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Management of Polychlorinated Biphenyls

1.0 Introduction

Polychlorinated biphenyls (PCBs) are a subset of the synthetic organic chemicals known as chlorinated hydrocarbons. PCBs are persistent when released into the environment because they resist metabolic processes that would break them down to simpler chemical compounds. Their low water solubility allows PCBs to accumulate in fatty tissues of exposed animals and humans. PCBs are known to cause chronic reproductive effects, gastric disorders, and skin lesions in laboratory animals. In addition, the U.S. Environmental Protection Agency (EPA) suspects that PCBs are probable human carcinogens.

To minimize the potential for adverse health effects caused by PCBs and other substances, Congress passed the Toxic Substances Control Act (TSCA), which strictly regulates all aspects of PCB use. The TSCA also regulates PCBs produced inadvertently as byproducts and impurities. The state of California has enacted additional regulatory requirements that apply when a spill involves PCBs or when PCBs are a waste under California's Hazardous Waste Control Law.¹

This document provides guidance for Lawrence Livermore National Laboratory (LLNL) personnel on:

- Identifying, labeling, and managing PCBs and PCB-contaminated materials.
- Responding to PCB spills.
- Disposing of PCBs.
- Using PCBs in research programs.
- Maintaining records on PCBs and PCB-contaminated materials.

This document does not address health and safety requirements for the "handling" of PCBs. Refer to your Environment, Safety, and Health (ES&H) Team for personnel protective equipment requirements. Much of this document addresses information for environmental professionals in dealing with PCBs. There are generator requirements throughout the document. For generator requirements only, see Document 36.1, "Waste Management Requirements," in the *ES&H Manual*.

¹ California Health and Safety Code § 25100 et seq., Hazardous Waste Control.

At LLNL, owners of PCB items are defined as those individuals who have been designated as having primary responsibility for the item. Throughout this document we use the term owner for this designated person.

2.0 Hazards

2.1 Background

Between 1926 and 1977, PCB-containing products were manufactured for applications demanding stable, fire-resistant, and heat-transfer properties. The most extensive use of PCBs occurred in dielectric fluids. Such fluids typically have the following characteristics: heavy oil appearance, high boiling point, high chemical stability, high flash point, low electrical conductivity, and low water solubility. PCBs were also used as plasticizers and additives in lubricating and cutting fluids.

During the 1970s, federal legislation² mandated the elimination of PCBs from distribution in commerce; however, the use of PCBs in existing equipment was, for economic reasons, allowed to continue for the useful or normal life of the equipment as long as specific conditions were met.

2.2 PCB Classifications

PCB-containing materials are classified according to the concentration of PCBs present. There are three classifications of PCB-containing materials:

- PCB ≥500 ppm
- PCB-contaminated ≥5 to <500 ppm
 - TSCA—federal regulated ≥50 ppm
 - California—state regulated ≥5 to 49 ppm
- NonPCB <5 ppm

Mixtures of PCB-containing materials are subject to the requirements of the highest concentration classification within the mixture. The deliberate dilution of PCBs in a resultant mixture is prohibited by the TSCA anti-dilution provision; however, unintentional dilution is allowed in specific situations. Please check with your ES&H Team environmental analyst for additional guidance.

² Toxic Substances Control Act (TSCA) of 1976 (amended by PL-97-129, December 29, 1981; PL 98-80, August 23, 1983; PL 98-620, November 8, 1984; PL 99-519, October 22, 1986; PL 100-368, July 18, 1988).

Federal and California (CA) state regulations differ on PCB classifications for waste. Under federal regulations, waste with a concentration less than 50-ppm PCBs may be defined as nonPCB waste; whereas, under CA state regulations, waste is required to have a concentration less than 5-ppm PCBs to be defined as nonPCB waste.

2.3 Identifying PCB Materials

There are more than 200 PCB isomers and compounds that vary from mobile, oily liquids to white, crystalline solids and hard resins. PCBs are difficult to distinguish without using analytical methods. Field screening techniques can test for the presence of chlorine, but laboratory analysis is necessary to identify PCBs and PCB concentrations. The difficulty in identifying PCBs emphasizes the importance of properly labeling equipment and materials that contain them.

PCB materials are divided into two main groups within the regulations: PCBs and PCB items. PCB items are further divided into four categories:

1. PCB articles
2. PCB containers
3. PCB-article containers
4. PCB equipment

Refer to Figure 1, which is a PCB identification chart, and the Glossary for more complete definitions of these terms.

By law, waste generators are required to ensure that appropriate labels (discussed below) are placed on PCB items, including PCB-containing equipment that is disposed of as waste. The owners of such PCB items and equipment are ultimately responsible for ensuring the identification of PCBs, generally through laboratory analysis if not originally labeled by the manufacturer. Contact your ES&H Team environmental analyst about any suspected PCB material so that it can be thoroughly evaluated.

2.4 Where PCBs Are Found

Before federal regulations limited PCB production and use, PCBs were commonly used in a variety of commercial products, including:

- Adhesives
- Transformers
- Large, high- and low-voltage capacitors



(Source: U. S. Department of Energy, Management of PCBs, 1993.)

Figure 1. PCB identification based on regulatory definitions in TSCA (40 CFR 761).

- Liquid-cooled electric motors
- Hydraulic systems
- Heat-transfer systems
- Fluorescent light ballasts
- Electromagnets
- Liquid-filled cable
- Gasketing and dampening felt
- Microscopy mounting media and immersion oil
- Switches
- Voltage regulators
- Vacuum pumps
- Microwave ovens
- Electronic equipment

Many of the past uses are now unauthorized under federal and state regulations. PCB use is allowed only under specific conditions in limited scenarios. Because PCBs were widely used in equipment that is still in service today, waste oil collected from such equipment frequently contains a detectable PCB concentration.

3.0 Labeling and Management of PCBs

3.1 Labeling Requirements

If items that may contain PCBs were not originally labeled by their manufacturer, the owner of such items is required to ensure that they are properly labeled. Owners are required to label the following items with their PCB classification:

- PCB containers
- PCB transformers
- Large, high- and low-voltage PCB capacitors when they are removed from service
- Electric motors using PCB coolant
- PCB hydraulic systems
- PCB heat-transfer systems

- PCB-article containers
- PCB storage areas
- PCB transport vehicles.

As shown in Figure 2, standard PCB labels are square and are available in 1-in. increments, from 2 in. × 2 in. to 6 in. × 6 in.

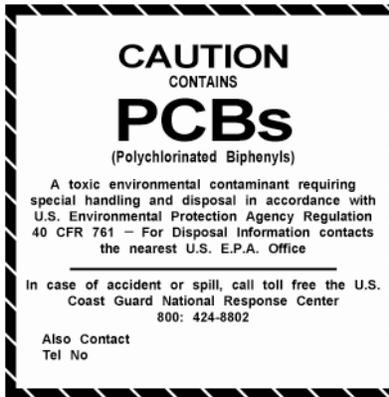


Figure 2. Standard PCB label.

If the standard PCB label is too large to fit on a piece of equipment, a 1-in. × 2-in. PCB label may be substituted, as shown in Figure 3.

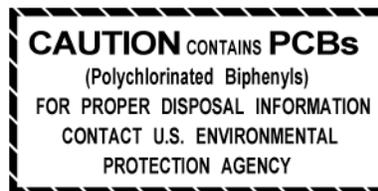


Figure 3. 1-in. × 2-in. PCB label.

When analytical results identify an item's PCB concentration, the owner shall write the concentration in permanent ink on the label. When the equipment is determined to have a concentration of less than 5-ppm PCBs, a "NonPCB" label shall be affixed to the equipment. Labeling is also required for those items listed above that do not contain PCBs. Large, low-voltage capacitors; small capacitors that are normally used in alternating circuits; and fluorescent light ballasts that do not contain any concentration of PCBs should be marked "No PCBs" by the manufacturer if manufactured after July 1, 1978. The PCB labels are available from your RHWM technician. NonPCB labels are available at Stores.

Once a PCB item is removed from service, the owner of the PCB article or container shall label it with the date when it was removed from service. In addition, other regulatory labeling requirements apply depending upon the contents of the container. See Appendix D for details.

Owners of PCB items can obtain standard PCB, PCB-contaminated, and NonPCB labels through the LLNL Materials Distribution Department (Stores).



Aged labels on electrical equipment may not accurately represent the PCB concentration of the equipment's contents. For example, sealed transformers labeled as containing nonPCB oil may become contaminated with PCBs during servicing. Other reasons for erroneous labeling include:

- Improper sampling and/or analysis at the time of original labeling.
- Equipment alterations that may have caused a change in PCB concentration since the labeling.
- Confusion over the difference between federal and state definitions of the nonPCB classification.

Hence, electrical equipment, including sealed transformers originally labeled as nonPCB and maintained in service as nonPCB, should be managed cautiously. The electrical equipment is required to be evaluated for PCBs and proper PCB classification when it is removed from service.

3.2 Managing Unidentified Equipment

The status of any unlabeled equipment suspected of containing PCBs shall be determined through laboratory analysis, from the equipment nameplate, or by obtaining a Material Safety Data Sheet. Transformers with a nameplate prior to 1978 are suspect for PCBs. After determining the PCB concentration, the owner shall affix the appropriate label (e.g., PCB, PCB-contaminated, or NonPCB) to the equipment. Some items, such as small capacitors, electromagnets, switches, voltage regulators, circuit breakers, and PCB-contaminated electrical equipment, do not require identification and labeling as a condition for continued use. The PCB concentration of oil-filled electrical equipment (e.g., transformers and capacitors) may be determined by the date of manufacture, dielectric fluid type, and volume of fluid contained in the equipment. Contact your ES&H Team environmental analyst for assistance and further details. The concentration of all PCB waste is required to be known by analytical or other methods to facilitate disposal.

3.3 Managing PCB Equipment

The regulatory requirements for managing PCB equipment vary according to equipment type. The regulations divide PCB equipment into several types:

- Transformers
- Capacitors
- Electrical light ballasts
- Electromagnets, switches, and voltage regulators
- Other PCB equipment.

Appendix A describes the specific equipment requirements and responsibilities in more detail. These requirements generally specify the conditions for continued equipment use and the frequency of equipment inspections. It is important to understand that PCBs and PCB-contaminated items stored for use and reuse are regulated as if they were in use.

To comply with federal law, LLNL is required to maintain and annually update an inventory of all PCB articles located onsite. The Plant Engineering (PE) Maintenance and Operations Division is responsible for maintaining the annual inventory. Notify your ES&H Team environmental analyst about any newly discovered and unlabeled PCB equipment for inclusion in the inventory. Appendix B provides more information on the required recordkeeping. Table B-1 identifies who is responsible at LLNL for completing and maintaining the records.

3.4 Avoiding Radioactive Contamination of PCB Equipment

Users of PCB equipment are required to take all precautions necessary to prevent radioactive contamination of PCBs. Few disposal options exist for radioactive PCBs.

4.0 Inspecting PCB Equipment

The owners of specific PCB equipment at LLNL are responsible for conducting equipment inspections on a regular basis and for maintaining equipment inspections logs. Table 1 shows the required or recommended frequency of inspections for PCBs and PCB-contaminated equipment. Required quarterly inspections may be conducted any time during each three-month period (January–March, April–June, July–September, and October–December), provided that there is a minimum of 30 days between inspections.

Table 1. Inspection frequency.

Equipment description	Inspection frequency
PCB transformers	Required quarterly
PCB-contaminated transformers	Recommended quarterly
PCB capacitors	Recommended annually
PCB electromagnets, switches, and voltage regulators	Required weekly when near food or feed; otherwise recommended quarterly
PCB-contaminated electromagnets, switches, and voltage regulators	Recommended quarterly
Large PCB capacitors stored for disposal	Required weekly
PCB containers and articles stored for disposal	Required monthly

When PCBs and PCB-contaminated equipment is inspected, owners shall check for proper labeling that meets requirements. Look for indications that the equipment may be leaking, such as:

- Oil stains near the equipment.
- Weep marks on the equipment.
- Gross physical damage.

Visual inspections do not require much time or effort, but an inspection log shall be maintained by the equipment owner to document the inspections. At a minimum, the inspection log shall contain the date and time of inspection, the name of the inspector, and any findings. The findings shall be followed by the corrective actions taken and the date that remedial actions were completed. The inspector shall initial or sign all log entries. Records of the inspections shall be retained for at least three years after disposing of the PCB-containing equipment.

5.0 Spill Response

When a spill of PCB materials occurs, specified solvents are used for decontamination, and specified decontamination standards are required to be achieved and documented by analysis. Thus, small spills of PCB materials should be remediated only by Radioactive and Hazardous Waste Management (RHWM) technicians in EPD with guidance from the ES&H Team. RHWM technicians are trained to handle PCBs and to comply with TSCA cleanup requirements. Cleanup of the released PCBs shall be initiated as soon as possible, but no later than 24 hours after discovery of a spill.

If a PCB-related spill is large, or if any employee has been injured or contaminated, immediately call the Laboratory emergency number (911 or ext. 2-7333 at the Livermore site; or 911 or ext.

3-5333 at Site 300). The LLNL Fire Department operates a hazardous material (Haz Mat) truck to respond to major spills. Access to the spill area shall be controlled to prevent accidental exposure of passersby.

Environmental regulations and U.S. Department of Energy (DOE) orders have notification and reporting requirements for PCB spills above certain amounts or when potential harm to individuals, property, or the environment exists. Report all spills of PCBs to the H&S technician and your ES&H Team environmental analyst. Appendix C provides additional guidance for EPD and authorizing organization personnel on spill cleanup and information reporting.

6.0 Disposing of PCB Materials

The disposal of PCBs and PCB-contaminated items shall be coordinated through RHWM. A PCB or PCB-contaminated item is required to be disposed of within one year from the date when the item is declared a waste or is no longer fit for use. PCBs and PCB-contaminated items stored for disposal shall be stored in an RHWM facility and should be shipped to an approved disposal facility within nine months of removal from service. Temporary storage of certain PCBs and PCB-contaminated waste can occur in a Waste Accumulation Area (WAA) for up to 30 days. New TSCA regulations allow 30-day storage for any PCB waste, regardless of concentration. Please note this is less time than other hazardous waste can be stored in the WAA.

Notify your RHWM technician and ES&H Team environmental analyst when PCBs and PCB-contaminated items require disposal. Appendix D provides packaging, labeling, and storage requirements for PCB wastes as well as guidance for RHWM personnel. Appendix E describes acceptable disposal options for PCB materials.

7.0 Other PCB Uses

7.1 PCB Research and Development

Research and development of PCB products are prohibited; however, other scientific experimentation or analysis using PCBs is permitted. PCBs may be purchased in hermetically sealed containers of less than 5 mL. Manufacturing, processing, and distributing PCBs for research and development require a special exemption granted from EPA.³

A laboratory using PCBs for research and development is required to provide spill containment and the appropriate labels for all PCB materials. PCB waste generated during the research and

³ Only persons granted an exemption under TSCA, Section 6(e)(3)(B) are permitted to manufacture, process, or distribute PCBs in small quantities for research and development.

development activities shall be stored and then disposed of properly. Notify your RHWM technician and ES&H Team environmental analyst when PCB waste requires disposal. Specific recordkeeping and documentation shall be maintained. The disposal of PCBs and PCB-contaminated waste shall be coordinated through RHWM.

If you want to purchase or dispose of PCB materials, you must report it to your ES&H Team environmental analyst.

7.2 Inadvertent Generation of PCBs

The inadvertent generation of PCBs in a concentration greater than 2 ppm is required to be reported by LLNL to the EPA⁴ within 90 days. PCBs can be produced when chlorine, hydrocarbon, and elevated temperatures (or catalysts) are present together. Contact your ES&H Team environmental analyst in the event of the inadvertent generation of PCBs.

8.0 Recordkeeping Requirements

PCB regulations require that seven separate types of reports and records be maintained on PCBs and PCB-contaminated materials. RHWM and the Permits and Regulatory Affairs Group (PRAG) of the Environmental Protection Department (EPD) are responsible for producing the required reports, with the exception of equipment inspection logs. PRAG is responsible for maintaining the records. PCB equipment owners are responsible for conducting equipment inspections and maintaining equipment inspection logs. (Refer to the section, Inspecting PCB Equipment above.) Appendix B provides further information regarding the required reports maintained by EPD.

9.0 Work Smart Standards

CA Health & Safety Code § 25100 et seq., Hazardous Waste Control.

California Health and Safety Code §§ 116275-116880, California Safe Drinking Water Act.

22 CCR §§ 66262.10-66262.89, Standards Applicable to Generators of Hazardous Waste.

29 CFR 1910 Subpart H, Hazardous Materials.

29 CFR 1910 Subpart Z, Toxic & Hazardous Substances.

40 CFR 112, Oil Pollution Prevention.

40 CFR 261, Identification and Listing of Hazardous Waste.

40 CFR 761, Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions.

⁴ Reporting requirements for the inadvertent generation of PCBs are detailed in 40 CFR 761.185.

49 CFR 100–199, Research and Special Programs Administration, DOT (Offsite).

DOE O 232.1A (8/1/97), Occurrence Reporting & Processing of Operations Information, Attachment 1 Contractor Requirements Document.

Public Law 91-596 § 5 (a)(1), OSHA Act of 1970.

10.0 References for More Information

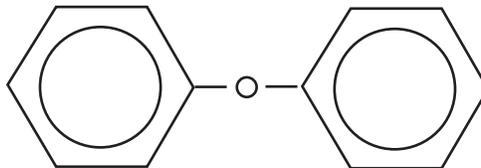
10.1 Contacts

Contact your ES&H Team environmental analyst if you have any questions regarding the regulatory management, inspecting, and disposal of PCBs and PCB-contaminated items.

10.2 Glossary of PCB Terminology

Anti-dilution Rule	No regulatory requirement specified by a specific PCB concentration may be avoided as a result of any dilution, unless specifically provided [see 40 CFR 761.1(b)]. The anti-dilution rule prohibits any person from avoiding specific PCB disposal requirements because a PCB concentration was reduced or shifted from one material or environmental medium to another by adding a diluent or separating or concentrating the PCBs.
Capacitor	A device for accumulating and holding a charge of electricity and consisting of conducting surfaces separated by a dielectric.
Dielectric fluid	A fluid with the electrical conductivity less than a millionth of a mho. Essentially, a dielectric fluid is a fluid that does not conduct electricity.
Fluorescent light ballast	A device that electrically controls fluorescent light fixtures and that includes a capacitor containing 0.1 kg (0.2 lb) or less of dielectric fluid.
Large, high-voltage capacitor	A capacitor containing 1.36 kg (3 lb) or more of dielectric fluid and that operates at or above 2000 V (ac or dc).
Large, low-voltage capacitor	A capacitor containing 1.36 kg (3 lb) or more of dielectric fluid and that operates below 2000 V (ac or dc)
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.

PCB Abbreviation for polychlorinated biphenyl. Includes any chemical substance limited to the biphenyl molecule (see below) that has been chlorinated to varying degrees, or any combination of substances that contain such a substance.



PCB annual log A written log of documents detailing the disposition of PCBs and PCB items. The annual log includes a summary of the annual records and an inventory of PCB materials. The deadline for compiling the annual log is six months after the end of the calendar year (i.e., July 1). This log shall be retained for at least three years after PCBs are reduced below regulated quantities.

PCB annual records Includes all documentation relative to the acquisition or disposal of PCBs over a 12-month period. This documentation includes purchase orders, manifests, certificates of disposal, and inadvertent generation reports. Annual records shall be maintained for the same period as the annual log.

PCB article Any manufactured article, other than a PCB container, that contains PCBs and whose surfaces have been in direct contact with PCBs. It includes capacitors, transformers, electric motors, pumps, pipes, and any other manufactured item (1) that is formed to a specific shape or design during manufacture, (2) whose end-use function is dependent in whole or in part on its shape or design during end use, and (3) that has experienced either no change of chemical composition during its end use or only those changes of composition that 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 surfaces have 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 surfaces have been in direct contact with PCBs.

PCB-contaminated	Any substance or material containing between 5 and 500 ppm PCBs. Toxic Substances Control Act (TSCA) regulations for PCB-contaminated materials apply to materials containing between 50 and 500 ppm PCBs. For waste disposal, the state of California hazardous waste regulations apply to all materials containing more than 5 ppm PCBs.
PCB electrical equipment	Any electrical equipment that contains PCBs, including, but not limited to, transformers, capacitors, circuit breakers, reclosers, voltage regulators, switches, electromagnets, and cable.
PCB equipment	Any manufactured item, other than a PCB container or a PCB-article container, that contains a PCB article or other PCB equipment.
PCB item	Any PCB article, PCB-article container, PCB container, or PCB equipment that deliberately or unintentionally contains or has as part of it any PCB or PCBs.
PCB transformer	Any transformer that contains 500 ppm PCBs or more.
PCB waste	For purposes of this guidance, any PCBs or PCB item that is no longer in use or is stored for use or reuse.
ppm	Parts per million by weight. Unit of concentration of PCBs expressed as milligrams per kilogram (mg/kg).
Small capacitor	A capacitor containing less than 1.36 kg (3 lb) of dielectric fluid. When the amount of dielectric fluid is not known, the following capacitors can be assumed to be small: (1) capacitors whose total volume is less than 1639 cm ³ and (2) capacitors with a total volume between 1639 and 3278 cm ³ and a total weight of less than 4.08 kg (9 lb).

10.3 Acronyms

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EDO	Environmental Duty Officer
EPA	U.S. Environmental Protection Agency
EPD	Environmental Protection Department
ES&H	Environment, Safety, and Health
RHWM	Radioactive and Hazardous Waste Management
HMTA	Hazardous Material Transportation Act
LLNL	Lawrence Livermore National Laboratory
OES	Office of Emergency Services (California)
ORAD	Operations and Regulatory Affairs Division
ORO	Occurrence Reporting Office (LLNL)
OSHA	Occupational Safety and Health Administration
PCB	Polychlorinated biphenyl
PRAG	Permits and Regulatory Affairs Group
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
RWQCB	Regional Water Quality Control Board
SF	San Francisco

SPCC	Spill Prevention Control and Countermeasures
TSCA	Toxic Substances Control Act of 1976, as amended
TTO	Total Toxic Organic
UC	University of California
WAA	Waste Accumulation Area
WDR	Waste Disposal Requisition

10.4 Other References

U.S. Department of Energy (1993), Environmental Guidance, Management of Polychlorinated Biphenyls

U.S. Department of Energy, Office of Environmental Guidance, RCRA/CERCLA Division, November (EH-231)

15 USC § 2601 et seq., Toxic Substances Control Act (TSCA) of 1999

PL 98-80

PL 98-620

PL 99-519

PL 100-368

Appendix A

Specific Requirements for PCBs and PCB-Contaminated Equipment

A.1 Transformers

Most transformers containing polychlorinated biphenyls (PCBs) may continue to be used for their remaining useful (active) or normal lives. There are, however, several exceptions under which PCB transformers (containing 500 ppm or more PCBs) are prohibited:

- The use or storage of PCB transformers is prohibited in any location where human food or animal feed products could be exposed to PCBs released from the transformer.
- Combustible materials may not be stored within 5 m (16.4 ft) of a PCB-transformer enclosure.
- Use of higher, secondary-voltage (480 V or greater), network PCB transformers in or near commercial buildings is prohibited. Existing transformers may be reclassified.
- Higher, secondary-voltage (480 V or greater), radial PCB transformers used in or near commercial buildings shall be equipped with electrical protection to avoid transformer ruptures caused by high-current faults and those caused by sustained, low-current faults.
- Lower, secondary-voltage (less than 480 V), network PCB transformers that are not located in sidewalk vaults shall be equipped with electrical protection to avoid transformer ruptures caused by high-current faults, or they shall be removed from service. These transformers shall also be registered in writing with the Regional Administrator of the U.S. Environmental Protection Agency (EPA).
- Lower, secondary-voltage (less than 480 V), network PCB transformers that are located in sidewalk vaults near commercial buildings shall be removed from service.
- All lower, secondary-voltage (less than 480 V), radial PCB transformers shall be equipped with electrical protection to avoid transformer ruptures from sustained, high-current faults.

Servicing of PCB transformers is allowed with a dielectric fluid at any concentration. However, if the coil needs to be removed to service the transformer, it shall not be reused but shall be disposed of by calling your ES&H Team environmental analyst. A PCB transformer shall not be serviced when the coil needs to be removed.

PCB transformers shall be visually inspected quarterly for leaks by the equipment owner. The visual inspections may occur any time during the periods of January to March, April to June,

July to September, and October to December, as long as there are at least 30 days between inspections. More frequent inspections (monthly) are recommended. The PCB transformer owner is responsible for maintaining records of inspections. Contact your ES&H Team environmental analyst, who will assist the owner in complying with these requirements.

No routine, visual inspections are required for PCB-contaminated transformers, but it is recommended that these transformers be visually inspected by the owner quarterly for leaks.

All leaking transformers shall be repaired immediately, or the transformer shall be replaced by the owner. A leak shall be cleaned up within 48 hours after its discovery. All active leaks shall be contained in a drip-pan or by some other appropriate method. Daily inspections by the owner are required until the leak is repaired.

If a PCB transformer is involved in a fire-related incident, the National Response Center shall be notified through the Fire Department, and specific reporting and containment requirements implemented by the Environmental Duty Officer (EDO) and the Radioactive and Hazardous Waste Management (RHWM) Division of the Environmental Protection Department (EPD). The owner of a PCB transformer shall immediately call the Laboratory emergency number (911 or ext. 2-7333 at the Livermore site; or 911 or ext. 3-5333 at Site 300) in the event of a fire-related incident. The owner shall also notify the EPD EDO by calling Fire Dispatch at 2-7595 if the fire-related incident involves a PCB transformer.

A.2 Capacitors

Large PCB capacitors (containing 1.36 kg or more of dielectric fluid) that are located in restricted areas (either a restricted-access electrical substation or a contained and restricted-access indoor installation) may continue to be used for their remaining lives. Large PCB capacitors that are not located in restricted areas are prohibited. All small capacitors may continue to be used for their remaining lives.

No routine inspection requirements apply to capacitors unless they are stored for disposal, but it is best management practice for the owner to inspect capacitors annually for leaks.

Most capacitors cannot be sampled for analysis of PCB concentration. In most cases, the presence of PCBs can be determined directly from information on the capacitor or from the manufacturer. Your ES&H Team environmental analyst can assist in such identification.

A.3 Electrical Light Ballasts

The EPA allows continued use of nonleaking PCBs and PCB-contaminated fluorescent light ballasts. When such ballasts are taken out of service, they shall be disposed of properly as hazardous waste and shall not be sold to subsequent users. The disposal of PCBs and PCB-contaminated items shall be coordinated through RHWM.

A.4 Electromagnets, Switches, and Voltage Regulators

Most electromagnets, switches, and voltage regulators containing PCBs may continue to be used for their remaining useful or normal lives. The use or storage of a PCB electromagnet (500-ppm PCBs or more) in a location where human food or animal feed could be exposed to PCBs released from the electromagnet is prohibited.

Weekly inspections by the owner are required for electromagnets with PCBs if they are in use or stored for reuse and contain between 50-ppm and 500-ppm PCBs and pose an exposure risk to food or feed.

No routine visual inspections are required for other PCBs or PCB-contaminated (less than 500-ppm PCBs) electrical equipment in use or stored for reuse, but it is recommended that such equipment be inspected by the owner quarterly for leaks.

A.5 Other PCB Equipment

Strict regulations apply to the use of PCBs in equipment that is not totally enclosed. Examples of such equipment include hydraulic systems, heat-transfer systems, and compressors. Generally, such equipment requires annual testing and fluid replacement to reduce PCB levels to less than 50 ppm. Small quantities of PCBs used in equipment during research or used in optical liquids may have less stringent requirements. Contact your ES&H Team environmental analyst for information on applicable regulations.

Appendix B

PCB Recordkeeping and Reporting

B.1 Introduction

Specific requirements on polychlorinated biphenyl (PCB) recordkeeping and reporting are presented in this appendix as guidance to Environmental Protection Department (EPD) and Lawrence Livermore National Laboratory (LLNL) personnel.

Federal regulations require that copies of all PCB records be kept in a central location. At LLNL, the central location for all PCB records is EPD. The records are maintained by the Permits and Regulatory Affairs Group (PRAG) of the Operations and Regulatory Affairs Division (ORAD) in EPD. Table B-1 shows the types of required records and the responsible organization or individual at LLNL.

Table B-1. Recordkeeping and reporting for PCBs.

Types of records	Regulatory citation (40 CFR)	Responsible LLNL organization
Annual records	761.180(a)(1)	EPD–RHWM (copy to ORAD PRAG)
Annual document log	761.180(a)(2)	EPD–ORAD PRAG
Report of PCB manufacturing process	761.187	EPD–ORAD PRAG
PCB waste manifest reports	761.215	EPD–RHWM (copy to ORAD PRAG)
Notification of PCB waste activity	761.205(b)	EPD–ORAD PRAG
Spill cleanup records	761.125(c)(5)	EPD–ORAD PRAG
Equipment inspection logs	761.30	Equipment owner

B.2 Annual Records

Annual records are required for any facility that uses or stores at least 45 kg (99.4 lb) of PCBs, or one PCB transformer, or 50 PCB capacitors. These records are the responsibility of Radioactive and Hazardous Waste Management (RHWM) and include:

- All signed manifests for PCBs generated by the facility during the calendar year (manifests should be legible).
- All exception reports and one-year exception reports.
- All Certificates of Disposal received by the facility during the calendar year.

The annual records shall be retained for at least three years after the facility drops below the required reporting quantities.

B.3 Annual Document Log

An annual document log is required for any facility that uses or stores at least 45 kg (99.4 lb) of PCBs, or one PCB transformer, or 50 PCB capacitors. The document log includes:

- The calendar year covered by the log; and the name, address, and the U.S. Environmental Protection Agency(EPA) identification number of the facility.
- The unique number of every manifest for PCBs generated by the facility during the calendar year.
- For all manifested PCB waste, unmanifested PCB storage, and any PCBs or PCB item received from or shipped to other facilities managed by the U.S. Department of Energy (DOE) or the University of California (UC):
 - A unique identification number (serial number) for each PCB article, PCB container, and PCB-article container
 - PCB weight (kg)
 - Date removed from service
 - Date placed in transport
 - Date of disposal, if known
- The total number of PCB articles, PCB-article containers, and PCB containers disposed of or stored for disposal by specific type. The total weight (kg) of PCBs in PCB articles, PCB-article containers, and bulk PCB waste.
- The total number of PCB transformers and the total weight (kg) of PCBs contained in transformers that remain in service at the end of the calendar year.
- The total number of PCB capacitors remaining in service at the end of the calendar year.
- The total weight (kg) of any PCBs and PCB items in PCB containers remaining in service at the end of the calendar year, including identification of the container contents.
- Records of phone calls and other documentation verifying receipt by the designated storage or disposal facility of PCB waste transported by an independent transporter.

B.4 Report of PCB Manufacturing Process

The manufacture of PCBs is prohibited in the United States except for PCBs inadvertently generated under certain conditions. The inadvertent generation of PCBs in a concentration greater than 2 ppm shall be reported to the EPA by ORAD. Additional data are required to be provided to the EPA whenever:

- The total quantity of PCBs in products leaving the manufacturing site in any calendar year exceeds 0.0025 percent of the site's rated capacity.
- The total quantity of PCBs released to the air from the manufacturing process exceeds 4.54 kg (10 lb) in any calendar year.
- The total quantity of PCBs released to the water from the manufacturing process exceeds 4.54 kg (10 lb) in any calendar year.

The data submitted by ORAD shall include all analytical data and corresponding throughput data for PCBs.

B.5 PCB Waste Manifest Exception Reports

The designated PCB storage or disposal facility within 35 days of the initial shipment date shall send RHWM a copy of the manifest with a hand-written signature. If RHWM does not receive this, it shall immediately contact the transporter and/or designated facility to determine the status of the PCB waste. Such contacts shall be documented. Copies of the manifests shall be included in the PCB annual log.

If RHWM does not receive a copy of the manifest with a handwritten signature from the designated PCB storage or disposal facility within 45 days of the initial shipment date shall submit an Exception Report to the EPA Regional Administrator, Region IX. The Exception Report shall include:

- A legible copy of the manifest.
- A cover letter explaining the efforts taken to locate the PCB wastes and the results of those efforts.

A One-Year Exception Report shall be filed by RHWM if it (1) does not receive a copy of the Certificate of Disposal within 13 months from the date of removal from service, (2) receives a Certificate of Disposal confirming disposal on a date more than one year after the date of removal from service, or (3) stores PCB waste for longer than one year prior to disposal. The only exception to this requirement is if RHWM does not transfer the PCB waste to the disposer within nine months from the date of removal from service, as required. The One-Year Exception Report shall include:

- A legible copy of the manifest, plus other documentation relevant to the transfer and disposal of the PCB waste.
- A cover letter, signed by the RHWM representative, explaining:
 - Date(s) when the PCBs or PCB items were removed from service.
 - Date(s) when the PCBs or PCB items were received by the submitter, if applicable.
 - Date(s) when the PCBs or PCB items were transferred to a designated disposal facility.
 - Identity of the transporters, storage facilities, and disposal facilities known to be involved with the transaction.
 - Reason, if known, for the delay in bringing about the disposal of the PCBs within one year from the date of removal from service.

B.6 Notification of PCB Waste Activity

LLNL filed a Form 7710-53 with the EPA in October 1997 for Site 300, and in June 1999 for the Livermore site. No further action is required at present.

B.7 PCB Spill Cleanup Records

ORAD shall maintain for five years records documenting the cleanup of spills with high concentrations (500 ppm or greater PCBs) or more than 454 g (1 lb) of PCBs. The records and certification shall consist of the following:

- Identification of the source (e.g., type of equipment) of the spill.
- Estimated or actual date and time that the spill occurred.
- Date and time that cleanup was completed or terminated (or the nature and duration of the delay if cleanup was delayed by an emergency or adverse weather).
- A brief description of the spill location and the nature of the material contaminated, including whether the spill occurred in an outdoor electrical substation, other restricted access location, or nonrestricted access area.
- Pre-cleanup sampling data used to establish the spill boundaries, if required because of insufficient visible traces, and a brief description of the sampling methodology used to establish the boundaries.
- A brief description of the solid surfaces cleaned.
- The approximate depth of soil excavation and the amount of soil removed.

- Post-cleanup verification sampling data, a brief description of the sampling methodology, and the analytical technique used.
- The estimated cost of cleanup (not required).

B.8 Equipment Inspection Logs

The equipment owner shall maintain records of the legally required inspections and maintenance history of PCB equipment, including the name of the person responsible for the inspections and the dates of inspection, for at least three years after disposal by RHWM.

Appendix C

PCB Spill Cleanup and Reporting Requirements (40 CFR 761.120–135)

Spill cleanup and reporting requirements for polychlorinated biphenyls (PCBs) are presented in this appendix as guidance to the Environmental Protection Department (EPD) and authorizing organization personnel. Spills of PCB materials can be remediated only by personnel trained to handle PCB cleanups. Report all spills of PCBs to your H&S technician and your ES&H Team environmental analyst.

When spills with low concentrations (less than 500 ppm PCBs) and less than 454 g (1 lb) of PCBs occur, all soil within the spill area (visible boundary plus a 1-lateral-ft buffer zone) shall be excavated and backfilled with clean soil. Solid surfaces shall be double washed/rinsed.⁵ This action shall be completed by Radioactive and Hazardous Waste Management (RHWM) within 48 hours after the owner of PCBs or PCB items was notified or became aware of the spill.

When spills with high concentrations (500 ppm or more PCBs) or more than 454 g (1 lb) of PCBs occur, the National Response Center shall be notified immediately by the EPD Environmental Duty Officer (EDO). The spill area shall be cordoned off with at least a 3-ft buffer zone. Warning signs shall be clearly visible. The area of visible contamination shall be documented and recorded, noting the extent and center of the visible trace areas. The cleanup of fluid from hard surfaces and the removal of contaminated soil shall be initiated (not necessarily completed) within 24 hours after the Responsible Individual was notified or became aware of the spill. If the spill will result in PCB exposure outside the facility, other spill reporting procedures may be required, and the mandated reports are completed by EPD personnel.

The U.S. Environmental Protection Agency (EPA), Region IX, regards soil, asphalt, wood, cement, and concrete as porous materials that absorb PCBs. Where practicable, these materials shall be removed when they are within the spill area. The spill boundary shall be verified by sampling and analysis. Solid, impenetrable surfaces (e.g., metals and impervious liners) may be decontaminated by a double wash/ rinse. All decontamination shall be verified by sampling and analysis using bulk samples for porous materials and wipe samples for impenetrable surfaces.

All concentrated soils, solvents, rags, and other materials resulting from the cleanup of PCBs shall be properly stored, labeled, and disposed of as PCBs or PCB-contaminated materials. The containers of PCB wastes generated shall be free of PCB contamination on all outside surfaces.

⁵ **Double wash/rinse means a minimum requirement to cleanse solid surfaces two times with an appropriate cleaning agent. PCBs shall be at least 5% soluble by weight in the selected cleaning agent. A volume of PCB-free fluid sufficient to cover the contaminated surface shall be used in each wash/rinse. The wash/rinse requirement does not mean the mere spreading of cleaning agent over the surface; nor does the requirement mean a once-over wipe with a soaked cloth.**

The PCB Spill Cleanup Policy for the EPA, Region IX, requires soils to be remediated to background levels (i.e., detection limits), where practicably attainable, of any PCB spill from a source greater than 50 ppm PCBs. In certain cases, the EPA, Region IX, will consider alternative cleanup levels. Cleanup under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 allows deviation from the Regional Policy when the reason for deviation is included in the Record of Decision (ROD). The ROD should have the concurrences of the EPA Pesticides and Toxics Branch Chief and the Toxics and Waste Management Division Director.

Spill reports (both verbal and written) shall be completed only by EPD personnel (e.g., PRAG, EOG or WGMG) and are required to contain the following information:

- Nature of waste or pollutant (i.e., PCBs).
- Quantity of waste or pollutant involved.
- Time and duration of the incident.
- Cause of the spill.
- Estimated size and location of the affected area.
- Nature of effects (e.g., fish kill, toxic cloud, discoloration of receiving water).
- Corrective measures taken or planned, and a schedule of such activities.
- Spill Prevention Control and Countermeasures (SPCC), and/or contingency plans in effect.
- Persons notified (including name, organization, date, and times).

Many agencies are potentially interested in spills of PCBs, depending on the spill concentration, quantity, and location. Spill reports shall be reported by EPD as soon as possible and within the 24-hour legal requirement. Table C-1 shows reporting requirements and identifies where written reports are also required.

Table C-1. PCB spill notification requirements for the Environmental Protection Department.

Agency	Phone number	Conditions	Regulatory authority
National Response Center	1 (800) 424-8802	Spills involving 454 g (1 lb) or more of PCBs to the environment	CERCLA 40 CFR 301 Clean Water Act 40 CFR 117.3
U.S. Coast Guard	(510) 437-3781	Concentrations greater than 5 ppm for liquids and 50 ppm for solids to the waters and/or soils of the state	Board WDR 90-106
Environmental Protection Agency (EPA), Region IX, Office of Pesticide and Toxic Substances Branch	(415) 556-5395	Concentration greater than 50 ppm and spills involving 4.54 kg (10 lb) or more of PCBs, or discharge to water or agricultural land	TSCA 40 CFR 761
Department of Energy (DOE)	Notify via the LLNL Occurrence Reporting Office (ORO)	Occurrence that requires nonroutine notification of regulatory agencies	DOE Order 232.1A
California Office of Emergency Services (OES)	1 (800) 852-7550	Spills involving 454 g (1 lb) or more of PCBs to the environment	
Regional Water Quality Control Board (RWQCB), San Francisco (SF) Bay Region ^a	8 am to 5 pm (510) 464-1255 After hours, call OES and U.S. Coast Guard	Concentrations greater than 5 ppm for liquids and 50 ppm for solids to the waters and/or soils of the state, or the CERCLA requirement of 454 g (1 lb)	Standard conditions Board Order 90-106
Regional Water Quality Control Board (RWQCB), Central Valley Region ^a	8 am to 5 pm (916) 361-5600 After hours, call OES and U.S. Coast Guard	Concentrations greater than 5 ppm for liquids and 50 ppm for solids to the waters and/or soils of the state, or the CERCLA requirement of 454 g (1 lb)	Board Order 94-131
Livermore Water Reclamation Plant ^a	(510) 373-5230	Concentrations exceeding 0.01 mg/l TTO ^b to sanitary sewer at LLNL main site	Wastewater Discharge Permit #1250-(99-00)

^a Written report also required within five working days.

^b Total Toxic Organic (TTO) compound concentration.

Appendix D

Waste PCB Packaging, Labeling, and Storage (40 CFR 761.65)

Packaging, labeling, and storage requirements for waste polychlorinated biphenyls (PCBs) are presented in this appendix as guidance for the Environmental Protection Department (EPD) and authorizing organization personnel. In general, generators of waste PCBs at LLNL shall notify the Radioactive and Hazardous Waste Management (RHWM) Division technician and ES&H Team environmental analyst when PCBs and PCB-contaminated items require disposal.

D.1 Packaging

Toxic Substances Control Act (TSCA) regulations defer to U.S. Department of Transportation (DOT) requirements for container specifications. Packaging for PCBs varies according to the type of PCB and mode of transportation. The DOT specifies containers according to package performance. All packaging for containers transported on public roads shall meet DOT specifications.

In generator areas, the generator packages PCB waste with guidance from RHWM field technicians. In RHWM, RHWM personnel package their own PCB waste.

The container shall be sealed, and the sides and top of the container shall be free of PCB contamination. The appropriate, standard PCB label shall be affixed to the outside of the container. In addition, the container shall conform to packaging requirements covered in the course, EP0006—Hazardous Waste Generation and Certification.

D.2 PCB Labeling

PCB items, PCB storage areas, and PCB transport vehicles shall be clearly identified by RHWM with appropriate labels indicating the presence of PCBs. The large PCB label is most often required by regulations (see Figure 2 in the main text for this label). A smaller label is also available for smaller items (see Figure 3). The label shall be placed in a position clearly visible by any person servicing or inspecting the item, storage area, or transport vehicle. If unlabeled PCB items are discovered, they shall be labeled by their owners as soon as possible. Labels are available through the Materials Distribution Department (Stores).

In addition to PCB labels and the date of removal from service, Resource Conservation and Recovery Act (RCRA) and DOT labeling requirements may be required. Certain PCB wastes require a manifest and a proper DOT shipping name and container. Contact your ES&H Team environmental analyst with questions.

D.3 PCB Storage in Waste Accumulation Areas

The following items may be stored in Waste Accumulation Areas (WAAs) at LLNL for up to 30 days from the date of their removal from service, provided that a notation is attached to the PCB item or PCB container indicating the date that the item was removed from service:

- Nonleaking PCB articles and PCB equipment.
- Leaking PCB articles and PCB equipment, if the PCB items are placed in a nonleaking PCB container that has sufficient sorbent materials to absorb any liquid PCBs remaining in the PCB item.
- PCB containers that hold nonliquid PCBs, such as contaminated soils, rags, and debris.
- PCB containers that hold liquid PCBs at a concentration ≥ 50 ppm, provided a Spill Prevention Control and Countermeasures (SPCC) Plan has been prepared for the WAA in accordance with 40 CFR 112.

PCB containers that have PCBs at a concentration less than 50 ppm may be stored in WAAs for up to 90 days from the date of their removal from service. A notation shall be attached to the PCB item or PCB container indicating the date that the item was removed from service and that the liquids in the container do not exceed 50-ppm PCBs. PCB-contaminated electrical equipment that has been drained of free-flowing dielectric fluid may be stored in WAAs for up to 90 days from the date of their removal from service.

No item or movable equipment that is used for handling PCBs and PCB items in the WAA and that comes into direct contact with PCBs shall be removed from the storage facility area unless it has been decontaminated by swabbing contaminated surfaces that have contacted PCBs with a cleaning agent. The cleaning agent shall contain less than 50-ppm PCBs, and the solubility of PCBs in the cleaning agent shall be more than 5% weight.

All PCB articles and PCB containers stored in the WAA shall be visually checked by the WAA operator for leaks weekly.

D.4 One-Year Storage Requirements

PCB articles and PCB containers can be stored at a permitted storage facility for up to one year from the date they were first placed in storage before disposal, but they shall be shipped to an approved disposal facility within nine months of removal from service. The disposal facility is required to operate under either a California hazardous waste permit or interim status document. Facilities used to store PCBs shall meet the following criteria:

- Roof and walls shall be adequate to prevent rainwater from reaching the stored PCBs and PCB items.

- The floor shall have continuous curbing with a minimum 6-in.-high curb. The floor and curbing shall provide a containment volume equal to at least two times the internal volume of the largest PCB article or PCB container being stored, or 25% of the total internal volume of all PCB articles and PCB containers being stored, whichever is greater.
- No drain valves, floor drains, expansion joints, sewer lines, or other openings that would permit liquids to flow from the curbed area are permitted.
- The floors and curbing shall be constructed of continuous, smooth, and impervious materials to prevent or minimize penetration of PCBs.
- The facility cannot be located below the 100-year floodwater elevation.

No item or movable equipment that is used for handling PCBs and PCB items in the storage facilities and that comes into direct contact with PCBs shall be removed from the storage facility area unless it has been decontaminated by swabbing contaminated surfaces that have contacted PCBs. The cleaning agent shall contain less than 50-ppm PCBs, and the solubility of PCBs in the cleaning agent shall be more than 5% weight.

All PCB articles and PCB containers in storage shall be visually checked for leaks at least weekly.

PCB-contaminated electrical equipment and large, high-voltage PCB capacitors that are nonleaking and structurally undamaged and that have not been drained of free-flowing dielectric fluid may be stored on pallets next to the permitted storage facility. Such storage outside the facility is only allowed when the immediately available, unfilled space in the storage facility is less than 10% of the volume of the capacitors and equipment stored outside the facility. The capacitors and equipment temporarily stored outside the facility shall be checked weekly for leaks.

Appendix E

PCB Disposal (40 CFR 761.60)

Disposal requirements for polychlorinated biphenyls (PCBs) are summarized in this appendix as guidance to Radioactive and Hazardous Waste Management (RHWM) Division personnel. PCBs or PCB-contaminated items shall be disposed of within one year from the date the item is declared a waste or is no longer in service. PCBs and PCB-contaminated items stored for disposal shall be stored in a Toxic Substances Control Act (TSCA)-approved storage area and should be shipped to an approved disposal facility within nine months of removal from service. Tables E-1 and E-2 identify the disposal options for bulk PCBs and PCB articles.

Table E-1. Disposal methods for bulk PCBs.

Types of bulk PCBs	Appropriate disposal methods
1. Mineral oil dielectric fluids (≥ 500 ppm)	Incineration
2. Mineral oil dielectric fluids (≥ 5 ppm and < 500 ppm)	Incineration Out-of-state chemical landfill (except ignitable waste) High-efficiency boiler Other approved disposal facility
3. Waste oil ^a (> 2 ppm and < 50 ppm)	Incineration Other approved disposal facility
4. Other liquid materials (≥ 500 ppm)	Incineration
5. Other liquid materials (≥ 50 ppm and < 500 ppm)	Incineration High-efficiency boiler
6. Other liquid materials (≥ 5 ppm and < 50 ppm)	Incineration Out-of-state chemical landfill (except ignitable waste) High-efficiency boiler Other approved disposal facility
7. Nonliquid PCBs (≥ 50 ppm)	Incineration Chemical landfill
8. Dredged materials and sewage sludge (≤ 50 ppm)	Incineration Chemical landfill Other approved disposal method

^a Waste oil may be burned or marketed only for energy recovery purposes.

Table E-2. Disposal methods for PCB articles.

Types of PCB articles	Appropriate disposal methods
1. PCB transformers	Incineration Chemical landfill (after draining, flushing, and filling with absorbent)
2. Small PCB capacitors ^a	Incineration Chemical landfill in a labpack
3. Large PCB capacitors ^a	Incineration
4. PCB hydraulic machines (≥ 1000 ppm)	Municipal solid waste facility or salvage (after draining and flushing)
5. PCB hydraulic machines (< 1000 ppm)	Municipal solid waste facility or salvage (after draining)
6. PCB-contaminated electrical equipment	Incineration Chemical landfill in a labpack
7. Other PCB articles (≥ 500 ppm)	Incineration Chemical landfill after draining
8. Other PCB articles (< 500 ppm)	Nonregulated after draining
9. PCB container	Incineration Chemical landfill after draining

^a The definitions for small and large capacitors are provided in 40 CFR 761.3.

PCB Material Mixed with RCRA Hazardous Waste

For PCBs or PCB items that are mixed with, contained in, or contaminated with Resource Conservation and Recovery Act (RCRA) hazardous waste, disposal may also be subject to the RCRA land disposal restrictions.

PCB Material Mixed with Radioactive Waste

PCBs or PCB items that are contaminated with radioactive constituents are regulated by the Atomic Energy Act, applicable DOE orders, and the TSCA; therefore, disposal may be subject to stricter requirements.