983 - Vol. 48, No. 62
January 3, 1983 - Vol. 48, No. 1
October 21, 1982 - Vol. 47, No. 204
August 25, 1982 - Vol. 47, No. 165
May 6, 1982 - Vol. 47, No. 88
March 10, 1981 - Vol. 46, No. 46
May 31, 1979 - Vol. 44, No. 106

It should be emphasized that the material in this Appendix consists of summaries of the final rules and regulations.

The exact text as it appears in the Code of Federal Regulations and the Federal Register should be used by any transit system when formulating specific plans to comply with its provisions.

CODE OF FEDERAL REGULATIONS

40 CFR PART 761

(FEDERAL REGISTER/VOL.48, NO. 62, March 30, 1983/
RULES AND REGULATIONS)

ENVIRONMENTAL PROTECTION AGENCY

Polychlorinated Biphenyls (PCBs):
Procedural Amendment of the Approval Authority for PCB Disposal Facilities and Guidance for Obtaining Approval.

Summary of Procedural Rule Amendment: Substitutes the Assistant Administrator for Pesticides and Toxic Substances for Regional Administrators as an approval authority for certain PCB disposal facilities.

Effective Date: April 24, 1983.

The Rule Amendment:

1. Specifies that landfills for PCB materials will continue to be approved by the Regional Administrators.

2. Specifies that the operation of site-specific stationary incinerators will continue to be approved by the Regional Administrators.

3. Specifies that mobile incinerators and stationary incinerators of identical design that are intended to be used in more than one region will be approved by the Assistant Administrator, except for research and development (R&D) involving less than 500 lbs. of PCB material. Such approval may be issued to be effective in all ten EPA regions.

4. Specifies that alternate disposal methods to incineration that are stationary and unique (site-specific) will be approved by the appropriate Regional Administrator. Alternate methods that are mobile or to be used in more than one region will be approved by the Assistant Administrator, except for R&D involving less than 500 lbs. of PCB material. Such approval may be issued to be effective in all ten EPA regions.

5. Specifies that Regional Administrators will be the approval authority for R&D in PCB disposal methods, regardless of type of method, using 500 lbs. or less of PCB contaminated material.

CODE OF FEDERAL REGULATIONS

40 CFR PART 761

(FEDERAL REGISTER/VOL. 48, NO. 1, January 3, 1983/
RULES AND REGULATIONS)

ENVIRONMENTAL PROTECTION AGENCY

Polychlorinated Biphenyls (PCBs):
Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions: Amendment to Use Authorization for PCB Railroad Transformers.

Summary of Final Rule: Postpones the deadlines for the use of PCB Railroad Transformers previously set on May 31, 1979, and allows the servicing of the transformers to lower PCB concentrations.

Effective Date: February 2, 1983.

The Final Rule:

1. Requires these railroad organizations to meet the 60,000 ppm level by July 1, 1984.

2. Requires these railroad organizations to meet the 1000 ppm level by July 1, 1986.

3. Authorizes the use of PCBs for the remaining period of these transformers at concentrations below 1000 ppm.

4. Permits railroad organizations to service these transformers to reduce PCB concentrations and thereby reduce costs of disposal.

5. Establishes interim performance deadlines as follows for railroad organizations to meet the 60,000 ppm PCB level:

   a. one-third of the transformers in active service by each railroad organization must reach this level by July 1, 1983;

   b. another third by January 1, 1984;

   c. final third by July 1, 1984.

6. Establishes interim performance deadlines as follows for railroad organizations to meet the 1000 ppm PCB level:

a. one-third of the transformers in active service by each railroad organization must reach this level by July 1, 1985;

b. another third by January 1, 1986;

c. final third by July 1, 1986.

7. Deletes expiration deadline for this use of PCBs at or below 1000 ppm allowing this use of PCBs for the remaining useful lives of these transformers at or below 1000 ppm.

CODE OF FEDERAL REGULATIONS
40 CFR PART 761

(FEDERAL REGISTER/VOL. 47, NO. 204/October 21, 1982/
RULES AND REGULATIONS)

ENVIRONMENTAL PROTECTION AGENCY

Polychlorinated Biphenyls (PCBs):
Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions, Used in Closed and Controlled Waste Manufacturing Processes.

Summary of Final Rule: Excludes certain process situations from the prohibitions and requirements of section 6(e) of TSCA; exclusion is voluntary.

Effective Date: November 22, 1982.

The Final Rule:

1. Sets numerical cutoffs for the purposes of defining the absence of PCBs in release from closed* and controlled* waste manufacturing processes.

2. Adds additional disposal mechanisms to the list of acceptable mechanisms for the disposal of controlled wastes containing PCBs in concentrations between the limit of quantitation and 50 ppm.

3. Institutes a new recordkeeping requirement and a reporting requirement.

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*Definitions:

Closed manufacturing processes: manufacturing process that produces PCBs but releases PCBs only in concentrations below the practical limits of quantification for PCB in air emissions, water effluents and products.

Controlled waste manufacturing process: manufacturing process that produces PCBs but only in concentrations below the practical limits of quantification for PCBs in air emissions, water effluents and products and all remaining PCBs are disposed of in accordance with methods specified in this rule.

CODE OF FEDERAL REGULATIONS
40 CFR PART 761

(FEDERAL REGISTER/VOL. 47, NO 165/AUGUST 25, 1982/
RULES AND REGULATIONS)

ENVIRONMENTAL PROTECTION AGENCY

Polychlorinated Biphenyls (PCBs):
Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions: Use in Electrical Equipment.

Summary of the Final Rule: Applies to Non-Railroad Transformers, Large PCB Capacitors, Mineral Oil-Filled PCB-Containing Electrical Equipment.*

Effective Date: September 24, 1982.

The Final Rule:

1. Uses the recodified version of the PCB rule (40 CFR, Part 761, May 6, 1982).

2. Prohibits the use of PCB Transformers and PCB Electromagnets with a concentration of 500 ppm PCBs or greater, posing an exposure risk to food or feed after October 1, 1985, and requires a weekly inspection of this equipment for leaks of dielectric fluid until that date.

3. Authorizes the use of all other PCB Transformers for the remainder of their useful lives, and requires a quarterly inspection of this equipment for leaks of dielectric fluid.

4. Authorizes the use of Large PCB Capacitors that are located in restricted access electrical substations for the remainder of their useful lives.

5. Authorizes the use of Large PCB Capacitors that are located in contained restricted-access indoor installations for the remainder of their useful lives.

6. Prohibits the use of all other Large PCB Capacitors after October 1, 1988.

7. Eliminates the proposed inspection requirements for Large PCB Capacitors.

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*Voltage regulators, switches (including sectionalizers and motor starters), circuit breakers, reclosers and cable.

8. Authorizes the use of all PCB-containing mineral oil-filled electrical equipment for its remaining useful life.

9. Clarifies what constitutes electrical equipment posing an exposure risk to food or feed.

10. Allows oil-filled cable to be assumed to contain less than 50 ppm PCBs if the actual PCB concentration is unknown.

11. Allows storage for disposal of non-leaking PCB Large High Voltage Capacitors and PCB Contaminated Electrical Equipment outside of qualified storage facilities after January 1, 1983.

12. Requires records of inspection and maintenance to be maintained for at least 3 years after disposing of PCB Transformers.

13. Changes wording in subparts C and D (Marking and Disposal) to reflect the new definitions of "PCB Transformers" and "PCB-Contaminated Equipment."

14. States that marking of PCB-Contaminated Electrical Equipment is not required.

15. Clarifies that "disposal" includes leaks of PCBs.

16. Does not include language regarding the extent of clean-up of PCB spills.

17. Specifies disposal requirements for PCB Capacitors, PCB-Contaminated Electrical Equipment, other PCB Articles and storage requirements for PCB Articles.

CODE OF FEDERAL REGULATIONS
40 CFR PART 761

(FEDERAL REGISTER/VOL. 47, NO. 88, MAY 6, 1982/
RULES AND REGULATIONS)

ENVIRONMENTAL PROTECTION AGENCY

Polychlorinated Biphenyls (PCBs):
Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions: Recodifications.

Summary of Rule: Recodification to provide more orderly organization of material. No substantive changes are involved.

Effective Date: May 6, 1982.

Annex I Incinerators, is renumbered CFR 761. 70.

Annex II Chemical Waste Landfills, is renumbered CFR 761. 75.

Annex III Storage, is renumbered CFR 761. 60.

CODE OF FEDERAL REGULATIONS
40 CFR PART 761

(FEDERAL REGISTER/VOL. 46, NO. 46/MARCH 10, 1981/
RULES AND REGULATIONS)

ENVIRONMENTAL PROTECTION AGENCY

Polychlorinated Biphenyls (PCBs):
Manufacturing, Processing, Distribution in Commerce and Use Prohibitions: Use in Electrical Equipment; Court Order on Inspection and Maintenance.

Rule-related Court Order and Enforcement Notice.

Summary of Notice: During the period of the Court ordered Stay, the existing PCB regulations will remain in effect with the additional requirement that certain owners and users of transformers containing 50 parts per million (ppm) of PCB or greater must undertake certain inspection and maintenance procedures known as the Interim Measures Program.

Effective Date: May 11, 1981.

The major requirements of the Program are as follows:

1. PCB Transformers (those that contain 500 ppm or greater) and PCB-Contaminated Transformers (those that contain between 50 ppm and 500 ppm PCBs) posing an exposure risk to food or feed products must be inspected for leaks once every week.

2. All other PCB Transformers must be inspected for leaks once every three months.

3. Any "moderate leak" discovered by the inspection must be repaired and cleaned or the transformer replaced beginning within 2 days from the time the leak is observed. Moderate leaks from transformers posing an exposure risk to food or feed products must be reported to EPA within 5 days from the date the leak is observed.

4. Records must be kept of the following:

    a. The location of each transformer subject to the Program.

    b. The date of each inspection and the name of the inspector.

c. All leaks observed.

d. A description of all servicing on the transformer after the date of the first inspection.

These requirements become effective May 11, 1981. This means that the first inspection of transformers posing an exposure risk to food or feed products must be completed by May 18, 1981, and the first inspection of other transformers subject to this Program must be completed by August 10, 1981.

CODE OF FEDERAL REGULATIONS
40 CFR PART 761

(FEDERAL REGISTER/VOL. 44, NO. 106/MAY 31, 1979/
RULES AND REGULATIONS)

ENVIRONMENTAL PROTECTION AGENCY

Polychlorinated Biphenyls (PCBs):
Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions.

Summary of Final Rule:

Effective Date: July 1, 1979.

Implements section 6(e) (2) of the Toxic Substance Control Act (TSCA) which states:

"...no person may manufacture, process, distribute in commerce, or use any PCB in a manner other than a 'totally enclosed manner,' after January 1, 1978 except to the extent EPA authorizes activities in a non-totally enclosed manner."

Implements section 6(e) (3) of the Toxic Substance Control Act (TSCA) which states:

"...no person may manufacture any PCB after July 1, 1979 except to the extent that EPA specifically exempts such activities.

"Format of Rule: In order to clarify the relationship between the PCB Disposal and Marking Rule, (contained in Federal Registers Vol. 43, No 34, February 17, 1978, and Vol. 43, no. 149, August 2, 1978) all of Part 761 is printed in this notice in a fully integrated form."

The Final Rule:

1. Defines the term "PCB" or "PCBs" as meaning a concentration of more than 50 ppm PCB for the purposes of this rule.

2. Allows the disposal of PCB-contaminated mineral oil containing 50 to 500 ppm PCB in high efficiency boilers with the specific approval of the appropriate EPA Regional Administrator, under certain specified conditions.

3. Permits thermal destruction of other liquid wastes with 50 to 500 ppm PCB on a case-by-case basis under certain specified conditions.

4. Permits the disposal of all liquid wastes with less than 500 ppm PCB in chemical waste landfills that comply with Annex II.

5. Permits the disposal of non-liquid PCBs in chemical waste landfills that meet the requirements of Annex II.

6. Permits the batch testing of samples taken from collection tanks from sources that are otherwise assumed to contain PCBs at a concentration between 50 ppm and 500 ppm PCBs (i.e., transformers). (Note: This testing option does not permit the dilution of the collected oil to reduce the concentration of PCBs in the resultant mixture below 500 ppm PCBs.

7. Permits the disposal of PCB Articles other than PCB Transformers and PCB Capacitors in chemical waste landfills as well as high temperature incinerators.

8. Permits the disposal of hydraulic systems as municipal solid waste, and the salvaging of the machines after draining.

9. Permits the disposal of PCB Containers that were used only to contain materials or fluids with PCB concentrations between 50 and 500 ppm as municipal solid waste.

10. Changes the marking and disposal rules to apply to all PCB Items that contain 50 ppm PCBs or greater.

11. Establishes a deadline for the marking of PCB Items to be completed by October 1, 1979, with the exception of transformers.

12. Requires that marks (or labels) be placed on the exterior of PCB Items and transport vehicles for the benefit of interested persons.

13. Contains information relative to exemptions for PCB Items and Equipment to permit manufacture of certain PCB contaminated chemicals.

14. Makes changes in Annexes concerning incineration, chemical waste landfills, storage, decontamination, records and monitoring.

15. Clarifies that the manufacturing prohibition applies to manufacturing processes which produce "PCB" or "PCBs" impurities and byproducts in a concentration of 50 ppm PCBs or more, unless a petition for exemption is filed and then approved by EPA.

16. Bans the importation of PCB in any form including PCB Items after July 1, 1979.

17. Allows the import and export of PCB wastes for disposal for 1 year.

18. Continues the disposal of Small PCB Capacitors as solid municipal waste.

19. Contains the detailed marking requirements for marking of PCBs and PCB Items as contained in the Federal Register, February 2, 1978, as summarized below.

    a) Specifies that on or after July 1, 1978, the following equipment be marked with a mark M_L (illustrated below) at the time of manufacture, at the time of distribution if not already marked, and at the time of removal from use if not already marked:

        1. PCB Containers.

        2. PCB Transformers.

        3. PCB Large High Voltage Capacitors.

        4. Equipment Containing a PCB Transformer or PCB Large High Voltage Capacitor.

In addition:

        1. PCB Large Low Voltage Capacitors at time of removal from use.

        2. Electric Motors using PCB coolants.

        3. Hydraulic systems using PCB hydraulic fluid.

        4. Heat transfer systems other than (PCB Transformers) using PCBs.

        5. PCB Article Containers containing articles or equipment that must be marked as above.

        6. Each storage area used to store PCBs and PCB Items for disposal.

    b) Specifies that as of January 1, 1979, the following equipment be marked with mark M_L:

        1. All PCB Transformers and PCB Large Capacitors not previously marked under a) above.

        2. One or more PCB Large High Voltage Capacitors installed in a protected location.

        3. All PCB Equipment containing a PCB Small Capacitor shall be labeled as containing PCB Capacitors.

c) As of October 1, 1979, applicable PCB Items containing PCBs in concentrations of 50-500 ppm and applicable transport vehicles loaded with PCB Containers that contain more than 45 kg. (99.4 lbs.) of liquid PCBs in concentrations of 50-500 ppm PCBs shall be marked with mark M_L.

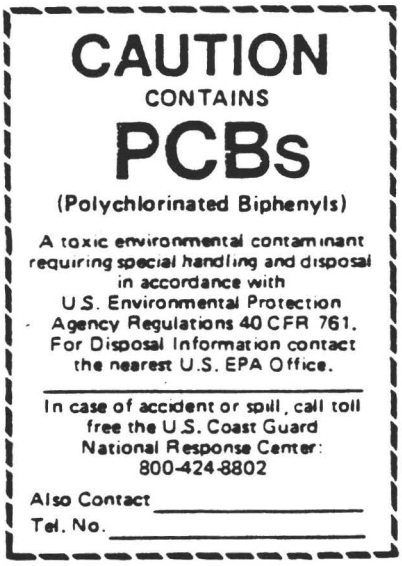
d) Where the PCB Article or PCB Equipment is too small to accommodate the smallest size of mark M_L, mark M_S may be used.

e) Each Large Low Voltage Capacitor, each Small Capacitor normally used in alternating current circuits, and each fluorescent light ballast manufactured between July 1, 1979, and July 1, 1998, that do not contain PCBs, shall be marked by the manufacturer with the statement, "No PCBs."

h) All marks must be placed on the exterior of PCB Items or transport vehicles so that they are easily identifiable to interested persons.

i) Applicable marking formats are:

a. Large PCB Mark — M_L



b. Small PCB Mark — M_S

20. Contains detailed disposal requirements for PCBs; mineral oil dielectric fluid from PCB-Contaminated Transformers containing a PCB concentration of 50 ppm or greater but less that 500 ppm; liquids other than mineral oil dielectric fluid; any non-liquid PCBs in the form of contaminated soil or other debris; PCB Articles (i.e., Transformers, Capacitors) and PCB Containers. These PCB Items are required to be disposed of in an incinerator meeting Annex I; a chemical waste landfill meeting Annex II; in a high efficiency boiler if the boiler meets certain criteria, or a disposal method approved by the appropriate EPA Regional Administrator. See text for specific conditions.

21. Contains storage facility requirements for PCBs prior to disposal. These requirements include provision for adequate floor, walls, etc., to prevent leaching and minimize PCB penetration.

22. Contains procedures for the testing of dielectric fluid to determine PCB concentration levels.

APPENDIX C

SEPTA RECOMMENDED RAILROAD TRANSFORMER
RETROFILL PROCEDURE

To reduce out of service time and accidental damages on the equipment, all work will be carried out with the transformer in place mounted on the cars. Incoming fluids to the transformer must be filtered to ensure that all moisture and particulate matter are removed from the fluids. Nitrogen gas is to be used to maintain positive pressure in the transformer at all times during the wash and flush cycles, when a vacuum is not being pulled.

1. Drain - P.C.B. fluid will be thoroughly drained in the normal manner followed by removal of drain plugs wherever fitted and new procedures developed to properly drain the heat exchanger and other areas where P.C.B. liquids could be trapped. A suction pump will be used to minimize residue at low spots if they can be reached.

2. Wash - The washing fluid (must be approved by SEPTA) is to be 100% of transformer fluid capacity clean and must be circulated through the transformer pump and cooling system for one hour. This has the advantage of thoroughly purging all parts of the cooler and interior oil ducts which would not necessarily be reached by a superficial wash of just the interior. Washing fluid will be drained, as in step #1. The transformer motor and pump may be used to circulate fluids if properly operated. An external pump may be used.

3. Flush - The transformer is to be filled to 100% of fluid capacity with a hot flushing fluid (which must be approved by SEPTA) at approximately 80°C., and the fluid must be circulated for a period of approximately eight (8) hours through its own circulating system. The temperature of

the fluid is to be maintained for the duration of the flushing period. The transformer must then be drained as in step #1.

4. Fill - Add the retrofill fluid (SEPTA plans to use IRA-LEC/FR-15) to the transformer and utilize a vacuum to remove water vapor and air bubbles that may be present in the transformer or fluid.

5. Initial Test - At time of completion of initial retrofill, each transformer shall be tested*, and P.C.B. concentration shall be no greater than 20,000 ppm. All tests must be officially certified and recorded by transformer serial number and car number, and the data forwarded to SEPTA.

6. Periodic Tests - After each transformer has been in service for two years, a sample of the oil must be taken again and the test results recorded. Oil samples are to be fully tested.* All tests must be officially certified and recorded by transformer serial number and car number, and the data forwarded to SEPTA. Failure to have satisfactory test results (i.e., reduced P.C.B. level below 6%) will result in the transformer being retrofilled at the contractor's expense.

*Tests include:

			ASTM #
1.	P.C.B. Analysis Performed by Electron Capture of Gas Chromatography in Accordance with the E.P.A. Accepted Method.		D 3612
2.	Dielectric Breakdown Strength	35 KV (Min.)	D 877
3.	Water Content ppm	50.0 KV (Max.)	D 1533
4.	Acid Number mg KOH/gm		D 974
5.	Specific Gravity gm/cc		D 1298

APPENDIX D

BART AND MBTA PROCEDURES FOR HANDLING OF PCBS

This Appendix contains four documents that BART and MBTA have issued to their employees:

The BART documents include:

1. System Maintenance Division Procedure #27, "Servicing PCB-Contaminated Components." This procedure is used by mechanics and electronic technicians who work on revenue vehicle components.

2. Stores Procedure #P-2, "Control and Handling of PCB-Related Material." This procedure is followed by Stores personnel in storing and transporting PCB components.

3. Fare Collection Maintenance Manual, "Replacement Procedure for Faulty Motor Start Boxes." This procedure is used by Fare Collection Technicians in servicing their equipment.

The MBTA document describes the procedure to contain spills or leakage of oils or hazardous materials and incident reporting.

BAY AREA RAPID TRANSIT DISTRICT

SYSTEM MAINTENANCE

DIVISIONAL PROCEDURE

BOOK NO. 16 | DIVISION: Rolling Stock Department

DEPARTMENT HEAD: _____ DIVISION HEAD: _____

PROC. NO. 27
PAGE 1 OF 11
DATE ISSUED 3/5/79
REVISION DATE
ORIGINATOR

SERVICING PCB-CONTAMINATED COMPONENTS

I. Purpose

To provide a procedure for the PCB decontamination of components and assemblies, to protect personnel and environment.

Department affected: Rolling Stock & Shops.

COPY

II. General

Polychlorinated biphenyls (PCB's) is a family of materials which are fire-resistant liquid insulations and coolants first used by General Electric Company in 1932 for their fire-resistant transformers.

PCB's are inert materials which are chemically stable, fire-resistant, heat-stable, non-corrosive, and have very low electrical conductivity. These qualities make PCB's very desirable for use in transformers and capacitors. The problem with PCB's is their inability to decompose in the environment before being absorbed by living organisms. Experiments on many type of animals show that the reproductive cycle in human beings may also be affected by eating contaminated food or breathing in PCB vapors and mists. PCB's also affect the reproductive cycle of fish and the birds who rely on them as a food source. Because of these problems, the Environmental Protection Agency is enforcing strict regulations governing the manufacture, use, and disposal of PCB's.

At ordinary temperatures PCB's have not caused serious industrial health problems. Prolonged or repeated skin contact can cause a skin condition similar to acne. With normal cleanliness habits this condition will typically soon clear up.

Eye contact may result in painful irritation but no permanent damage to tissues.

III. Personal Hygiene

A. Skin contact - immediately wash with soap and water.

B. Eye contact - flush eyes with water for 15 minutes, then refer to doctor.

C. Oral ingestion - refer to doctor immediately.

D. Contaminated clothes - remove affected clothes immediatel and treat exposed areas of body per Item A.

E. Breathing in PCB aerosol or dense vapor - refer to docto immediately.

F. Remove protective gear and wash exposed skin areas with soap and water prior to eating, drinking, smoking, using toilet facilities, or leaving BART property.

G. Wear personal protective equipment as indicated in following procedure.

IV. Components and Assemblies Affected

Contamination is encountered due to rupture or leakage of the following components:

Assembly	Component Name	Component Stock No.
Semi-Conductor Box	Commutating Capacitor	18-31-13114
T-Trays and Semi-Conductor Box	Snubbing Capacitors	18-31-13104 and 18-31-13110
Fare Collection Motor Start Box	Running Capacitor	64-10-14090

V. Manpower

Keep to a minimum to reduce possible personnel exposure.

VI. Materials Required

A. Personal Protective Equipment

1. Hard hat or bump cap.
2. Non-porous disposable gloves (gauntlet style).
3. Disposable coveralls and hood.
4. Overboots.
5. Respirator (organic vapor).
6. Goggles (chemical splash).

B. Cleanup Materials

1. Absorbent materials (rags, sawdust or Sorball, etc...).
2. Solvent (deodorized base kerosene or other Safety Department-approved solvent for this task).
3. Plastic drop cloth (4mil minimum).
4. "Texwipe" pads.

VII. PCB Decontamination

A. Richmond and Concord Shops

WARNING

IF THERE IS ANY EXTERNAL EVIDENCE OF PCB LEAKAGE, DO NOT OPEN SEMI-CONDUCTOR BOX, but PROCEED TO STEP 2.

1. Inspect Semi-Conductor Box and T-Trays for indication of PCB contamination - can be recognized by oily film, puddles of oil or obvious PCB unit rupture.

2. a. If a Commutating Capacitor is leaking, wrap Semi-Conductor Box with plastic drop cloth and secure with tape to prevent leakage to environment and further possible personnel contact. If personnel contact with PCB's is likely, use personal protective equipment.

   b. If a Snubbing Capacitor is leaking, remove and wrap affected T-Tray(s) with plastic drop cloth and secure with tape to prevent leakage to environment and further possible personnel contact. If personnel contact with PCB's is likely, use personal protective equipment.

3. Affix "Pink" tag to plastic cover indicating "PCB Contamination".

4. Notify supervision that vehicle (or T-Tray) is to be sent to Hayward Shop for decontamination and repair.

5. If leaking Snubbing Capacitor leaves a PCB residue in Semi-Conductor Box:

a. Wear personal protective equipment (respirator and overboots not required).

b. Clean up PCB residue in Semi-Conductor Box using "Texwipe" pads.

c. Clean hard hat with "Texwipe" pads.

d. Dispose of "Texwipe" pads, goggles, overalls, hood and gloves in the "DRY" PCB waste drum.

6. Wash exposed skin areas with soap and water prior to eating, drinking, smoking, using toilet facilities, or leaving BART property.

B. Hayward Shop

WARNING

IF THERE IS ANY EXTERNAL EVIDENCE OF PCB LEAKAGE, DO NOT OPEN SEMI-CONDUCTOR BOX, BUT PROCEED TO STEP 2.

1. Inspect units for indication of PCB contamination - can be recognized by oily film, puddles of oil or obvious PCB unit rupture.

2. a. If a Commutating Capacitor is leaking, wrap Semi-Conductor Box with plastic drop cloth and secure with tape to prevent leakage to environment and further possible personnel contact. If personnel contact with PCB's is likely, use personal protective equipment.

b. If a Snubbing Capacitor is leaking, remove and wrap affected T-Tray(s) with plastic drop cloth and secure with tape to prevent leakage to environment and further possible personnel contact. If personnel contact with PCB's is likely, use personal protective equipment.

c. If Fare Collection Motor Start Box is leaking, wrap in plastic drop cloth and secure with tape or place in two plastic bags (such as trash bags) and seal to prevent leakage to environment and possible personnel contact.

3. Affix "Pink" tag to plastic cloth indicating "PCB Contamination".

4. Contaminated Semi-Conductor Box Removal: after removing contaminated Semi-Conductor Box from vehicle undercarriage, be sure it is wrapped with plastic drop cloth and secured with tape. Tag with "Pink" tag indicating "PCB Contamination".

5. If leaking Snubbing Capacitor leaves a PCB residue in Semi-Conductor Box:

   a. Wear personal protective equipment (respirator and overboots not required).

   b. Clean up PCB residue in Semi-Conductor Box using "Texwipe" pads.

   c. Dispose of "Texwipe" pads, goggles, overalls, hood and gloves in the "DRY" PCB waste drum.

6. All wrapped and tagged PCB-contaminated units shall be stored on the southwest corner of the Hayward Shop apron to await pick-up by vendor.*

   *Note: Final decontamination of these units will be performed by vendor.

7. Remove protective gear and wash exposed skin areas with soap and water prior to eating, drinking, smoking, using toilet facilities, or leaving BART property.

VIII. Removal of Non-Leaking PCB Components

A. All components containing PCB's shall be handled carefully to minimize the likelyhood of breakage.

B. All components containing PCB's removed from service for disposal shall be placed in a "DRY" PCB waste drum.

IX. Spill Cleanup of PCB's or PCB-Contaminated Materials

WARNING - NOTIFY SAFETY DEPARTMENT AND SHOP SUPERVISOR

WEAR ALL PERSONAL PROTECTIVE EQUIPMENT. ALL SPILLS MUST BE CLEANED UP IMMEDIATELY.

A. Liquid Spills

1. Attempt to contain spill as soon as possible with absorbent materials such as rags, Sorball, earth, etc...
2. Transfer as much of the liquid into a "WET" PCB waste drum.
3. If spill is on a soft surface (such as earth), dig out contaminated soil and debris and place this material in a "DRY" PCB waste drum as directed by the Safety Department
   Extent of soil removal to be determined by Safety Department.
4. If spill is on a hard surface (such as concrete), decontamination is as follows:
   a. Spread Sorball over affected area
   b. With stiff-bristle broom, work Sorball around to soak up residue
   c. Dispose of absorbent in "DRY" PCB waste drum.
   d. Wash area with kerosene and rags.

e. Repeat Step (d) two more times.

f. Dispose of rags in "DRY" PCB waste drum.

B. Solid Waste Materials

1. Transfer spilled waste materials into "DRY" PCB waste drum.

2. Same as Steps A.3 and A.4.

C. Final Clean up

1. Clean respirator, hard hat, and overboots with "Texwipe" pads.

2. Place the following PCB-contaminated materials in the "DRY" PCB waste drum:

- Absorbent materials
- Gloves
- Goggles
- Disposable overalls and hood
- Respirator cartridges

3. Seal and secure "DRY" PCB waste drums.

NOTICE

If spill is beyond the scope of this section, such as covering a large area, down a drain, etc..., notify the Safety Department on Extension 244.

X. Records

The following records are to be kept for a period of not less than 5 years:

A. PCB Storage Record Form: (see Figure #1)

1. Notify Safety Department when drums are full and sealed. Safety Department will complete steps #1 through #5.
2. Shop Supervisor will notify Disposal Service.
3. Shop Supervisor to complete Item #6 and forward copy of completed form to Safety Department. Retain original copy in shop files.

B. Hayward Shop PCB Storage Facility Inspections:

1. Safety Department will inspect "PCB" Storage Facility on a monthly basis and record inspections on the PCB Storage Facility Inspection Log (see Figure 2).
2. Original retained by Safety Department and copy forwarded to Hayward Shop Supervisor for shop files.

   Any PCB spills noted <u>must</u> be reported immediately to the Safety Department and Shop Supervisor.

   <u>WARNING</u>

   IF SPILL IS SELF-CONTAINED, DO NOT MAKE ATTEMPT TO CLEAN UP UNTIL FURTHER INSTRUCTION FROM SAFETY DEPARTMENT.

   IF SPILL THREATENS TO GO OUT OF CONTROL (SUCH AS GOING DOWN A DRAIN, CONTAMINATING LARGE AREAS OR CONTAMINATING WATER WAYS) ATTEMPT TO CONTAIN SPILL USING AVAILABLE MATERIAL (such as soil, rags, etc...).

PCB STORAGE RECORD

SERIAL NUMBER OF DRUM _____

1. Date Drum Filled and Sealed _____ by _____

2. Shop _____

3. Contents:

WET

Solvents and Detergents /____/

Leaking Electrical Components /____/

Other /____/ _____.

DRY

Non-Leaking Electrical Components /____/

Type and Approximate Number _____.

Rags, Absorbent Materials, Disposable Garment /____/

Other /____/ _____.

4. Estimated Weight of Total Contents of Drum _____ Kilograms.

5. Estimated Weight of PCB's in Drum _____ Kilograms.

6. Date Shipped for Disposal _____.

Name of Disposal Service _____.

Address of Disposal Service _____

_____.

FIGURE 1

PCB STORAGE FACILITY INSPECTION LOG

YEAR_____

MONTH	DATE OF INSPECTION	REMARKS	SIGNATURE OF INSPECTOR
January			
February			
March			
April			
May			
June			
July			
August			
September			
October			
November			
December			

In "Remarks" column, indicate any discrepancies such as unsealed containers, leakage, damage to storage facility, etc... If no discrepancies noted, state "None".

FIGURE 2

MANAGEMENT INFORMATION SYSTEM PROCEDURE	PROCEDURE NO. P-2
SYSTEM BART STORES PROCEDURES	PAGE NO. 1 of 5
PROCEDURE TITLE CONTROL AND HANDLING OF PCB-RELATED MATERIALS	EFFECTIVE DATE 3/5/79
APPROVED BY R. S. Rainey A. Wilhelm	REVISION NO.

Prepared By: V. Webster/L. Cohen
Stores Safety

PURPOSE:

1. To explain the general nature of PCB's.

2. To explain the general uses of PCB's.

3. To explain the role of the Storerooms in the control and handling of PCB-related materials.

GENERAL:

1. PCB's stands for Polychlorinated Biphenyls. The name Polychlorinated Biphenyls can be broken down as follows: "poly" means more than one group combined to create a unit, and "chlorinated" means any compound which contains chlorine. A common example is swimming pool bleach, which is dissolved chlorine in water. "Biphenyl" is more difficult to relate to and chemically means a split phenolic (a type of hydrocarbon).

   Polychlorinated biphenyls (PCB's) is a family of materials which are fire-resistant liquid insulations and coolants first used by General Electric Company in 1932 for their fire-resistant transformers. PCB's are inert materials which are chemically stable, fire-resistant, heat-stable, non-corrosive and have very low electrical conductivity. These qualities make PCB's very desirable for use in transformers and capacitors. The problem with PCB's is their inability to decompose in the environment before being absorbed by living organisms. Experiments on many types of animals show that the reproductive cycle in human beings may also be affected by eating PCB-contaminated food. Ingestion of PCB's also affect the reproductive cycle of fish and the birds who rely on them as a food source. Because of these problems, the Environmental Protection Agency is enforcing strict regulations governing the manufacture, use and disposal of PCB's.

   TOXICITY

   At ordinary temperatures, PCB's have not caused serious industrial health problems. Prolonged or repeated skin contact can cause a skin condition similar to acne. With good cleanliness habits, this condition will typically soon clear up.

INHALATION

If PCB's are spilled in a closed or confined area, avoid inhaling the vapors by clearing the immediate area of personnel, posting the area and contacting the Safety Department, LMA, Ext. 209 or 875.

SKIN CONTACT AND FIRST AID

If PCB's are accidentally spilled on hands, no serious skin irritation will occur. Prolonged or repeated skin contact must be avoided. In case of contact, wash the skin with soap and water; remove saturated clothing. Eye contact may result in painful irritation but no permanent damage to tissues. If PCB's get in the eyes, flush with large amounts of water for 15 minutes, then refer to a doctor immediately.

The National Institute for Occupational Safety and Health (NIOSH) recommends that employee exposure to PCB's in the work place be controlled by adherence to various standards. The standards are designed to protect the health and provide for the safety of employees for up to a ten-hour workday, forty-hour workweek, over a normal working lifetime. Compliance with the standards will substantially reduce any risk of effects due to PCB's. The following procedure will provide such protection in compliance with NIOSH and EPA.

If you have any further questions concerning the potential health hazards of PCB's, please refer them to the BART Safety Department.

2. At BART, PCB's are used mainly as an insulator inside sealed capacitors located in closed equipment boxes underneath the revenue vehicles. PCB's are also used in the San Francisco Vent Structure transformers and capacitors in the AFC equipment.

3. Storeroom personnel are involved with PCB's and PCB-related materials in the delivery of unused PCB waste disposal drums, and in the storage of new electrical components containing PCB's.

WARNING: SPILLS AND RUPTURES

If PCB materials are spilled (or units containing PCB's are ruptured) but spill is self-contained, do not make any attempt to clean up until further instruction from the Safety Department. (Call Ext. 209 or 875 at LMA.) If spill threatens to go out of control (such as going down a drain, contaminating large areas or contaminating water ways), first attempt to contain spill using available absorbent material (such as soil, rags, etc.).

RESPONSIBILITY	ACTION
Shop Foreman	Delivery of Unused PCB Waste Disposal Drums. 1. Request unused PCB waste disposal drum from Hayward Storeroom. 2. Assemble all unused PCB waste disposal drums as listed below so they may be supplied to the requesting shop areas. The drums are stored in the restricted, fenced area south of the Hayward Main Shop. a. 55 gallon steel drum (painted orange) b. Attach a lid and gasket, securing ring and bolt. These materials are available with each drum. c. "PCB Caution" label affixed to the side of the drum. Labels are available from the Material Control Section at Hayward. d. Get a PCB Storage Record Form (Figure 1) from Material Control. The forms will be completed by Maintenance and Safety. e. Tie a plastic pouch (vinyl pocket) to the securing ring with the PCB Storage Record Form inside. (BART Stock #81-05-64100 - Vinyl Pocket) 3. Arrange for the Stores truck to deliver the drum to the requesting Storeroom to the attention of the requesting Shop Foreman. 4. At this point, there should be no further involvement by the Storeroom personnel with the PCB waste disposal drums. They are now the responsibility of maintenance personnel. 5. The drums containing PCB waste materials will be stored in the shipping container (8'x40') located at Hayward Yard south of the Main Shop.
Storekeeper	Storage of Components with PCB's 1. All components containing PCB's shall be kept segregated. 2. At each location where components containing PCB's are stored, a "PCB Caution" sticker shall be posted.

RESPONSIBILITY	ACTION
Storekeeper	3. The following BART components contain PCB's:

Stock No.	Description	Storeroom	Bin Locations
18-31-13104	Capacitor, T-Tray	CY	AC053E
		HY	AC093
		RY	AA141
		WS	
18-31-13110	Capacitor, w/clamp	HY	AC093
		RY	AA073H
		WS	
18-31-13114	Capacitor, TE20	CY	AC053E
		HY	AC093
		RY	WD021
		WS	
18-31-88530	Tray, Capacitor Line Filter	CY	AA040A
		HY	AT120
		RY	AF010
		WS	EE040
64-10-14090	Capacitor, Oil Imp.	HY	BH044E
		LM	AF113R
		WS	CN180

NOTE: By Federal Law, manufacturers are not permitted to sell items containing PCB's. Therefore, newly-received stock will not contain PCB's. These items can be identified since they bear a label which states that they "Do not contain PCB's."

FIGURE 1

PCB STORAGE RECORD

SERIAL NUMBER OF DRUM _____

1. Date Drum Filled and Sealed _____ by _____

2. Shop _____

3. Contents:

WET

Solvents and Detergents /____/

Leaking Electrical Components /____/

Other /____/ _____

DRY

Non-Leaking Electrical Components /____/

Type and Approximate Number _____

Rags, Absorbent Materials, Disposable Garment /____/

Other /____/ _____

4. Estimated Weight of Total Contents of Drum _____ Kilograms

5. Estimated Weight of PCB's in Drum _____ Kilograms.

6. Date Shipped for Disposal _____ _____

Name of Disposal Service _____

Address of Disposal Service _____

_____ _____

REPLACEMENT PROCEDURE FOR FAULTY MOTOR START BOXES

EFFECTIVITY IBM & CUBIC T.H.M.

GENERAL

At present, the 8 uf capacitor, BART #64-11-14090, IBM #5247156, used in the motor start boxes contains polychlorinated biphenyl (PCB). For the past year, IBM #5252809, which does not contain PCB has been used as a replacement. Until all motor start boxes have been checked and the capacitors using P.C.B. have been removed, the following procedure must strictly be adhered to. This procedure pertains only to those start boxes which may contain P.C.B.'s.

NOTE: Motor start boxes which definitely have non-PCB capacitors can be identified by a label affixed to the outside of the start box stating "Non-PCB Caps."

OBJECTIVE

To insure the maximum protection to the employee who may come in contact with PCB. Also, that all rules and regulations regarding its disposal are followed.

PROCEDURE

When encountering a faulty motor start box (whether or not it is externally leaking fluid), no attempt shall be made to open the unit. It shall be assumed that the 8 uf capacitor containing PCB fluid may be leaking. This process is designed to eliminate possible additional exposure or contact with the chemical compound.

1. If the unit shows any sign of external fluid leaking:

   a. Upon encountering the leaking motor start box, the employee shall notify the shift foreworker who will note the occurrence in the daily log book.

   b. The employee who proceeds with the removal is required to acquire and use the following materials:

      - Safety goggles
      - Non-porous gloves
      - Rags or paper towels
      - Disposable coveralls or non-porous apron
      - Texpads
      - Polyethylene liner bags commonly used in trash containers.

c. The employee cleaning the leaking fluid and removing the motor start box shall wear the safety goggles, gloves, and disposable coveralls.

d. The rags and Texpads used to clean up the fluid will be discarded in polyethylene bags.

e. The motor start box will be placed in a separate polyethylene bag and sealed. Three polyethylene bags should be used to ensure containment of the fluid in case of puncture.

f. The gloves, goggles and coveralls used in cleaning the fluid shall then be disposed of in the polyethylene bags. The bags shall then be sealed.

g. Employee shall wash his/her hands with soap and water.

h. All polyethylene bags containing material which has been contaminated with PCB fluid shall be tagged, stating that the enclosed material contains exposed PCB fluid.

i. The wrapped and tagged motor start box shall be shipped to the Electronic Repair Shop in Hayward.

j. The bags containing the rags, paper, gloves, and disposable coveralls shall then be disposed of in the specially marked orange 55-gallon drums marked "PCB Material", located in an enclosure at the north end of the Oakland Shop Facility.

Some materials that should be used in the clean up and handling operatio follows:

BART STOCK #	DESCRIPTION	LOCATION
42-40-36710	Goggles, safety	LM, WS
42-40-36490	Gloves, NBR #490	WS
81-05-05230	Bags, polyethylene	WS
42-40-18205	Coveralls, disposable (large)	OHY, WS
42-40-18200	Coveralls, disposable (medium)	OHY, WS
42-40-03010	Apron	LM, WS

2. If the unit does <u>not</u> show any signs of external fluid leakage:

a. The employee shall wear disposable coveralls or non-porous apron, + non-porous gloves.

b. The motor start box will be placed in a polyethylene bag, sealed, and shipped to the Electronic Repair Shop in Hayward.

WARNING

If during performance of this process, it becomes evident that capacitor oil is leaking, proceed according to step 1 of this procedure.

To: All Department Heads

From: R. L. Foster
Chairman and Chief Executive Officer

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Date: June 13, 1979

Chairman's Directive No. 54

Subject: Environmental Protection - Containment of Spills or Leakage of Oils or Hazardous Materials and Incident Reporting

Federal and State agencies enforce regulations regarding the pollution of earth, storm drains, streams and waterways by industry which uses oils or hazardous waste. This Authority, in order to comply with these regulations, must act to contain or prevent oil or hazardous materials from entering surface drains, catch basins, storm sewers, etc. When a spill does occur, the area foreman/supervisor is required to make a telephone report, as detailed in the procedure below, and to assist in any other action which will prevent or reduce the amount of pollution.

The heads of Departments whose operations include the handling or use of oils or hazardous materials are responsible for instructing their key supervisors on the details of this procedure and assuring compliance.

PROCEDURE FOR CONTAINMENT OF SPILLS OR LEAKAGE OF OILS OR HAZARDOUS MATERIALS AND INCIDENT REPORTING

I. Area Foreman/Supervisor responsible for the following:

A. Planning their operations so that oils or hazardous material are contained in tanks, barrels, etc., for removal by a waste-material disposal contractor.

B. Controlling a spill or leak to prevent material entry to drain systems either inside or outside a building by using absorbent material, sand, etc.

C. Notifying the Engineering and Maintenance Work Reception Center promptly by telephoning X5278 with:

(1) Location of the spill; ie., Eagle Street Garage, South Boston Power, Everett Shops, etc.
(2) Type of spilled material; ie., Diesel oil, gasoline, solvent, etc.
(3) Whether or not material has entered a drain.
(4) Quantity spilled; ie. estimated gallons, barrels, etc.
(5) Specific action being taken to control spill.

TAB - 119

II. The Engineering and Maintenance Work Reception Clerk, X5278 ("Hot Line") is responsible for:

A. Logging the information received regarding oil-hazardous material spill or leakage.

B. Immediately consulting with appropriate supervisor who can order salvage contractors or MBTA equipment, manpower or materials to assist location personnel in cleanup of the oil or hazardous material.

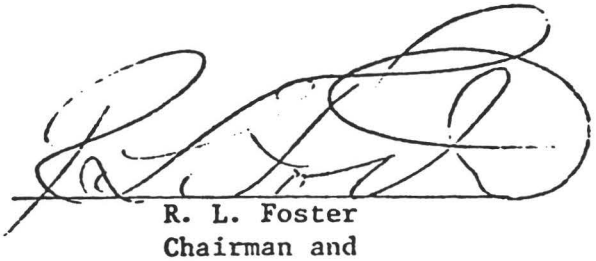
C. Notifying the following Governmental Agencies by telephone if oil or hazardous waste has entered a drainage system or a body of water:

Department of Environmental Quality Engineers	727-3855 727-3189	8:45 a.m.-5:00 p.m. 5:00 p.m.-Midnight
Federal Government	1-800-424-8802	
Local Coast Guard	223-3644	

D. Notifying the Office of Safety as follows:

During regular business hours 5135/5136
Evenings, 4:30 p.m. - 8:00 a.m. 5137
Weekends: Notify Duty Man listed at Equipment Dispatcher

Any employee witnessing or discovering a spill or leakage condition, and not responding as delineated above, will be subject to disciplinary action.



R. L. Foster
Chairman and
Chief Executive Officer

RLF:dmm

To: All Department Heads

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

From: R. L. Foster
Chairman and Chief Executive Officer

Date: June 13, 1979

Chairman's Directive No. 55

Subject: Policy Regarding Control of Hazardous Materials and Chemicals

Chemicals are useful and essential tools which increase the productivity and efficiency of employees and the transportation system. However, many chemicals, both liquid and dry, must be stored, used and disposed of in accordance with local, State and Federal laws and standards. Some materials are hazardous under certain conditions including, but not limited to, lead, asbestos, mercury, etc., and must be used under controlled conditions and with appropriate personal protective equipment.

Effective immediately, all materials described above may be purchased only on approval from the Office of Safety. The approval must be obtained before final processing of the Material Requisition. The Office of Safety approval for these materials will be contingent on the planned use, quantity, type of potential hazards, availability of potential hazard control (ie., approved storage areas, fire-extinguishing equipment, etc.), and other criteria.

Included in the approval cycle is the requirement for a "Material Safety Data Sheet" which must be completed on both sides by the manufacturer. A copy must be readily available in the user foreman's area, the user Department Head's office and Office of Safety.

"Material Safety Data Sheets" contain safety precautions which must be taken to prevent employee injury, fire (if flammable) control of spills or other undesired occurrences. If an employee is injured by contact with the chemical, a copy of the Material Safety Data Sheet should be supplied to the doctor for diagnostic information.

Vendors bringing into our maintenance facilities trial samples of chemicals, etc., described in the paragraphs above must furnish a completed MSDS from the material manufacturer to the Office of Safety prior to test use on MBTA vehicles, equipment or facilities.

R. L. Foster
Chairman and
Chief Executive Officer

TRS-119

RLF:dmm

D-23/D-24

APPENDIX E

CLEAN INDUSTRY, INC. PCB SPILL CONTAINMENT AND COUNTERMEASURE PLAN

Clean Industry, Inc., headquartered in Boston, Massachusetts, was contacted regarding the PCB handling services it provides. Clean Industry, Inc., has developed a PCB Spill Containment and Countermeasure Plan which includes:

1. Immediate action required when a PCB spill occurs.
2. Hard Surface Spill Clean-Up Procedures to follow.
3. Soft Surface Spill Clean-Up Procedures to follow.
4. Decontamination Procedures for equipment used in PCB clean-up procedures.
5. Safety protective equipment to be worn.
6. First aid procedures regarding PCB exposure.

The Spill Containment and Countermeasure Plan developed by Gregory B. Heath, Environmental Engineer, of Environmental Solutions, Inc., Waltham, Massachusetts, for Clean Industry, Inc., is reprinted here.

PCB Spill Containment & Countermeasures

First Person on Scene

* Promptly stop flow of liquid by creating dikes of dirt or Speedi-dri.

* If humans or vehicles are likely to enter the contaminated area, barricade the area and remain at the site until clean-up personnel or other appropriate personnel arrive.

* Promptly notify: Hazardous Material Spill Coordinator(s)
  Phone number: office(s), Pager #(s), Home #(s)

* Place no smoking signs around the perimeter of the spill to warn of fire hazard of cleaning solvents.

* Determine the cause of the spill: leaking bushings or drain plugs, or damaged or failed transformer.

* US EPA should be notified within 24 hours if spill is over 2.4 gallons, and MA DEQE should be notified within 24 hours if spill is over .75 gallons.

* If spill is of a magnitude that normal procedures will not handle situation, call the U.S. Coast Guard (1-800-424-8802)

* Call the facility's PCB spill clean-up contractor if a facility spill task force does not exist.

* Avoid contact with electrical equipment - it may not be dead and may be very hot to touch, or still energized.

* Try to obtain a security detail to maintain a secure area of non-involved personnel.

Hard Surface Spill Clean-Up Procedure

1. Absorb all standing liquids.

   a. absorb all liquids with Speedi-dri, sand, dirt, sorbent pads or other non-biodegradable sorbant materials

   b. sweep absorbant material around spill area to insure absorption

   c. carefully sweep-up and collect with shovels, the sorbant media contaminated with PCB

   d. collect all solid debris contaminated with PCB and place in a DOT spec 17H drum

   e. label and identify the drum of its contents and the date of incident

Hard Surface Spill Clean-Up Procedure (Continued)

2. Solvent Wash of affected areas.

   a. disperse solvent (Kerosene, diesel fuel, etc.) onto affected areas

   b. scrub solvent into affected areas with stiff brush

   c. absorb solvent wash and loosened oily product with Speedi-dri or sorbent pads

   d. collect solid debris in 17 H drum and label drum

3. Solution Wash/Rinse of affected areas.

   a. apply a solution of cleaner (Penetone #155 or Zepteen)

   b. scrub solution into affected areas with a stiff brush

   c. absorb solution wash/rinse with Speedi-dri

   d. collect solid debris into 17 H drum and label drum

Soft Surface Spill Clean-Up

   a. absorb all liquids with Speedi-dri, sand, etc.

   b. spread a ½" portion of Speedi-dri around affected area, let stand a few minutes

   c. remove top 12 - 18 inches of soil area with shovels or excavation equipment

   d. collect all solid debris in 17 H drums, or

   e. collect all solid debris on 10-12 mil polyethylene plastic sheeting for eventual loading into lined dump trailers or, if necessary, into 17 H drums.

Decontamination

All shovels or equipment used in connection with the spill clean-up should either be decontaminated or disposed of. For capital type equipment, decontamination is the route to proceed with.

1. Triple wash of equipment affected

   a. use solvent to wash affected surfaces with three separate applications

2. collect solvent washes for disposal

3. rinse equipment with detergent solution and collect rinse for disposal

Safety Protective Equipment & First Aid

Personnel Protective Equipment

1. Clothing impervious to PCB's

    a. disposable coveralls, non-porous type (viz, Saranex)

    b. disposable boots, non-porous type (i.e., butyl rubber, etc.)

    c. gloves, non-porous type (viz, Viton, or double-layer equivalent)

    d. bib aprons, non-porous types (i.e., butyl rubber, PVC, etc.)

2. Eye protection

    a. safety goggles, or

    b. face shields with safety glasses

3. Respiratory protection

Due to a variety of conditions under which an exposure can occur, the following table divides respiratory protection into three separate categories

    a. small outside leak, no vapor accumulation, fresh air available

    b. large leak outside or small leak inside with limited ventilation

    Full face respirator with acid gas/organic vapor cartridge. Care should be taken to replace these cartridges as necessary.

    c. large leak inside or leak anywhere where PCB has been exposed to arcing, fire or explosion

        1) Self contained breathing apparatus with full-face piece operated in pressure-demand or other positive pressure mode.

        2) Combination Type C supplied air respirator with full face piece operated in pressure demand or other positive pressure mode, and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.

    Another thing to consider is that during the use of Speedi-dri and other particulate sorbent products is dust generation which is contaminated with PCB's, goggles and dust respirator should be used to prevent exposure via inhalation or skin/eye contact.

Avoid breathing PCB vapors, particularly in enclosed spaces. Confined spaces shall be forced-ventillated and respiratory protection worn when needed. Generally, PCB vapors are not a problem in open spaces unless large quantities or elevated temperatures are involved.

First Aid

1. Inhalation: Remove victim to fresh air. Monitor victim's breathing and be prepared to institute Cardio-Pulmonary Resuscitation. Seek medical attention. Advise medical personnel of potential exposure to:

   - Carbon Monoxide 0.3%
   - Carbon Dioxide 0.3%
   - Oxygen 0.6%
   - Inert Gases 1.5%
   - Hydrogen Chloride 97.3%

2. Eyes: If liquid PCB's or PCB contaminated solid debris contacts the eyes, irrigate immediately with clean water for at least 15 minutes and consult medical attention.

3. Skin: Wash any skin exposed with waterless soap, and then with soap and water.

   Wear prescribed clothing as necessary to prevent contact. Contaminated personal clothing shall be removed and disposed of with other contaminated wastes.

4. Ingestion: Induce vomiting. Repeat until vomit is clear. Do not induce vomiting if the victim is unconscious. Get immediate medical attention. Consult fire department for procedures involving inhalation of smoke or mist (re: hydrogen chloride)

   Do not swallow PCB oil or PCB contaminated materials. No eating, drinking or smoking is permitted in areas where PCB's are present. When working around PCB's, wash hands and exposed skin areas thoroughly before eating, drinking, smoking or using toilet facilities.

APPENDIX F

EPA APPROVED DISPOSAL COMPANIES AND LANDFILL LOCATIONS

To date there are ten disposal companies and nine landfill locations which have received EPA approval for the destruction and disposal of PCBs.

F.1 EPA-APPROVED DISPOSAL COMPANIES

Company	Location	Type of Waste	Method and Process
ACUREX	Mobile unit	PCB-contaminated mineral oil, no limit on maximum PCB concentration.	Chemical dechlorination
Chemical Waste Management	Emella, AL	PCB capacitors.	
ENSCO Incineration Services	Eldorado, AR	PCB-contaminated mineral oil.	Thermal, Annex I incineration
General Electric	Pittsfield, MA	PCB-contaminated mineral oil.	Thermal, liquid injection, Annex I incinerator
General Electric*	Waterford, NY	PCB-contaminated waste oil.	Thermal, incineration
PPM, Inc.	Mobile unit	PCB-contaminated mineral oil.	Chemical dechlorination
Rollins Environmental Services	Dear Park, TX	PCB-contaminated solid waste.	Thermal, Annex I incinerator
SED	Greensboro, NC	PCB capacitors.	Mechanical, shredding with extraction
SUNOHIO	Mobile unit	PCB-contaminated mineral oil, no limit on maximum PCB concentration.	Chemical dechlorination
Transformer Consultants	Akron, OH	PCB-contaminated waste oil to 2000 ppm PCBs.	Chemical detoxification

*This G.E. facility in New York incinerates PCB-contaminated mineral oil generated from other G.E. facilities only.

F.2 DISPOSAL COMPANIES PENDING EPA APPROVAL

Environmental International,
Kansas City, MO

Rose Chemical Corporation,
Holden, MI

SCA Chemical Services,
Chicago, IL

F.3 EPA-APPROVED LANDFILL LOCATIONS

Company	Location
Casmilia Disposal Co.	Santa Barbara, CA
Chemical Nuclear	Portland, OR
Chemical Waste Management	Emelle, AL, and Kettlemen Hills, CA
Nuclear Engineering Co.	Beatty, NV
SCA	Model City, NY
SEACOAST	Niagara Falls, NY, and Williamsburg, OH
WEST-CON	Twin Falls, ID

There are no landfills pending EPA approval. Those listed here are closed to capacitors.

APPENDIX G

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