EPA 560/6-77-013

MICROECONOMIC IMPACTS OF THE PROPOSED MARKING AND DISPOSAL REGULATIONS FOR PCBs

FINAL TASK REPORT

Submitted to:

U.S. Environmental Protection Agency
Office of Toxic Substances
Washington, D.C.

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Contract No. 68-01-3259

Submitted by:

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This report has been reviewed by the Office of Toxic Substances, U.S. Environmental Protection Agency, and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

PREFACE

The attached document was prepared by Versar Inc. for the Office of Toxic Substances of the Environmental Protection Agency. The purpose of the work reported in this document was to estimate the probable costs of complying with the draft PCB marking and disposal regulations, 40 CFR 761 (Appendix B). These regulations are being prepared in fulfillment of the statuatory requirements of Section 6(e) of the Toxic Substances Control Act (Appendix A).

This economic analysis program was sponsored by the EPA, but the results reported are those of Versar Inc. This report was submitted in partial fulfillment of the requirements of Contract No. 68-01-3259. The report is not an official EPA publication. However, this study does meet all of the requirements of an economic impact analysis of the proposed regulation.

The economic analysis of the draft disposal and marking regulation was one of a number of research tasks concerning PCBs which Versar has performed for the Office of Toxic Substances, U.S. EPA. This report was prepared under the supervision of Mr. Robert Westin, Principal Investigator. Other major contributors were:

Louis Fourt, Ph.D. (Economic methodology and transportation costing)

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Special acknowledgements must be given for the close support received from Mr. David E. Wagner, EPA Project Officer, and Mr. Harold Snyder, EPA Regulations Development Group of the Office of Toxic Substances. The factual

strengths of this report are due to the close cooperation received from industry, particularly representatives of the existing incinerators and the major electrical equipment manufacturers.

This report is based on the draft regulations as they were written on April 18, 1977. This draft was undergoing continued review by the Office of Toxic Substances and other offices within EPA, and changes which may have been made to the draft regulations after April 18 could not be considered in this analysis. Therefore, it is suggested that the draft regulation which is included in Appendix B be carefully compared with the formal proposed regulation which will be published in the Federal Register, and that the economic costs developed in this report be recalculated as necessary to reflect any subsequent changes in the draft regulation.

This report is being released and circulated prior to the public hearing on the proposed regulation. It will be considered along with the information during the hearings in the establishment of the final regulations. Prior to final promulgation of the regulations, this study shall have standing in any EPA proceeding or court proceeding only to the extent that it represents the views of Versar. It cannot be cited, referenced, or represented in any respect in any such proceeding as a statement of EPA's views regarding the impact of the proposed regulations.

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1.0 INTRODUCTION

The purpose of this study was to evaluate the economic impact of the draft regulations for the marking and disposal of polychlorinated biphenyls (PCBs), 40 CFR 761. The draft regulations were prepared by the Office of Toxic Substances of the Environmental Protection Agency with the support of the Interagency PCB Work Group.

The scope of this analysis included estimates of the quantities of PCBs and equipment containing PCBs which will be affected by the proposed regulations, the present and required future availability, feasibility, and costs of the required PCB disposal facilities, the secondary costs of controlled disposal including storage, recordkeeping, and transportation, and the costs of satisfying the various marking requirements. The economic analysis included estimates of the additional costs of complying with these regulations as a function of year and economic sector. The analysis also considered the possible economic effects of these costs on price levels, investment requirements, and employment. Finally, the effects of compliance on energy requirements and on the availability of strategic materials were estimated.

1.1 Current PCBs Usage in the United States

PCBs have been used in the United States since 1929. Major uses of this chemical in the past have included transformer cooling liquids, capacitor dielectric liquids, heat transfer and hydraulic liquids, as a dye carrier in carbonless copy paper, as a plasticizer in paints, adhesives and caulking compounds, and as a filler in investment casting wax. Under a previous task of this contract, Versar studied the use of PCBs and reported the estimated usage and distribution of PCBs as shown in Table 1-1.[1]

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(1) Versar Inc. PCBs in the United States: Industrial Use and Environmental Distribution. NTIS PB-252 402/3WP. Feb., 1976.

Table 1-1

Estimates of Cumulative PCBs Production, Usage, and Gross Environmental Distribution in the United States Over the Period 1930-1975 in Millions of Pounds(1)

	Commercial Production	Commercial Sales	Industrial Purchases of PCB	PCBs Currently in Service	PCBs Currently in Environment	PCBs Destroyed	Estimated Reliability of Values
U.S. PCB Production	1,400						+ 5% - 20%
Total U.S. PCB Imports	3						± 30%
U.S. PCB Domestic Usage		1,253					+ 5% - 20%
Total U.S. PCB Exports		150					± 20%
PCB by Use Category:							
Petroleum Additives			1				± 50%
Heat Transfer			20				± 10%
Misc. Industrial			27				± 15%
Carbonless Copy Paper			45				± 5%
Hydraulics and Lubricants			80				± 10%
Other Plasticizer Uses			115				± 15%
Capacitors			630	450			± 20%
Transformers			335	300			± 20%
Uses Other than Electrical				8			± 60%
PCB Degraded or Incinerated:							
Environmentally Degraded						30	± 70%
Incinerated						25	± 10%
Landfills and PCBs in Dumps:							
Cap. and Trans. Production Wastes					110		± 20%
Obsolete Ele. Equipment					80		± 40%
Other (paper, plastic, etc.)					100		± 40%
Free PCBs in the Environment (soil, water, air, sediment)					150		± 30%
Total	1,403	1,403	1,253	758	440	55	

(1) Versar Inc. PCBs in the United States: Industrial Use and Environmental Distribution February, 1976, NTIS PB-252 402/3WP

The major U.S. manufacturer of PCBs has been Monsanto. Since 1972, Monsanto has limited sales of PCBs to manufacturers of transformers and capacitors. A previously reported investigation by Versar indicated that about one million pounds of PCBs were produced by a small manufacturer from 1972 through 1974 for use as a heat transfer liquid, but that there were no significant amounts of U.S.-produced PCBs remaining in use in non-electrical systems in 1976.[1]

PCBs have also been imported for use in investment casting wax, for maintenance of certain mining machinery, and as the coolant in electrical transformers. The use and industrial importance of these imported PCBs was the subject of a recent investigation by Versar.[2]

Decachlorobiphenyl was imported from Italy for several years for use as a filler in investment casting wax, but this use was ended in mid 1976. Several manufacturers of investment casting wax are presently using imported polychlorinated terphenyls in their products, and these PCTs may be contaminated with up to 10% PCBs. It is assumed that the concentration of PCBs in the PCTs can be reduced to below .05% by stricter quality control during manufacturing. If this cannot be done, the PCTs will have to be marked as being PCBs, and the used wax may be subject to the proposed marking and disposal requirements.

The use of imported PCBs in the maintenance of certain mining machinery is well documented, and will be investigated in more detail during a research program to be sponsored by the U.S. Bureau of Mines later this year. Section 6(e)(2)(A) of the Toxic Substances Control Act requires that this mining machinery not be used after 1977. The disposal of the PCBs in the machinery and the contaminated machinery will be subject to the require-

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(1) Versar Inc. Usage of PCBs in Open and Semi-Closed Systems and the Resulting Losses of PCBs to the Environment. EPA 560/6-77-009 (unpublished Draft Report). September 1, 1976.

(2) Versar Inc. Assessment of the Environmental and Economic Impacts of the Ban on Imports of PCBs. EPA 560/6-77-007 (unpublished Draft Report). February 1, 1977.

ments of the proposed disposal regulations. The disposal of the PCBs from the approximately 350 mining machines is not expected to have a significant impact on the availability of landfill or incineration facilities, nor is it expected to have a significant economic impact on the mines.

Recent imports of PCBs as components of transformers are known to have exceeded 500,000 lbs. Such imports of PCBs do not significantly effect the estimates of total amounts of PCBs in service based on U.S. production data. The PCBs in such foreign built equipment will, of course, be subject to the proposed marking and disposal regulations.

Due to growing concern about the environmental hazards of PCBs, Monsanto announced late in 1976 that it would cease operation of its PCB manufacturing facility in October, 1977. As a result, most manufacturers of PCB transformers and of large high voltage capacitors have switched to other liquids in place of PCBs, and most manufacturers of small capacitors have indicated that they will stop using PCBs during 1977 or 1978.

Based on these previous studies, we can conclude that the marking and disposal regulations will have little effect on manufacturers who use PCBs in new equipment, and that the only existing PCB uses that will be affected will be transformers and capacitors.

For purposes of analysis, the existing PCB electrical equipment has been classified in the following six categories. The PCB and equipment weights and the service lives listed for each category are averages for all equipment in that category. The total weights listed for the capacitors are the average weights of the smallest disposable units.

PCB transformers @:

2150 lb PCBs
3000 lb liquid
6500 lb drained weight
40-year average life

(LHV) Large High Voltage Capacitors @:

25 lb PCB

120 lb total

20-year average life

(LLV) Large Low Voltage Capacitors@:

3.5 lb PCB

20 lb total

15-year average life

(HID) High Intensity Discharge Lighting Capacitors @:

2 lb PCB

8 lb total

20-year average life

(SA) Small Appliance Capacitors @:

1 lb PCB

5 lb total

15-year average life

(FL) Fluorescent Lighting Ballasts @:

0.1 lb PCB

3.5 lb total

15-year average life

The total numbers of electrical items containing PCBs is summarized in Table 1-2.

The importance of controlling disposal of PCBs from electrical equipment lies in the fact that there is presently five times as much PCB in use in electrical equipment as there is free in the environment. Although controlled disposal of the PCBs presently in use will not solve the problems which are now being caused by PCBs in the environment, uncontrolled disposal could increase the levels of environmental PCBs by a factor of six or more.

Table 1-2

Number of PCB Items in Service

	Transformers	Capacitors				
		LHV	LLV	HID	SA	FL
Utilities	84,000	7,600,000	1,000,000	800,000	---	---
Commercial and Apartment Buildings	28,000	---	7,500,000	500,000	5,000,000	630,000,000
Industrial	28,000	400,000	7,500,000	19,200,000	---	130,000,000
Private Residential	---	---	4,000,000	---	45,000,000	40,000,000
TOTAL	140,000	8,000,000	20,000,000	25,000,000	50,000,000	800,000,000

1.2 Effect of the Toxic Substances Control Act on the Usage of PCBs

In 1971, the President's Council on Environmental Quality developed a legislative proposal for dealing with pollution from toxic chemical substances. Finally, after many complex congressional hearings and debates, the Toxic Substances Control Act was signed into law in October 1976. The Toxic Substances Control Act became effective on January 1, 1977. The Act enables the Administrator of the Environmental Protection Agency to obtain from industry any information bearing on the use, distribution, production volumes and methods, health effects, and any other data necessary to understanding whether or not to what extent any given chemical substance or compound may adversely affect peoples' lives either directly or indirectly. The Administrator of EPA is empowered to act through the courts to prohibit the manufacture, processing, distribution, use, or disposal of any chemical substance or mixture found to present an unreasonable risk of injury to health or the environment.

The Act addresses only one chemical class directly, that being polychlorinated biphenyls, a class of bicyclic compounds having between 1 and 10 chlorine atoms per molecule. Section 6(e) of the Act establishes dates for the discontinuation of the use of PCBs in open systems, for the end of manufacturing and importation of PCBs, and for the end of the use of PCBs in newly manufactured equipment (see Appendix A). Section 6(e)(1) requires that the Administrator promulgate rules prescribing the disposal and marking of PCBs by July 1, 1977. The draft of the proposed regulation analyzed by this report was prepared in response to this statuatory requirement by the Office of Toxic Substances with the support of the Interagency PCB Work Group.

With the exception of the regulations for marking and disposal, Section 6(e) will have little impact on the use of PCBs. The Act does not require that existing capacitors or transformers be removed from service, nor does it specifically prohibit the continued use of stock-piled PCBs for transformer maintenance. The prohibition on open system uses after 1977 will result in the early retirement or modification of several hundred mining machines, but no other significant open system uses are known. The manufacturers of transformers and large capacitors plan to end most of their usage of PCBs by the end of 1977. Several manufacturers of small capacitors will continue using PCBs into 1978, working from inventories of PCBs as there will be no U.S. production of PCBs after 1977. The marking requirements will apply to these small capacitors and to the new electrical equipment in which they are used as components, but these marking requirements should end within a year or two as use of PCBs is discontinued in new capacitors.

1.3 Draft Regulation for the Marking and Disposal of PCBs

The draft regulation is included in this report as Appendix B. This regulation specifies the required disposal procedures for various types of PCB equipment and materials, and establishes requirements for storage areas, record keeping, and labeling of PCB equipment, containers, storage areas, and vehicles.

Prior to the enactment of the Resource Conservation and Recovery Act of 1976 (Pub. Law 94-580) in October, 1976, the Federal EPA had no jurisdiction over the operations of hazardous waste incinerators and chemical waste landfills. Regulations have not yet been promulgated under RCRA. Therefore, EPA has included special requirements for PCB incinerators and landfills in the proposed marking and disposal regulations. These proposed regulations require that all incinerators and chemical waste landfills used for the disposal of PCBs must be approved by the EPA Regional Administrator, and establish guidelines for the evaluation of the acceptability of the facilities. Since this requirement for Federal approval has not previously been required, existing facilities operate under state authorization and do not have the required Federal approval. It is not known whether any of the existing landfill facilities can meet the proposed requirements without modifying their facilities and/or operating procedures. All existing incinerators will have to be modified to provide for additional monitoring before they will meet the requirements.

1.4 Definition of Economic Impact

Executive Order 11821 (as extended) and OMB Circular A-107 require that major legislative proposals and regulations by agencies of the Executive Branch must be accompanied by a statement certifying that the economic impact of the proposal has been evaluated. EPA's guidelines on Economic Impact Analysis Statements (formerly Inflation Impact Statements) provide that regulations shall be considered a major action and shall require an Economic Impact Analysis under the following conditions: (1) If the incremental annualized costs of compliance, including capital charges, exceed $100 million in any year, (2) the incremental cost of production of any major product exceeds five percent of the selling price of the product, (3) net national energy consumption would be increased by the equivalent of 25,000 barrels of oil a day, or (4) the supply or demand of certain specified materials would be affected by more than three percent.

The major impact of the rules will apply to the owners and users of currently operating PCB capacitors and transformers. These persons will be affected by increased costs due to the special marking, storage, disposal, and recordkeeping that will be required for this equipment. In the following analyses, we have reviewed the availability and costs of disposal facilities, storage facilities, and transportation services. Estimates are also made of the amount of PCB equipment requiring controlled disposal by year and segment of the economy. The total costs are calculated based on the application of unit capital and operating costs to the disposal requirements. Price impacts are calculated on the assumption that all costs of complying with the regulations will be recovered from the ultimate consumer of goods and services. Effects on energy requirements and the supply of strategic materials are calculated on a national basis using the upper bound estimates of the impacts of the regulations.

In a similar way, the effects of the marking, storage, and recordkeeping costs have been analyzed on a unit basis as applied to individual items or facilities. Total economic impacts are then calculated based on estimates of the total number of such items or facilities affected by the regulations.

2.0 DISPOSAL TECHNOLOGY

Consideration of the unit costs of storage and disposal are basic to any calculation of the total economic impacts of the proposed regulation. The proposed regulations are very specific both in specifying what is to be done and in specifying how it is to be done. The following sections of this report consider in detail the technical and economic aspects of each part of the proposed disposal requirements.

2.1 Proposed Disposal Requirements

The basic disposal requirement for all PCBs is controlled use and storage followed by high temperature incineration. Considerations of the present lack of incineration facilities capable of handling capacitors and of the high costs that would be incurred by requiring removal of small capacitors from large equipment and requiring special handling of fluorescent light ballasts in individual residences have resulted in a number of exemptions from the basic requirement of incineration:

(1) Until July 1, 1979, non-liquid PCB mixtures (contaminated soil, rags, sewage sludge, etc.), PCB capacitors and PCB fluorescent light ballasts may be disposed of in chemical waste landfills.

(2) PCB containers (tank cars, trucks, drums, etc.) that have been contaminated with PCBs may be decontaminated by triple rinsing.

(3) PCB transformers may be disposed of in chemical waste landfills following rinsing to reduce their content of PCBs and the chance of leakage during transportation or after burial.

(4) Small PCB capacitors in electrical equipment do not have to be removed before the equipment is disposed of. Since most capacitors are removed from service because the equipment is

obsolete, rather than due to failure and replacement of the capacitor, the effect of this exemption appears to be that the disposal of most small capacitors will be as municipal solid wastes as part of larger equipment.

(5) Small capacitors and fluorescent light ballasts used in private housing units may be disposed of by the occupant as municipal solid waste.

(6) Material or equipment containing less than 500 ppm (one pound per ton) of PCBs will not require special handling or disposal.

Incinerators and chemical waste landfills used for disposal of PCBs will have to have approval from the EPA regional administrator. The proposed regulations establish detailed technical guidelines for the proper operation of these facilities.

All industrial plants, utilities and others who dispose of other than small PCB capacitors will be required to provide special diked and protected storage areas. Each storage facility larger than two 55 gallon drums will also be required to maintain records as to how the PCBs are handled.

Owners of significant quantities of PCBs in transformers, capacitors, or other equipment are required to maintain records including the location and scheduled disposal of the PCBs.

2.2 Decontamination

Because of the potential for liability from accidental spills of PCBs during decontamination, we do not foresee much use of this alternative disposal method. There will be some initial decontamination of tank cars, tank trucks, and production machinery as production of new PCBs is phased out. This will not have a major effect on total economic impacts. Any decontamination performed after this initial period will result in a slight decrease in the costs shown for incineration, but the effect should not be significant.

Effective decontamination of drums and small containers has been reported for pesticides, by triple rinsing of the containers with solvents which contain < 0.05 per cent of pesticide but have a solubility of 5 per cent or more for the pesticide.[1] Each rinsing uses a volume of solvent approximately 10 per cent of the volume of the container, and the rinsing must be accomplished by sloshing or otherwise forcing repeated contact of the container internal surfaces with the solvent. The efficiency of decontamination depends in part on the degree of solvent contacting and on the condition of the container surfaces being cleaned. After each rinse, the solvents are collected and incinerated. This procedure is believed readily adaptable for PCB containers.

Most large transformers are filled with a liquid which acts both as a cooland and as an electrical insulator. Approximately 5 per cent of such transformers are filled with a mixture of PCBs with up to 40 per cent trichlorobenzene. This non-flammable coolant containing PCBs is known by the generic term "askarel". Complete decontamination of askarel filled transformers does not appear feasible. However, partial decontamination of askarel transformers which are being taken out of service is required. This can be accomplished by thoroughly draining the askarel fluid from the transformer, followed by refilling and recirculating for several hours with a solvent such as mineral spirits. The solvent is then drained and incinerated. Preliminary results of a test which was performed by Westinghouse, sponsored by the Federal Railway Administration, and based on the above procedure, achieved a 99 per cent reduction in the quantity of PCBs in the transformer. Transformers so treated may then be disposed in a chemical waste landfill.

The remaining 95 per cent of liquid filled transformers are filled with mineral oil. This mineral oil may be contaminated with small amounts of PCBs because the same equipment has been used in the past to manufacture and service mineral oil filled and askarel filled transformers, and the equip-

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(1) Midwest Research Institute, Guidelines for the Disposal of Small Quantities of Unused Pesticides, EPA-670/2-75-057, Cincinnati, Ohio: National Environmental Research Center, USEPA, June, 1975.

ment has not always been decontaminated thoroughly after handling PCBs. Recent surveys have indicated that the contamination of the mineral oil is almost always below a concentration of .02 per cent PCBs. No cases are documented where transformer mineral oil has contained over .05 per cent PCBs though the ultimate disposal of any such oil would have to be by high temperature incineration under the requirements of the proposed regulations. It is possible that routine incineration of transformer mineral oil may eventually supply a significant portion of the fuel required to incinerate PCB capacitors. Such incineration of mineral oil would not be expected to have a significant economic impact because its value as a fuel would offset the cost of handling the oil.

Askarel transformers which are kept in service, but retrofilled with a silicone or other oil, should be thoroughly drained of askarel oil prior to refilling with replacement oil. Subsequent drainings and refillings of such transformers will require eventual incineration of the oil used to retrofill the transformers. In the case of silicone oil, it has been reported that treatment with an activated carbon will remove the PCBs and permit reuse of the oil.(1) In the case of mineral oil, the initial retrofill must be incinerated. Subsequent mineral oil retro-fills must also be incinerated until the level of PCB is less than 500 ppm.

2.3 Storage for Disposal

Most storage areas required by the proposed regulations will be established by office and commercial buildings, electrical repair shops, and small industrial buildings for the storage of small capacitors and fluorescent light ballasts that are removed during normal maintenance. These storage requirements may be fairly significant in the case of a large building. For instance, the World Trade Center in New York City has 250,00 fluorescent light ballasts; replacement of failed ballasts may result in the requirement to store several hundred ballasts per week prior to disposal. Small facilities may generate only a few capacitors or ballasts each year for disposal.

(1) Personal communication, Mr. Tor Orbeck, Dow Corning, Midland, Michigan.

If the storage areas for accumulation of small capacitors (and presumably fluorescent light ballasts) are limited in size to two 55 gallon drums stored inside, no special flooring, diking, or record keeping will be required. The cost of establishing such an area will be the cost of procuring a DOT spec 5, 5B, or 17C open head drum, marking the drum and area, and establishing maintenance policies requiring the collection of capacitors and ballasts. Total costs would be about $25 for the drum, plus $10 (one man hour) for labeling the drum and setting up the storage location, and an additional administrative expense of $80 for ordering the drum, establishing policy, etc. First year costs would therefore be about $115 per small storage area plus an equivalent of rent for the storage area of $30, or a total of $145 per area.

Annual operating costs of the small storage facilities include the equivalent of rent for the area dedicated to PCB accumulation (10 square feet x $3/ft^2/year), replacement drum costs (0.6 drums/year x $25), and $50 per year administrative costs, for a total of $95 per year.

While all of these costs can be attributed to the establishment and operation of small storage areas, they may not all be economic costs. By locating the drum in an unused area of the basement or warehouse, the facility could reduce or eliminate the economic costs of the storage area. Similarly, by using second hand drums and by setting up the storage area during a time of slack labor demands, the out of pocket costs for the establishment and operation of the storage areas could be reduced to the few dollars a year required to purchase the special labels and procure (or not return for credit) the drums.

In addition to the small storage areas, special indoors storage facilities which may not now exist will be required by utilities, transformer repair shops, and other operations which store large capacitors or transformers or which stockpile PCBs for transformer maintenance. These storage areas will require impermeable floors and dikes. Engineering and construction costs of $1000 to $5000 would be incurred in meeting these specifications for each major storage facility. An average major storage facility might have an area of 200 square feet, requiring a capital outlay of $2000. Equivalent rental costs of $3.00 per square foot per year would still apply, and drum costs would be about $225 per year. Labor costs would be incurred in handling the PCB equipment and checking the drums; two man hours per week would result in an annual cost of $1000. Administrative costs of $300 per year might also be attributable to the storage area. The operating costs for each major storage area would therefore be $2125 per year.

2.4 Chemical Waste Landfill

Chemical waste landfills provide environmental safeguards and long term protection designed to prevent the entry of stored PCBs into the environment. Although the PCBs will only be immobilized, rather than destroyed, the use of chemical waste landfills is to be preferred to uncontrolled disposal of PCBs where incineration capabilities are not available.

2.4.1 Proposed Requirements

The draft regulations require that chemical waste landfills used for the disposal of PCBs be approved for such use by the EPA Regional Administration. The proposed regulations specify the following guidelines for approval of chemical waste landfills:

(1) The composition and volume of each waste is known and approved for site disposal by pertinent regulatory agencies.

(2) The site should be geologically and hydrologically approved for hazardous wastes. Included in the criteria would be soil or soil-liner permeation rate of less than 10^{-7} cm/sec; in-place soil thickness of 4 feet or compacted soil liner thickness of 3 feet, greater than or equal to 30 percent passing a number 200 sieve; liquid limit greater than or equal to 30; a plasticity index of greater than or equal to 15; and an artificial liner thickness of 30 mils or greater. Some typical liner materials include clay, rubber, asphalt, concrete and plastics such as Hypalon (a chlorinated polyethylene plastic)

and PVC (polyvinyl chloride). The water table should be at least 50 ft below the lowest level of the landfill and adequate provision should be made for diversion and control of surface run off. If the soil is massively impermeable, the level can be as little as 5 feet to the water table.

(3) Monitoring wells are provided.

(4) Leachate control and treatment (if required).

(5) Three-dimensional records of burial coordinates to avoid any chemical interactions.

(6) Registration of the site for a permanent record of its location once filled.

At this time there are no secured sites known to be approved by the regional administrator for disposal of PCBs. For further detail on criteria see Appendix B, Sections 761.41 and 761.45(b).

2.4.2 General Engineering Considerations

Chemical waste landfills should be sited to take advantage of geologic factors responsible for optimum attenuation of the wastes and any decomposition products, and designed to overcome the disadvantages posed by less favorable sites.

In selecting and evaluating a chemical waste landfill site, some general criteria to be considered are:[1]

(a) Chemical waste landfills ideally should be located in areas of low population density, low alternative land use value, and low ground water contamination potential.

(b) All sites should be located away from flood plains, natural depressions, and excessive slopes.

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(1) Battelle Pacific Northwest Laboratories, Program for the Management of Hazardous Wastes, (EPA Contract No. 68-01-0762), Richland, Wa.,: July 1973.

(c) All sites should be fenced, or otherwise guarded to prevent public access.

(d) Wherever possible, sites should be located in areas of high clay content due to the low permeability and beneficial adsorptive properties of such soils.

(e) All sites should be within a relatively short distance of existing rail and highway transportation.

(f) Major waste generation should be nearby. Wastes transported to the site should not require transfer during shipment.

(g) All sites should be located an adequate distance from existing wells that serve as water supplies for human or animal consumption.

(h) Wherever possible, sites should have low rainfall and high evaporation rates.

(i) Records should be kept of the locations of various hazardous waste types within the landfill to permit future recovery if economics permit. This will help facilitate the analysis of causes if undesirable reactions or other problems develop within the site.

(j) Detailed site studies and waste characterization studies are necessary to estimate the long-term stability and leachability of the waste sludges in the specific site selected.

(k) The site should be located or designed to prevent any significant, predictable leaching or run-off from accidental spills occurring during waste delivery.

(l) The base of the landfill site should be a sufficient distance above the high water table to prevent leachate movement to aquifers. Waste leachability and soil attenuation and transmissivity characteristics are important in determining what is an acceptable distance. Evapotranspiration and precipitation characteristics are also important. The use of liners, encapsulation, detoxification, and/or solidification/fixation can be used in high water or poor soil areas to decrease ground water deterioration potential.

(m) All sites should be located or designed so that no hydraulic surface or subsurface connection exists with standing or flowing surface water. The use of liners and/or encapsulation can prevent hydraulic connection.

(n) In arid regions where the cumulative precipitation is less than the evapotranspiration, water will not be likely to accumulate in the landfill or migrate through the soil. Under such conditions, leachate containment precautions (liners, etc.) will not be necessary unless the water table is high or large quantities of liquid wastes are disposed.

(o) Unless leachate generation or escape is prevented in some manner, such as by encapsulation, location in arid regions or naturally impermeable basins, or by immediate cover with an impermeable membrane to prevent infiltration, it will be necessary to line the basin with an impermeable membrane, collect the leachate in headers, and recycle it through the fill or pump it to an appropriate treatment facility.

(p) All liners, cover materials, and encapsulating materials must be tested or have known chemical resistance to the materials it will contain or might otherwise come in contact with. Ideally, such materials should have effective life greater than the toxic life of the wastes they contain.

(q) Studies will be necessary to determine general site monitoring requirements. Hydrogeological monitoring will be required to detect routine and accidental releases of liquid effluents. A system of observation wells should be installed in aquifers around the site and concentrated in potential water and waste movement paths downgradient from the site. A monthly sampling frequently has been suggested by one source. Downstream monitoring stations and a bimonthly sampling frequency were suggested for surface streams in the site vicinity.

Monitoring wells are necessary for the safe operation of a chemical waste landfill. Prior to the deposition of hazardous wastes, observation and monitoring wells should be installed around the periphery of the site. Locations should be determined by the appropriate regulatory authorities based on the site topography and hydrogeological conditions. A recent OSW documented case history[1] illustrates the importance of monitoring wells. A company in the north central United States had utilized the same dump site for laboratory waste disposal since 1953. More than half of the waste dumped was arsenic. Although the monitoring wells around the site were superficial in nature, arsenic concentrations greater than 175 ppm were detected. The U.S. Public Health Service drinking water standard for arsenic is 0.05 ppm.[1] The dump site is located above a limestone bedrock aquifer which supplies about 70 percent of a nearby city's residents with drinking and crop irrigation water. Indications are that this water is in danger of being contaminated

(1) Office of Solid Waste Management Programs. Report to Congress: Disposal of Hazardous Wastes. (SW-115) Washington: U.S. Environmental Protection Agency, 1974.

by arsenic seepage through the bedrock. Without monitoring wells, this waste transport would not have been detected, and serious illness could have resulted.

2.4.3 Currently Available Chemical Waste Landfills

A 1977 Office of Solid Waste survey of hazardous waste management facilities indicated sixteen with "secured" or chemical waste landfill sites. In order to assess the capabilities of existing sites to handle these PCB-containing solid wastes, these facilities were contacted, disposal costs were updated, and the estimated operating life of each fill and its willingness to accept PCB-containing solid wastes were ascertained.

Fifteen of the sixteen landfill sites surveyed indicated a willingness to accept PCB-containing solid wastes such as capacitors and transformer internals although many indicated that they have not had requests for disposal of such items. The fifteen sites are scattered throughout the country: nine Class I landfill sites in California, one in Idaho, one in Illinois, one in Nevada, two in New York, and one in Texas. The one secured site which indicated it could not accept PCB-containing solid waste is located in Missouri. Private companies operate four of the Class I landfill sites in California and five others are operated by local jurisdictions. The landfills run by county jurisdictions serve only a limited locale and this could pose problems in adequate disposal capacity.

The California sites are regulated by the California State Department of Public Health and must meet the following criteria:[(1)]

(a) Geological conditions are naturally capable of preventing hydraulic continuity between liquids and gases emanating from the waste in the site and usable surface or ground waters.

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(1) California State Water Resources Control Board, Disposal Site Design and Operation Information, Sacramento: March 1975, p. 19-21.

(b) Geological conditions are naturally capable of preventing lateral hydraulic continuity between liquids and gases emanating from wastes in the site and usable surface or ground waters, or the disposal area has been modified to achieve such capability.

(c) Underlying geological formations which contain rock fractures or fissures of questionable permeability must be permanently sealed to provide a competent barrier to the movement of liquids or gases from the disposal site to usable water.

(d) Inundation of disposal areas shall not occur until the site is closed in accordance with requirements of the regional board.

(e) Disposal areas shall not be subject to washout.

(f) Leachate and subsurface flow into the disposal area shall be contained within the site unless other disposition is made in accordance with requirements of the regional board.

(g) Sites shall not be located over zones of active faulting or where other forms of geological change would impair the competence of natural features or artificial barriers which prevent continuity with usable waters.

(h) Sites made suitable for use by man-made physical barriers shall not be located where improper operation or maintenance of such structures could permit the waste, leachate, or gases to contact usable ground or surface water.

(i) Sites which comply with a,b,c,e,f,g, and h but would be subject to inundation by a tide or a flood of greater than 100-year frequency may be considered by the regional board as a limited Class I disposal site.

The other sites comply with the criteria and are licensed by their individual state or local permitting authorities.

These landfills range in size from 32 acres to 1,300 acres. However, the areas of each site which are currently active range from one to 300 acres. Most of the landfills were indicated to have sufficient operating capacity for expansion and operating lives in excess of 10 years.

A site-by-site listing of pertinent information is given in Appendix C. This data was gathered from both the 1975 and 1977 Survey of Hazardous Waste Management Facilities, and from phone contacts with knowledgeable personnel at each site.

2.4.4 Costs of Chemical Waste Landfill Disposal

Costs for disposal in chemical waste landfills are highly variable and are dependent on location and area serviced. Landfills in California are county-operated to service specific nearby locales and have relatively low charges plus additional state fees.

Sites which service a number of states typically charge from $1.00 to $10.00 per cubic foot of material disposed including freight and imposed state fees. The lower costs are largely attributable to California and the West where climate and geology allow location of Class I landfill sites close to the counties which are serviced. The facilities in the East must provide impermeable liners and more stringent monitoring and leachate controls, thus making disposal more expensive.

A representative average cost of $3.00 per cubic foot is felt to be a reasonable nationwide average for the disposal of PCBs in chemical waste landfills. Although the specific requirements in the proposed regulation may result in one or more of the currently operating landfills not being able to accept PCBs, no major impacts of the regulation on the availability or costs of such disposal is anticipated.

2.5 Incineration

2.5.1 Existing Incinerator Facilities

2.5.1.1 Liquid Waste Incinerators

During the performance of Task II under this contract, it was determined that the facilities listed on Table 2-1 are the existing commercial scale incinerators which are capable of handling PCBs liquid wastes.

Monsanto has a John Zink designed, forced draft incinerator at Sauget, Ill. that vaporizes the PCBs liquids and waste oils and maintains a turbulent burning gas at 2200°F for about 2 seconds. General Electric at Pittsfield, Mass. uses a John Zink designed, induced draft incinerator with a combustion temperature of 1600°F to 1800°F and a residence time of 3 seconds or longer depending on the concentration of PCBs in the industrial oil.

Rollins uses specially designed units at three locations: Bridgeport, N.J., Deer Park, Texas, and Baton Rouge, La. Rollins' basic incinerator is a Dow design; however, reportedly, since 1972 Rollins has made significant modifications to the incinerator-scrubber unit. The Rollins unit includes a solids burning rotary kiln that exhausts to an afterburner plus a liquid turbulent burning chamber which also exhausts to the afterburner. Liquids can be burned either in the liquid chamber or in the kiln. The afterburner is 40 feet long and is followed by a hot duct of about equivalent length that allows further combustion. Rollins claims an overall residence time of 3 to 4 seconds, at a minimum temperature of about 2400°F at the aft end of the hot duct. The gases then go to a Venturi scrubber and a tower scrubber for cooling and neutralization.

The Dow Chemical Plant in Midland, Michigan operates four liquid combusters to destroy in-house industrial liquids.

Liquid PCB wastes as handled by the commercial disposers are normally diluted with waste solvents to a 5-10 percent by weight PCB level, prior to incineration. Average heat of combustion of the blended

TABLE 2-1

Existing PCBs Liquid Waste Incinerators

Facility Location	Annual Capacity[5] liters (gallons)	Typical Operating Temperature Range	Residence time, sec.	Typical Feed Rate lpm(gpm)	Air Pollution Controls	Draft	Approximate System Cost, $ (cost basis)
G.E., Pittsfield, Mass.	Up to 8×10^6 [1] (2.1×10^6)	871-1093°C (1600-2000°F)	1 to 12	Up to 15.1 (4)	Packed Tower Scrubber	Induced	450,000 (1974)
Chem-Trol Model City, N.Y.	Up to 27.8×10^6 [7] (7.4×10^6)	1482°C (2700°F)	2.5	Up to 52.9 (114)	Scrubber	Forced	---
Rollins[2] Environmental Services	Up to 31.8×10^6, each (8.4×10^6)	1316-1370°C (2400-2500°F)	3-4	Up to 60.5 (16)	Afterburner, Venturi Scrubber, & a Packed Tower Scrubber	Forced	2,500,000 (1974)
Dow Chemical[3] Midland, Mi.	51.5×10^6 [4] (13.6×10^6)	982°C (1800°F)	<2	~31.1 (~8)	High Pressure Venturi with Demister	Forced	---
Monsanto Sauget, Ill.	2.4×10^6 (0.63×10^6)	1093-1204°C (2000-2200°F)	2+	7.6 (2)	High Pressure Venturi Scrubber followed by a Packed Tower Scrubber	Forced	790,000 (1970)[6]

Notes: (1) Industrial oil which is contaminated with approximately 2 wt% PCBs.

(2) Three identical units (kiln, liquid destruction chamber & an afterburner) located one each at Bridgeport, N.J., Deer Park, Texas and Baton Rouge, La.

(3) Four combusters to destroy in-house industrial liquids.

(4) Estimated capacity of the four combusters.

(5) There are differences of opinions as to optimum temperature level and residence time for PCBs incineration. Capacities given are reported values based on incineration of undefined feedstocks. The capability of these units for PCBs destruction can be only determined if a given doctored feed and a specific test plan is used to evaluate and compare the performance of these units.

(6) An additional $160,000 was spent for modification during 1970-74.

(7) This unit has been shut down since 1974. Chem-Trol ships liquid PCBs to the St. Lawrence Cement Co., Mississauga, Ontario, Canada, as blends in waste solvents, to be destroyed at that facility. Solid PCB wastes shipped to Chem-Trol are landfilled in 55 gallon drums.

material is 9-10,000 BTU/lb. Monsanto has been burning liquid PCBs on an as-received basis. General Electric has been burning PCB-waste oil mixtures (as a supplemental fuel to natural gas), with PCB concentrations as high as 20% by weight. General Electric has been successfully burning 1260 type Aroclor with 60% chlorine content; this is believed to be the most refractory material being destroyed by incineration.

The incineration units described above can be categorized as liquid injection type incinerators. Injection type incinerators increase the rate of vaporization and thus combustion by atomizing the liquid waste to create a larger heat transfer surface area. Normally, this is done by means of internal mixing nozzles and steam atomization. Forced draft and/or induced draft is supplied to the combustion chamber to provide the necessary mixing and turbulence.

The General Electric, Monsanto and Rollins facilities are examples of vortex combusters. Such units typically feature very high heat release rates e.g., 100,000 BTU/hr - ft^3. In operation the ignition chamber is preheated and the waste and primary air are introduced in such a manner as to create a vortex which is maintained through the length of the combuster.

2.5.1.2 Solid Waste Incineration

General Electric's incinerator at Pittsfield, Mass. has partial solid waste incineration capability. This facility can handle PCB soaked transformer internals in a high temperature incapsulator for waste incineration and copper recovery. This unit destroys paper, rags cardboard and the like but it does not handle fuller's earth contaminated with PCBs (used for PCBs filtration), contaminated dirt and similar materials.

Rollins uses their Bartlett-Snow tumble burners (the rotary kilns) for handling solid wastes of almost all types. For PCBs contaminated materials, the kiln is operated at 2200°F. The gases from the kiln pass to the afterburner operating at a temperature of 2500°F. They exit the

the afterburner to a long hot duct that completes combustion and maintains the temperature to 2400°F until the gases enter the Venturi scrubber. Rollins accepts solid wastes which are packed in 35 or 47 gallon lined fiber packs, or in standard steel drums. Solid PCB wastes are fed to the tumble burner only in the fiber packs. The liquid contents of steel drums are mechanically transferred to a storage tank prior to blending and incineration. Rollins will not accept impact sensitive, radioactive materials, or heavy metals concentrations in the PCBs wastes of generally greater than 25 ppm. As a general rule, Rollins will accept solid wastes which are packed according to the latest ICC tariff for hazardous materials.

2.5.1.3 Costs of PCBs Incineration

Current toll charges for disposal of PCBs by incineration are as follows:

Disposal Facility	PCBs Waste	Toll Incineration Charge(1)
Monsanto, Sauget, Illinois	Liquid	10¢/lb(2)
Chem-Trol, Model City, N.Y.	Liquid	7-9 1/2¢/lb(3)
General Electric, Pittsfield, Mass.	Liquid	10¢/lb
Rollins Env. Services, Bridgeport, N.J., Baton, Rouge, La., Deer Park, Texas	Liquid Solids	10-14¢/lb $40/drum (35 gal. fiber packs)

(1) Does not include transportation or drum handling charges. Complete schedules of toll charges for Chem-Trol and Rollins are included in Appendix D.

(2) Regardless of quantity (minimum charge is $10.00). There is also an $8/drum handling charge. Customer pays freight.

(3) Some of the liquid PCBs are incinerated at the St. Lawrence Cement Co. facility in Mississauga, Ontario, with the balance being landfilled at Chem-Trol's Wilsonville, Illinois, chemical landfill.

2.5.2 Comments on Draft Liquid PCBs Disposal Regulations

The draft liquid PCB waste incineration regulations (Sec. 761.40) provide for the following combustion criteria:

A. Maintenance of the introduced liquids for a 2-second dwell time at 1200°C (± 100°C) and 3 percent excess oxygen in the stack gas, or

B. Maintenance of the introduced liquids for a 1 1/2 second dwell time at 1600°C (± 100°C) and 2 percent excess oxygen in the stack gas.

C. Combustion efficiency shall be at least 99 percent based on:

$$\text{Combustion Efficiency} = \frac{Cco_2 - Cco}{Cco_2} \times 100$$

where:

Cco_2 = concentration of carbon dioxide
Cco = concentration of carbon monoxide

Comments on these and other parts of this section are presented below:

2.5.2.1 Rollins Environmental Services, Inc.

This commercial disposer believes that the proposed temperatures and dwell times, while in the right range, represent a "tight" condition, i.e., they would rather see a minimum combustion temperature of 1316°C (2400°F) (which their equipment is capable of maintaining) and 3-4 seconds dwell time as a minimum. They seriously question the availability of equipment for continuous trouble-free monitoring of oxygen, carbon monoxide and carbon dioxide. They believe that a suggested 1 ppb PCBs[(1)] level in the scrubber waste water is achievable by use of a water cleanup system such as activated carbon or ozonolysis. They have never encountered CO in the incinerator stack gas, so maintenance of at least 99 percent combustion efficiency is not a problem.

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(1) Not in the draft PCB disposal regulations.

2.5.2.2 General Electric Co., Pittsfield, Mass.

This General Electric division has been disposing of waste liquid PCBs by incineration since 1972 both for themselves and for other divisions of the company. Their experience with liquid PCB incineration indicates that given the proper incinerator geometry and flame distribution and properly blended PCB-fuel feed, a combustion temperature of 871-982°C (1600-1800°F) with a minimum 3 second dwell time will effectively destroy PCBs. A combustion temperature below 1093°C (2000°F) would limit NO_x generation, permit the use of standard refractory firebrick (rather than the very costly high temperature brick), and result in longer equipment life. This unit has operated 24 hours per day, 7 days per week, for approximately 5 years at an average feed rate of 60 gallons per hour with a total replacement of 40 individual firebricks during this time.

Another important consideration in PCB incinerator operations, according to G.E., is the type of air movement used, e.g., induced draft versus forced draft. An inspection of Table 2-1 shows that only G.E.'s incinerator is of the induced draft type. This mode of operation, where the incinerator is always under slight negative pressure, prevents the penetration of HCl through the firebrick which would otherwise cause extensive corrosion of the metal incinerator shell. This type of corrosion was observed on the Chem-Trol incinerator during a recent visit to the Model City facility by Versar personnel. The shell had become so badly pitted that a steel "bandage" had to be placed around a portion of the unit.

General Electric believes that more realistic criteria for disposal of liquid PCBs by incineration should include:

a) Limits on PCB level of gaseous emissions
b) Limits on PCB level in scrubber water effluent

In effect these two limits define a "destruction efficiency".

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(1) Office of Solid Waste Management Programs, U.S. Environmental Protection Agency, Hazardous Waste Management Facilities in the United States (EPA/530/SW-146.3), NTIS PB-262 917/8WP, January 1977.

2.5.3 New Incinerator Facilities

Based on the latest EPA national survey of commercial hazardous waste incineration facilities, there are approximately twenty liquid waste incineration operations which will not or do not handle PCBs.[1] There are three installations which presently have the capability of handling both solid and liquid PCB wastes and which have the presently required environmental approvals. There are two installations which have liquid PCB incineration capability and one installation with both solid and liquid PCB waste incineration capability which are awaiting state operating permits. There is one facility, presently shut down, which has state authorization (as of 1974) to dispose of liquid PCB wastes. The two liquid PCB waste incineration operations carried on by industry - General Electric at Pittsfield, Massachusetts[1] and Monsanto at Sauget, Illinois, will be both shut down well before the proposed disposal regulations take effect. Various technical and economic factors will affect incinerator design once the proposed new regulations take effect.

2.5.3.1 New PCBs Incinerator Design Bases

The three currently operating incineration facilities with both liquid and solid PCB disposal capabilities are all owned by Rollins Environmental Services, Inc. These units are located in Logan Township, N.J., Baton Rouge, Louisiana and Deer Park, Texas, and each serves a five to six state area. Data from a recent test burn of shredded capacitors at the Deer Park (Houston) facility indicated that this unit processed approximately 700-800 pounds per hour of shredded capacitors containing 20 percent PCBs.[2] This burn resulted in a PCB destruction efficiency of greater than 99.99 percent. The residue from the burn contained approximately 0.1 ppm PCBs. Total dwell time was 2.5 seconds and combustion temperature ranged from 2,000 to 2,400°F. Number 2 fuel oil was used for a heat supply and 1.3 gallons of fuel oil was consumed per pound of PCB contaminated waste feed. A test burn

(1) This facility is scheduled to cease PCB incineration as of April 15, 1977.
(2) Personal Communication, Mr. Gene Crumpler, USEPA, OSW, March 10, 1977.

was also conducted on whole capacitors. PCBs level in the gaseous emissions during this test was less than 0.001 gm/kg of feed. However, the solid residues had close to 500 ppm of PCB making this material unacceptable for disposal in a sanitary landfill according to the proposed EPA disposal regulations. Based on this admittedly limited data, it is believed that the PCB capacitor disposal operation should be conducted with shredded feed material. Figure 2-1 presents a schematic of the Deer Park test PCB burn.

In order to conform to the proposed incineration regulation, the Deer Park unit would have to be modified with suitable instrumentation to continuously measure the concentration of carbon dioxide, carbon monoxide, and oxygen in the stack emissions. In addition, suitable milling equipment would be required to be installed in order to supply the shredded capacitor feed to the Houston unit.

Rollins personnel believe that an improved shredding action is needed to break up the capacitors prior to incineration.(1) The Gruender hammer mill used to prepare the Houston feed caused a great deal of spraying and fragmenting of the PCBs and PCB-bearing material during the pulverizing operation. Rollins favors a tearing or shredding operation, such as provided by a finger-like or claw-like action which imposes more torque and less impact energy in comparison to a hammer mill. They are evaluating other shredders, and expect to make a decision on acquisition of a shredding unit in the near future. Improved shredding is expected to increase incineration capacity significantly. Estimates are as high as 5,000 #/hr, but tests are needed to find out just how much of a gain can be made. Rollins is also considering running two rotary kilns in parallel feeding the rest of the incinerator train in order to double the capacitor handling capacity.

The scrubber water discharge from the Deer Park test burn contained 5-10 ppb of PCBs. This concentration range is given as representative of the three Rollins operations.(1) A 1 ppb PCB level in the

(1) Personal Communication, Mr. C. E. Ashby, Rollins Environmental Services, Inc., Logan Township, N.J., March 21, 1977.

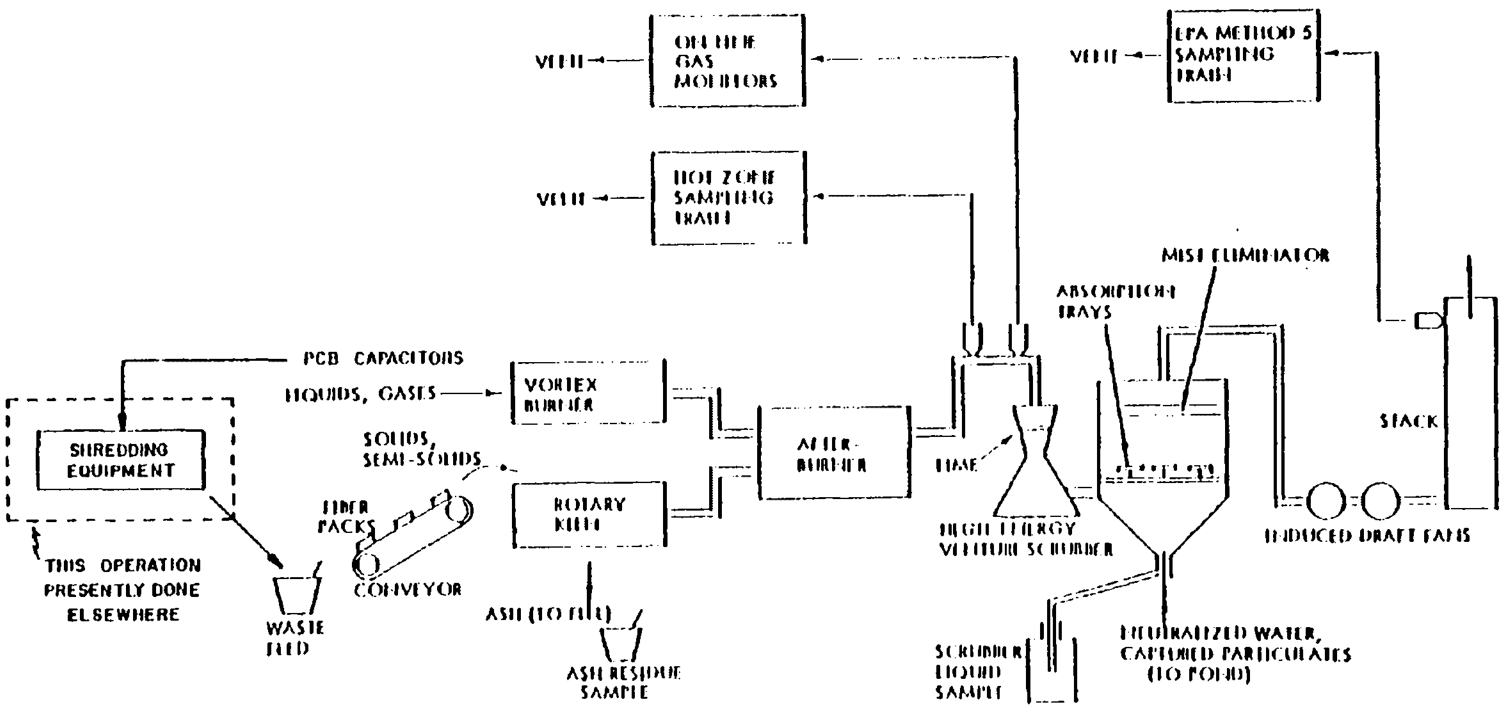

FIGURE 2-1 SCHEMATIC OF ROLLINS ENVIRONMENTAL SERVICES INCINERATOR AT HOUSTON SET UP FOR PCB CAPACITORS TEST BURN

Source: TRW Systems Group, Destructing Chemical Wastes in Commercial Scale Incinerators, Facility Test Plans, Vol II, (NTIS PB-257 710), July, 1975, page 26.

effluent is believed to be practicably attainable through the use of activated carbon treatment.[1] Equipment for this purpose would include a fixed bed system containing activated carbon and suitable filtration equipment to remove particulate from the feed to the carbon bed. The spent carbon would be incinerated in the rotary kiln unit after suitable dewatering.

2.5.3.2 New PCB Incinerator Facility Cost Estimate

A preliminary estimate for the cost of a complete shredded capacitor disposal unit based on the Houston design is $5 million, installed. Such a unit would be capable of processing 3000 lb/hour of shredded capacitors.[2] The same unit could handle 500-1000 lb/hour of liquid PCB wastes as a blend in the fuel feed to the incinerator. A breakdown of the investment cost for the dual purpose unit is shown in Table 2-2. The annual costs of operation have been determined based on data from the Houston facility test burn of shredded capacitors and engineering estimates, and are tabulated in Table 2-3. All costs shown are in 1977 dollars.

The unit cost of 52 ¢/lb. for solid PCB waste disposal represents an upper bound for this cost. The major cost item involved - fuel cost, can be averaged down by using inexpensive waste solvents as fuel. This is the current practice of commercial incineration facilities.[2]

Figure 2-2 is a plot of PCB solid waste incineration capacity versus total annual operating cost. A 0.6 exponent was used to adjust the respective plant investment costs. Inspection of Figure 2-2 indicates a rapid rise in total per pound cost above a plant capacity of 2000 lb/hour of solid PCBs. Operating cost becomes relatively insensitive to plant capacity above a rate of 4000 lb/hr.

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(1) Personal Communication, Mr. Richard Fusco, Calgon Corp., Pittsburgh, Pa., March 30, 1977. This statement is qualified by the need for experimental verification using the actual scrubber water effluent.

(2) Personal Communication, Mr. C. E. Ashby, Rollins Environmental Services, Inc., Logan Township, N.J., March 21, 1977.

Table 2-2

Preliminary Engineering Estimate of a Dual Purpose PCBs Incineration Facility

Plant Capacity: 3000 lb/hr shredded PCB capacitors
500 lb/hr PCB liquids

Equipment		Installed Cost
Shredding and Solids Conveying Equipment		100,000
Rotary Kiln, Afterburner, Liquid Combustor and Associated Ducting		2,000,000
Scrubbing Equipment, Tankage, Pumps		500,000
Stack, Foundations, Site and Site Preparation		150,000
Activated Carbon Treatment System including Activated Carbon Beds and Filtration System		250,000
Settling Pond System		100,000
	Sub-Total	3,100,000
Piping and Valves @ 25%		775,000
	Sub-Total	3,875,000
Engineering @ 7%		270,000
	Sub-Total	4,145,000
Contingency @ 20%		830,000
	Total	4,975,000
	Say	$5,000,000

Table 2-3

Annual Operating Costs for PCB Capacitor Incineration

Plant Capacity: 3,000 lb/hr of shredded PCB capacitors
500 lb/hr of PCB liquids

Operating Factor: 7300 hours/yr

Capital Investment:	$5,000,000
Variable Costs	
Fuel Oil (#2) 21,900,000 gal, @ 40¢/gal(1)	8,760,000
Direct Operating Labor, 2 men/shift @ $9/hr	157,000
Supervision and Administrative @ 50% of direct operating labor	79,000
Activated Carbon System(2)	122,000
Maintenance @ 20% of capital investment	1,000,000
Power, 100,000 kwh @ 3¢/kwh	3,000
Sampling and Analysis	100,000
Waste Disposal, 9,000 TPY @ $10/ton(3)	90,000
Total Variable Costs	10,311,000
Fixed Costs	
Capital Recovery Rate (10 yrs @ 10%)	814,000
Taxes and Insurance @ 4% of capital cost	200,000
Total Fixed Costs	1,014,000
TOTAL ANNUAL COST	11,325,000
Cost/lb of PCB Solid Waste $0.52	

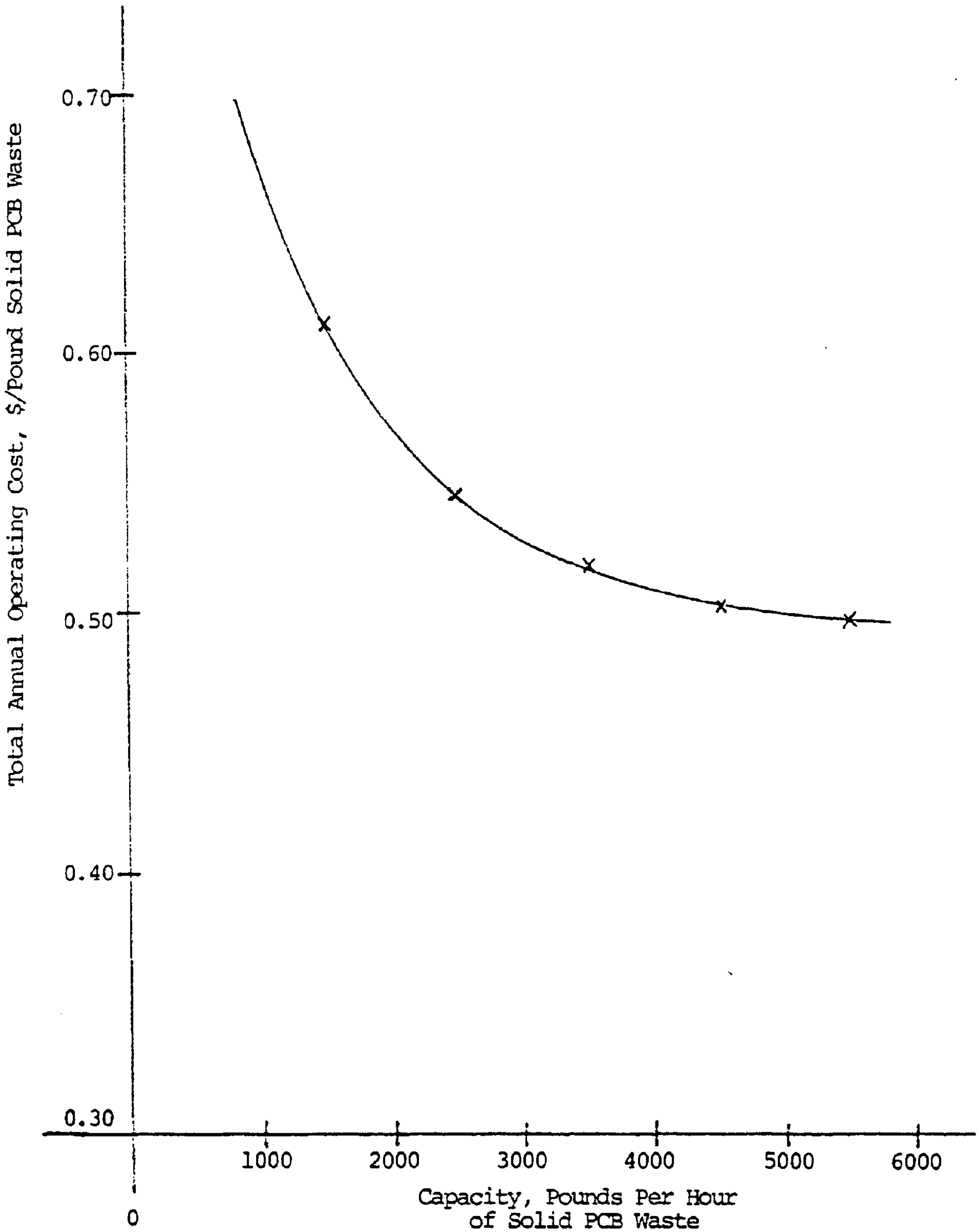
(1) Assuming a 1:1 fuel oil/solid PCBs feed ratio. This is approximately 30% lower than data from recent EPA sponsored test of incinerating shredded capacitors by Rollins at Houston.

(2) This includes replacement of 43,000 lb/yr of spent activated carbon and incineration of the spent carbon in the PCBs facility.

(3) Assurances were given by the EPA that the ash disposal requirements in the draft regulation would be revised to allow sanitary land-fill disposal of ash having insignificant levels of PCBs.

Figure 2-2

PCBs Incineration Cost as a Function of Plant Capacity



2.5.3.3 Factors Affecting Expansion of Commercial Incineration Facilities

RES, Inc. (Rollins) appears to be the only commercial waste disposer with currently available incineration capacity and know-how to handle PCB solid wastes. Rollins is ready to consider building new incineration facilities when market research shows that the economics are favorable, that the states are going to enforce hazardous and toxic substance regulations and restrict landfill uses, and where the local political climate is favorable to the establishment of a modern waste treatment facility. Rollins estimates that new facilities could be installed and running at their existing installations by early to mid 1979 assuming immediate assurances from EPA as to the "teeth" in the proposed new PCB disposal regulations.

For any new incineration facility installed anywhere in the country, approval of an environmental impact statement, and obtaining of local and state approvals, could cause delays of from one to two years before orders could be placed for equipment. It would seem probable that the best course of action for near-term disposal of significant amounts of PCB solid wastes by incineration would be the expansion of existing facilities even though this would entail excessive transportation costs for waste generators located at considerable distances from these sites.

2.5.4 Cement Kiln Operations

The possibility of disposing liquid PCBs in existing cement kiln operations needs to be evaluated as an alternative to incineration in the relatively few incinerators meeting EPA's proposed disposal requirements. Cement kilns normally operate at 3000°F flame temperature and dwell time of a few seconds to as much as a minute. Preliminary tests at the St. Lawrence Cement Co., Mississauga, Ontario, Canada, have been conducted during 1975 and 1976 under the sponsorship of the Canadian Environmental Protection Service, using mixtures of highly chlorinated hydrocarbons (including up to

50 per cent PCBs) as partial fuel input to the cement kiln.[1,2] These materials were destroyed in the cement kiln with at least 99.98 per cent efficiency in all cases. Emissions of high molecular weight chlorinated hydrocarbons were not detected. Tentative recommendations are:

(a) Chlorinated hydrocarbon wastes may be used in cement kilns, replacing other forms of chloride ion (such as calcium chloride) used for reduction of alkali content.

(b) A small proportion of fossil fuel required for cement manufacture is conserved through use of these materials.

(c) Burning chlorinated hydrocarbon wastes is considered a valuable means of destroying persistent and toxic forms of pollutants while recovering useful heat values.

Recent test runs at the Peerless Cement Company, Detroit, Michigan, have confirmed the St. Lawrence Cement Co. results.[3] In the Peerless tests, waste Aroclor 1260 from the Detroit Edison Co. was injected directly into the hot zone of a wet process cement kiln. There was no detectable increase in stack PCB emissions over background levels.

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(1) McDonald, L.P., (St. Lawrence Cement Co.), D.J. Skinner (Environmental Canada), F.J. Hopton and G.H. Thomas (Ontario Research Foundation), Burning Waste Chlorinated Hydrocarbons in a Cement Kiln, for the Petroleum and Industrial Organics Chemicals Division, Water Pollution Control Directorate, Environmental Protection Service, Environment Canada, Report No. EPS 4-WP-77 (unpublished report) 1977.

(2) As a result of the incineration studies at the St. Lawrence Cement Co., Chem-Trol Pollution Services (one of the participants in these studies) has received a U.S. Patent No. 4,001,031 covering the use of chlorinated hydrocarbons as a blending material in the cement kiln fuel. The basic claim of this patent is that the potential K_2O content of cement clinker due to the presnece of potassium compounds in the raw feed mix is substantially eliminated by introducing a chlorinated organic waste product into the kiln along with or in conjunction with the fuel used to fire the kiln. The destruction of the chlorinated material in the kiln liberates HCl which is effective converting K_2O to KCl.

(3) Personal Communication, Mr. Myron W. Black, Dir. of Env. Control, Peerless Cement Co., Detroit, Michigan to Mr. Karl Bremer, USEPA Region 5, Chicago, Illinois, March 7, 1977.

There are relatively few cement kiln operations which could employ waste liquid PCBs as a fuel blend in their operations (most cement kilns are now coal-fired) and which would benefit from reduction in calcium chloride requirements. Preliminary discussions with industry representatives indicate that there could be a problem of handling the highly toxic PCBs (prior to injection in the cement kiln) by operators not familiar with the hazards of these materials. Also, there would be a marked increase of volatile alkali chlorides in the electrostatic precipitator dusts. These dusts are reused in some plants and appreciable concentrations of alkali chlorides limit the use of the recycled material. Some corrosion problems could also develop in dust collection ductwork and in chain sections. The waste liquid PCBs would be most advantageously employed in those kilns using fuel oil as a source of heat input.

The measurable benefits of PCB liquid incineration may be marginal to cement kiln operations, primarily resulting from slightly reduced fuel costs. The only clear-cut benefit is in providing additional incineration capability for the waste liquid PCBs. The potential disposal rate for waste liquid PCBs is approximately 18,000,000 pounds per year over the next few years, with a gradual decline thereafter. Current disposal charges are in the 10-15 ¢/lb range. Commercial incineration of liquid PCBs is therefore a substantial potential source of revenue for cement kiln operations.

2.5.5 Power Boilers

Tests have been conducted to determine the feasibility of PCB destruction in a power boiler.(1) This unit apparently has no flue gas scrubbing equipment so that PCBs level in power boiler scrubber water could not be determined. The PCB concentration in the boiler fuel feed was approximately 4 ppm. Only liquid PCBs were incinerated.

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(1) Environmental Science and Engineering, Inc., Report on PCB Emissions From Sanford Unit No. 4, Florida Power and Light Company, May 1976.

The PCB incineration results are considered preliminary as the various parameters affecting PCB destruction efficiency, i.e., boiler feed composition and rate, and ash analysis were not sufficiently evaluated. Combustion temperature and dwell time appear to meet the proposed EPA disposal regulations.[(1)]

2.5.6 Sewage Sludge Incineration of PCBs

A review of test data[(2)] indicates that destruction of liquid PCBs by co-incineration with sewage sludge is not desirable in that the average combustion temperatures achieved in this operation (950°-1,150°F) are sufficient to insure 99.99% destruction efficiency of the PCBs. Criteria for destruction of PCBs in sewage sludge at levels of ~25 ppm, dry basis, are discussed in the Federal Register of Thursday, June 3, 1976, Part IV.[(3)]

2.5.7 Incinerator Ships

Incinerator ships (as exemplified by the ship M/V Vulcanus sailing under Dutch registry) can only operate with favorable logistics when large loads of liquid incinerables are available at one time at a port. The Vulcanus handles 4,000 metric tons per day. The full charge for a recent burn of waste chlorinated hydrocarbons for Shell Chemical Co., Deer Park, Texas, on the Vulcanus was $72/metric ton (~40¢/lb).[(4)]

Since the ship's incinerator operations are carried out many miles from land, there is no need for scrubbing of the gaseous pollutants such as HCl. The Vulcanus has not yet incinerated any liquid PCBs.

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(1) Personal Communication, Mr. Tom Fair, Florida Power and Light Company, Miami, Florida, March 23, 1976.

(2) Versar Inc., Destruction of Polychlorinated Biphenyls in Sewage Sludge During Incineration, NTIS PB 258 162, 1976.

(3) U.S. Environmental Protection Agency, Municipal Sludge Management; Environmental Factors, 41 FR 22531 (June 3, 1976), page 22536.

(4) Personal Communication, Mr. Neighbors, Universal Shipping, Arlington, Va., March 17, 1977.

2.6 Transportation Costs

Unit transportation costs depend on mode, region, distance, size of shipment, type of material or product, and exact city-pair for departure and arrival.

In this study the main concern is with trucking 55 gallon steel drums of:

PCB liquids from draining transformers
Solvents used to flush drained transformers
Rags, sawdust, etc. used to soak PCB spills

2.6.1 Trucking Costs

The American Trucking Association's Classification Board has assigned the following codes to materials and articles of interest in this study:

capacitors	61,400	
transformers	63,420	
used electric motors	62,580	
fluorescent fixtures	109,830	
electrical oils	155,250	if derived from petroleum
	43,940	for chemicals not otherwise indexed

2.6.1.1 Shipments of Liquid PCBs

One 55 gallon drum of PCB liquids will have a net weight (not including the container) of 55 x 11.5 lbs or 632.5 lbs. Shipments of 500-100 lbs for 0-100 miles cost $4.75 per one hundred pounds in the Mid-Atlantic Conference. Thus a single drum of PCB liquids weighing 45 lbs empty and 632.5 + 45 filled or 677.5 lbs gross weight will cost $32.18 for a trip up to 100 miles. The rates per drum do not increase proportionately with increasing quantities or distance of shipment. The rates for various size shipments of drums of liquid PCBs for distances up to 500 miles are summarized in Table 2-4 and Figure 2-3.

Table 2-4

Truck Freight Charges for Single Drums of Transformer Oils

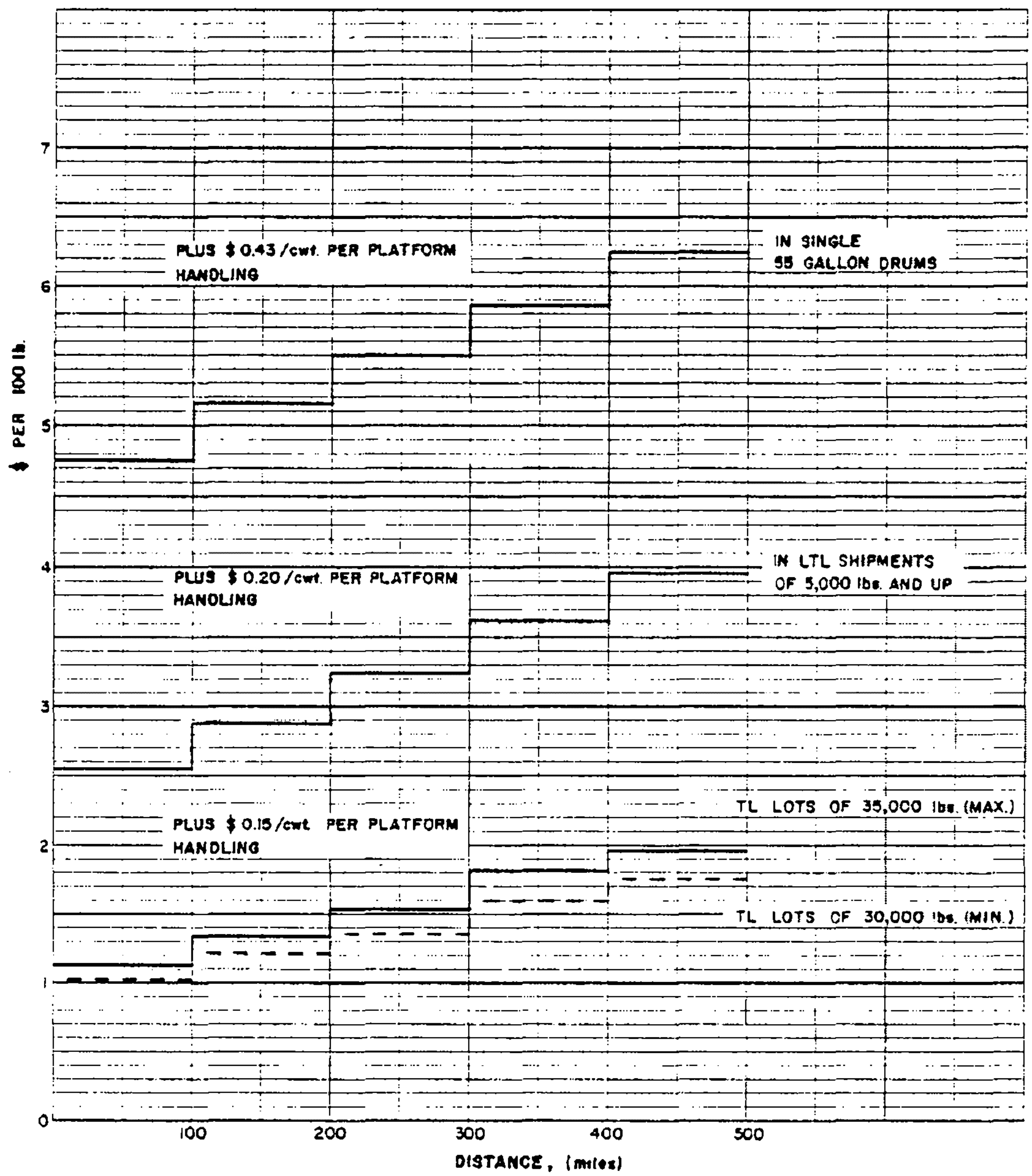
Distances	Mid-Atlantic Conference $/100 lb	Total Charge for 677.5 lbs.
0-100	$4.75	$32.18
100-200	5.16	34.96
200-300	5.51	37.33
300-400	5.87	39.77
400-500	6.24	42.28

Truckload Rates:	TL $/100 lb	30,000 lb Minimum $/100 lb
0-100	1.14	1.01
100-200	1.34	1.21
200-300	1.54	1.37
300-400	1.81	1.60
400-500	1.97	1.73

Less than truckload rates for 5000 lb. shipments and up

	LTL $/100 lb
0-100	2.53
100-200	2.89
200-300	3.23
300-400	3.62
400-500	3.96

Source: S.G. Harold, Exec. V.P., Middle Atlantic Conference and I.C.C. Statement No. 2C1-75



SOURCE: S.G. HAROLD, EXEC. V.P., MIDDLE ATLANTIC CONFERENCE
AND I.C.C. STATEMENT NO. 2C1-75

Figure 2-3

Trucking Charges for Transformer Oil
by Type of Shipment and Distance

Even lower shipping costs for liquids would result from shipping 5000 gallon tank truck lots. The savings are achieved both in the elimination of the expense of buying (and disposing of) drums, and in lower transportation and handling charges. The tank truck rates for liquid PCBs are summarized in Figure 2-4.

2.6.1.2 Shipments of Capacitors and Transformers

The truck transportation rates for shipments of capacitors and transformers are summarized in Figure 2-5.

2.6.2 Platform Costs

In addition to charges for intercity hauling, there may be significant charges for handling at the origin, destination or intermediate interchange point. The latter are more likely to occur when two commercial haulers are involved because of limitation on the routes each may service.

Unit costs for one platform handling for one drum at 677.5 lb in the Middle Atlantic Region[1] would be 43.2¢ per one hundred pounds or $2.85 per drum.[2] Thus one commercial platform handling increases the costs by 13%, two by 26% and three by 39%. Presumably, similar real costs would be incurred in private, non-commercial loading and unloading, except for savings possible from use of less expensive non-union or under-utilized labor. Actually, handling at an interchange involves one unloading and one loading so the charge is roughly double that of one platform handling.

2.6.3 Other Factors Affecting Transportation Costs

It is significant that platform costs bear heavily on single drums and especially so if multiple handling is required. On the other hand,

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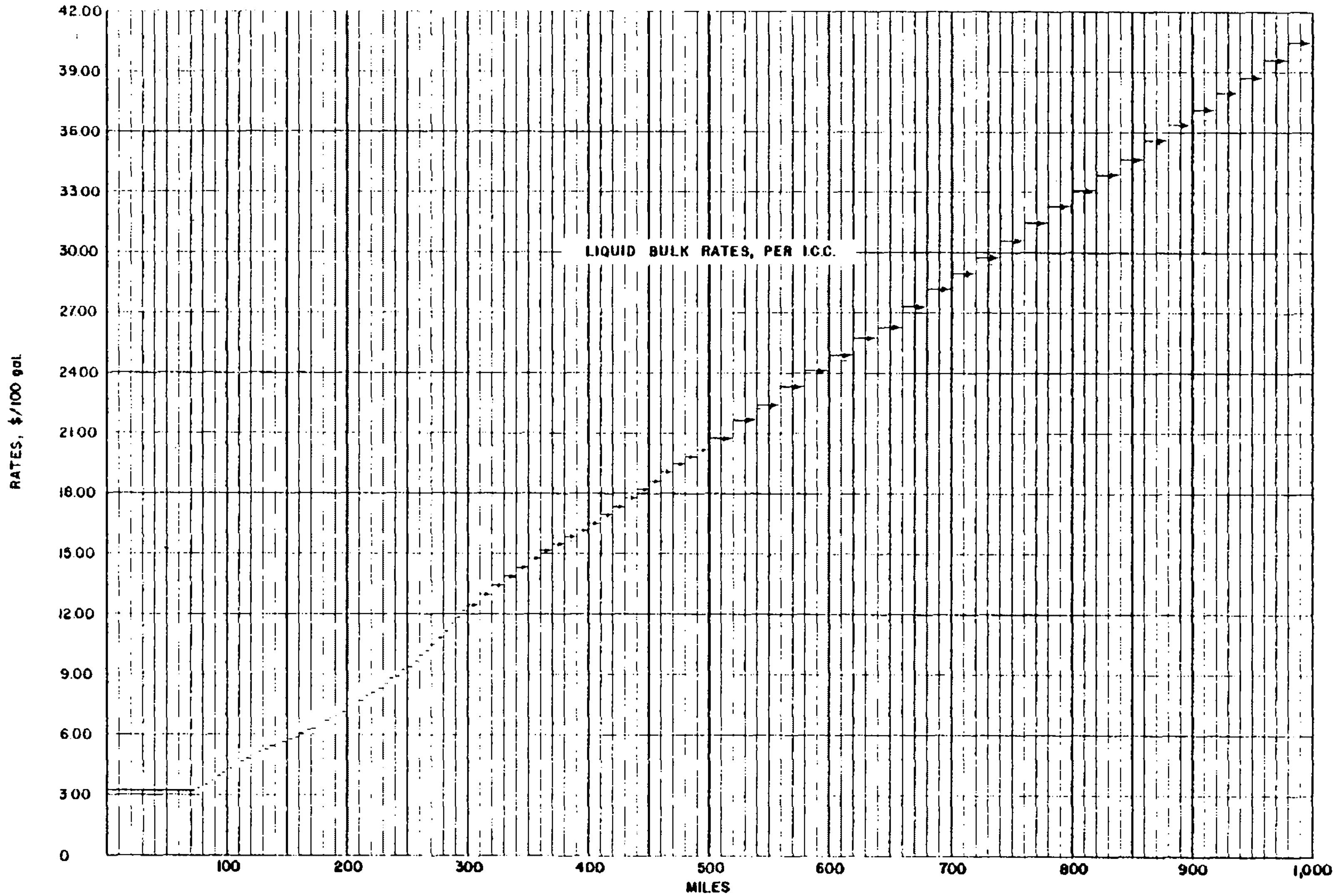
(1) This is one of the higher-cost regions and can be considered an upper bound.

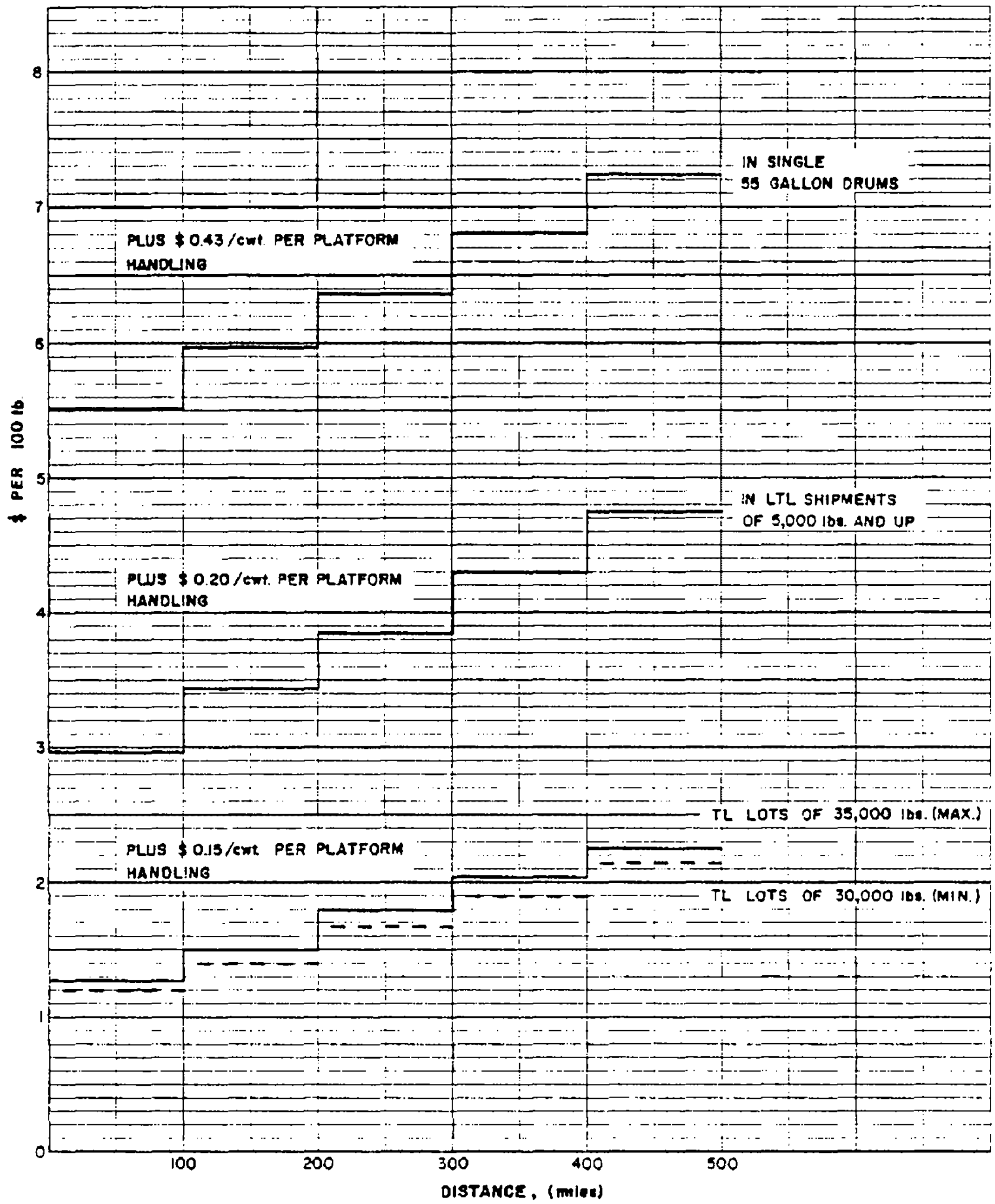
(2) Interstate Commerce Commission, Cost of Transporting Freight by Class I and II Motor Common Carriers of General Commodities, 1975, Bureau of Accounts Statement No. 201-75, December 1976.



SOURCE: I.C.C. FREIGHT TARIFF 1005D

Figure 2-4

5,000 Gallon Minimum Bulk Shipments Electrical Oil
by Distance



SOURCE: S.G.HAROLD, EXEC. V.P., MIDDLE ATLANTIC CONFERENCE
AND I.C.C. STATEMENT NO. 2C1-75

Figure 2-5

Trucking Charges for Capacitors and Transformers
by Type of Shipment and Distance

truckloads of drums may involve no intermediate handling beyong exchanging motor-cabs. Also, the handling charges that are incurred are smaller. For example 5000 lb lots would be charged 19.5¢/per one hundred pounds per handling or 7.5% of 0-100 mile travel charge. At 400-500 mile distances the platform charge is 4.9%. Truckload lots incur 14.6¢/one hundred pounds for weights from 11,000 lbs to 30,000 lbs.

Collection points can be used to store capacitor solids and PCB liquids or solvents until at least 5000 lbs (8 fifty five gallon drums) are accumulated. Short trips to collection points may not be out-of-pocket costs at all. For example, a small business with a pick-up truck, van or even a station wagon could combine delivery of one 55 gallon drum with other routine business near the closest or most convenient collection point and experience no tangible costs. Only otherwise unused capacity is involved, so the opportunity costs are zero or very close to zero.

Trucking charges in rates per one hundred pounds or per 100 gallons increase almost linearly with distance and decrease with size of truck and shipment. Thus establishment of centralized collecting points and incinerator locations would minimize the length of haul for small shipments and maximize the size of shipment for long hauls. The problem with these prescriptions is that each of them increases the amount of storage required. Unfortunately, it turns out that storage is already the largest single cost before these trade-offs are considered.

2.7 Reporting and Record Keeping

The draft regulations impose record keeping and reporting requirements on incinerators, chemical waste landfills, large storage facilities, and major users of PCBs. The record keeping and monitoring costs for incinerators and chemical waste landfills have been implicitly included in the estimated disposal costs for PCBs by these methods. The proposed regulation does not impose any record keeping requirements on the million small storage areas which handle only small capacitors.

The 2000 large storage areas will be required to maintain a perpetual inventory of all items or containers in storage. Since the record for each item must include its weight, origin, and date of entry into the area, clerical costs of perhaps two dollars per item might be expected in addition to a cost of $200 per area to establish the record keeping procedure. In addition, the annual reports will require about one man week per facility ($400).

In addition, owners of transformers and large capacitors must maintain records as to their location, estimated date of retirement, and date of disposal. Costs of establishing such records might be expected to run $5 per transformer or high voltage capacitor location. Modification of the records to reflect retirement of equipment would cost about one dollar per item disposed of.

3.0 ECONOMIC COSTS OF THE DRAFT DISPOSAL REGULATIONS

3.1 Disposal Demand

The estimated amount (in pounds) of PCB electrical equipment requiring disposal in 1978 is summarized in Table 3-1.

The proposed regulation requires that all of this material be incinerated with the following exceptions:

- Transformers may be disposed in chemical waste landfills if they are flushed to remove at least 98 percent of the PCBs
- Capacitors may be disposed in chemical waste landfills until July 1, 1979
- Small appliance capacitors and fluorescent light ballasts in private residences may be disposed in sanitary landfills
- Small capacitors (and presumably fluorescent light ballasts and HID capacitors) need not be removed from equipment which is disposed in sanitary landfills.

Because of the higher costs of incineration, it may be assumed that few capacitors will be incinerated until after July 1, 1979. The upper bound estimates of incineration requirements are shown below in option 1 which assumes that all PCB capacitors are removed from equipment before it is scrapped. Option 2 is probably a more realistic estimate of disposal requirements as it assumes that 2/3 of all small appliance capacitors, HID capacitors, and fluorescent light ballasts are not removed from the equipment, but are disposed of as municipal solid wastes with the equipment. Option 2 still results in the requirement to incinerate large numbers of fluorescent light ballasts from commercial and industrial buildings. The PCBs in these ballasts are very well contained, and little migration would be expected in a landfill. Therefore, option 3 is suggested as a less expensive disposal alternative which differs from option 2 only in that it allows the continued disposal of fluorescent light ballasts in chemical waste landfills.

Table 3-1

Disposal Requirements for PCB Electrical Equipment in 1978, millions of pounds

	TRANSFORMERS			CAPACITORS				
Source	PCB Liq.	Solvent	Trans.	Large High Voltage	Flu Light Ballasts	Hi Intensity Light Ball.	Large Low Voltage	Small Appliances
Utilities	6.3	4.7	13.6	45.6	-	.3	1.3	-
Large Residential and Commercial	2.1	1.6	4.6	-	146.8	2	10	1.7
Industrial	2.1	1.6	4.6	2.4	30.4	7.7	10	-
Private Residential	-	-	-	-	9.5	Negligible	5.4	15
Total	10.5	7.9	22.8	48	186.7	10	26.7	16.7

The disposal requirements for the year following July 1, 1979, are summarized in Table 3-2 for each of these three options. As PCB electrical equipment is removed from service, the disposal requirements would be expected to decrease at a rate of about 7 percent per year.

The effect of the various options on the disposal of PCBs is summarized in Table 3-3.

3.2 Decontamination

We do not see much use of decontamination to reduce the PCB level in equipment because of the potential liability from accidental spills of PCBs.

There will be some initial decontamination of tank cars, tank trucks, and production machinery as production of new PCBs is phased out. This will not have a major effect on requirements for incineration or total economic impacts. Any decontamination of electrical equipment performed after this initial period will result in a slight decrease in the costs shown for incineration, but the effect should not be significant.

Effective decontamination has been achieved for drums and small containers contaminated with pesticides. The decontamination procedure requires triple rinsing of the containers with solvents which contain less than 0.05 percent of pesticide but have a solubility of 5 percent or more for the pesticide.(1) Each rinsing uses a volume of solvent equal to approximately 10 percent of the volume of the container, and the rinsing is accomplished by sloshing or otherwise forcing repeated contact of the container internal surfaces with the solvent. The efficiency of decontamination depends in part on the degree of solvent contacting and on the condition of the container surfaces being cleaned. After each rinse, the solvents are collected and incinerated. This procedure is believed readily adaptable for PCB containers.

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(1) Midwest Research Institute, Guidelines for the Disposal of Small Quantities of Unused Pesticides, EPA-670-2-75-057, Cincinnati, Ohio: National Environmental Research Center, U.S. EPA, June 1975.

Table 3-2
Annual PCB Equipment Disposal Requirements, after July 1, 1979: millions of pounds

	TRANSFORMERS			CAPACITORS								
				Disposal Option 1[1]			Disposal Option 2[2]			Disposal Option 3[3]		
Source	PCB Liq.	Solvent	Empty Trans.	MSW	CWLF	Incin	MSW	CWLF	Incin	MSW	CWLF	Incin
Utilities	6.3	4.7	13.6	–	–	47.2	0.2	–	47.0	0.2	–	47.0
Large Residential and Commercial	2.1	1.6	4.6	–	–	160.5	100.3	–	60.2	100.3	48.9	11.3
Industrial	2.1	1.6	4.6	–	–	50.5	25.4	–	25.1	25.4	10.1	15.0
Private Residential	–	–	–	29.4	–	0.5[4]	29.4	–	0.5[4]	29.4	–	0.5[4]
Total	10.5 (incin)	7.9 (incin)	22.8 (CWLF)	29.4	–	258.7	155.3	–	132.8	155.3	59.0	73.8

SLF = Sanitary Landfill
CWLF = Chemical Waste Landfill
Incin = Incinerate

[1] Incinerate all except for residential. MSW(residential): All except 10% of large low voltage capacitors (motor run, air conditioner, etc.) removed for replacement by service shops.
[2] MSW = 2/3 of flu light ballasts, HID, and small applicance capacitors; Incin – All HV and large LV+1/3 (flu lights + HID + small appl.)
[3] MSW = same as option 2; CWL = 1/3 of flu light ballasts; Incin = all HV and large LV+1/3 (HID + small appl.)
[4] 10% of large LV cap. removed by repair shops (central air cond., motors, etc.)

Table 3-3

Disposal of PCB Chemical Substance in PCB Equipment, after July 1, 1979: million lb/year

	TRANSFORMERS			CAPACITORS								
				Disposal Option 1[1]			Disposal Option 2[2]			Disposal Option 3[3]		
Source	PCB Liq.	Solvent	Empty Trans.	SLF	CWLF	Incin	SLF	CWLF	Incin	SLF	CWLF	Incin
Utilities	4.5	.2	.1	–	–	9.79	0.05	–	9.74	0.05	–	9.74
Large Residential and Commercial	1.5	.1	.05	–	–	6.78	3.35	–	3.43	3.35	1.40	2.03
Industrial	1.5	.1	.05	–	–	5.04	1.86	–	3.18	1.86	0.29	2.89
Private Residential	–			4.12	–	0.01	4.12	–	0.1	4.12	–	0.1
Total	8.	.4	.2	4.12 (16%)		21.71 (84%)	9.38 (36%)		16.45 (64%)	9.38 (36%)	1.69 (7%)	14.76 (57%)

SLF = Sanitary Landfill
CWLF = Chemical Waste Landfill
Incin = Incinerate

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[1] Incinerate all except for residential.
SLF (residential): All except 10% of large low voltage capacitors (motor run, air conditioner, etc.) removed for replacement by service shops.

[2] SLF: 2/3 of flu light ballasts, HID and small applicance capacitors
Incin: All HIV and large LV+1/3 (flu lights + HID + small applicances

[3] SLF: Same as option 2
CWLF: 1/3 flu light ballasts
Incin: All HIV and large LV+1/3 (HID + small appl.)

Complete decontamination of askarel transformers does not appear feasible. However, partial decontamination of askarel transformers which are being taken out of service is required. This can be achieved by thoroughly draining the askarel fluid from the transformer, followed by refilling with a solvent such as mineral spirits and recirculating for several hours. The solvent is then drained and incinerated. Preliminary results of a test which was performed by Westinghouse, sponsored by the Federal Railway Administration, and based on the above procedure, achieved a 99 percent reduction in the quantity of PCBs in the transformer. Transformers so treated may then be disposed in a chemical waste landfill.

The rinsing of transformers will generate a quantity of contaminated solvents equal in volume to that of the askarel drained from the transformer. A total of 36,500,000 gallons of solvent will eventually be required to flush the 140,000 existing askarel transformers. This solvent could cost as much as $.40 per gallon, but it is likely that waste mineral oil from scrapped oil-filled transformers would be used. The maximum annual cost for this solvent, assuming new kerosene is used, would be $365,000 per year. All of this contaminated solvent would require special incineration in a chemical waste incinerator or cement kiln. However, the energy value of the solvent would be high, and the incineration fuel costs should therefore be negligible.

Askarel transformers which are kept in service, but retrofilled with a silicone or other oil, should be thoroughly drained of askarel oil prior to refilling with replacement oil. Subsequent drainings and refillings of such transformers will require special disposal of the retro-fill oil. In the case of silicone oil, Dow Corning has reported that treatment with activated carbon will remove the PCBs and permit reuse of the oil. In the case of mineral oil, the initial retro-fill must be incinerated. Subsequent mineral oil retro-fills must also be incinerated unless the level of PCBs less than 500 ppm. The operation of the askarel transformer with replacement oils would result in the residual PCBs being leached out of the insulation. If, after draining the retro-fill oil, the residual levels of PCBs in the transformer weigh less than

.05 percent of the total weight of the transformer, the transformer need no longer be considered a PCB item for purposes of labeling or disposal.

3.3 Storage for Disposal

The draft regulation requires that each industrial and commercial facility that disposes of small capacitors such as fluorescent light ballasts must have a specially designated PCB storage area consisting of a specially marked steel drum. The number of such facilities could conceivably run into the millions, depending on how strictly EPA enforces the storage requirements. Undoubtedly, there will be substantial non-compliance by the smaller facilities. Therefore, it is probably safe to assume an upper bound estimate of one million such small storage facilities.

Large storage facilities will be required by electric utilities, major manufacturing facilities, transformer repair shops, and other concerns who have large capacitors, significant numbers of askarel transformers, or who service askarel transformers. The total number of such facilities required by electric utilities will be about 800 (see Section 4.2.2). There may be as many as 20 transformer repair shops that will require the large storage areas. A total number of 2000 such areas, including the utilities, is probably a realistic estimate.

The total attributable costs of the storage facilities are summarized in Table 3-4. As expalined in Section 2.3, these costs may be considerably in excess of the economic opportunity costs as much of the attributable costs may be for otherwise under utilized storage space and manpower.

3.4 Chemical Waste Landfill

The draft regulation allows the use of chemical waste landfills as the least expensive disposal alternative only for transformers that have been drained and partially decontaminated. Demand for such disposal in 1978 may be 22,800,000 lb at 100 lb/cubic foot. The total cost of landfill at $3.00/cubic foot would then be $684,000/year initially, decreasing thereafter at 7 percent per year.

Table 3-4

Economic Costs of Storage Facilities

Size	Type of Cost	$	Number of Facilities	Total
Small			1,000,000	
	Drum (initial)	25		
	First Year Administrative	80		
	Labor	10/year		
	Equivalent Rent	30/year		
	First Year Total	145		$145,000,000
	Replacement Drum	15/year		
	Continuing Administrative	50/year		
	Subsequent Year Total	105		$105,000,000
Large			2,000	
	Engineering and Construction	2,000		
	Drum Costs	225/year		
	Labor Costs	1,000/year		
	Administrative Costs	300/year		
	Equivalent Rent	600/year		
	First Year Total	4,125		$ 8,250,000
	Subsequent Year Total	2,125		$ 4,250,000

For the one year period 7-1-78 through 6-30-79, the regulations would allow disposal of all capacitors in chemical waste landfills. Depending on the number of such capacitors removed from electrical equipment, the cost of landfill for this one year period (assuming 150 lb/cubic foot) would run from $5.2 million (option 1) to $2.7 million (option 2). After 7-1-79, the proposed regulation would preclude the use of chemical waste landfills for capacitors.

Disposal option #3 proposed in this report would allow the disposal of 59,000,000 lb/year of fluorescent light ballasts in chemical waste landfills following 7-1-79. This would result in a continuing cost of landfills of $1,180,000/year.

In addition to this electrical equipment, there may be an additional immediate demand for chemical waste landfill for contaminated rags and other equipment associated with decommissioning present PCB facilities, and for disposal of capacitors presently being stored awaiting the promulgation of the regulations. This would not be expected to increase the landfill costs by more than one million dollars in 1978.

Total landfill costs could reach a peak of $7 million in 1978, but would probably be somewhat less. Continuing costs would be incurred only if disposal option #3 is incorporated into the regulation. This would result in continuing landfill costs of $1,180,000 per year. Not all of these costs can be attributed to the proposed regulation. Chemical waste landfills are currently specified as the disposal method for transformers and capacitors in the ANSI Guidelines for aksarels.(1) As much as 50,000,000 pounds of large capacitors and transformers might be disposed of in chemical waste landfills in 1978 even if no disposal regulations were promulgated. Thus, the peak year economic costs of chemical waste landfills attributed to the regulations should not exceed $5,500,000.

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(1) American National Standards Institute, Inc. Guidelines for Handling and and Disposal of Capacitor- and Transformer-Grade Askarels Containing Polychlorinated Biphenyls, ANSI C 107.1-1974, New York: 1974.

3.5 Incineration

The greatest demand for incineration will occur in the year starting July 1, 1979. As summarized in Table 3-2, facilities will be required to incinerate 10.5 million lb of transformer askarel, 7.9 million lb of contaminated solvent, and (depending on the disposal option promulgated) from 73.8 million to 258.7 million lb of capacitors. In addition, small amounts of contaminated solids such as rags, dirt, etc., will require incineration.

The unit cost estimates developed in Section 2.5.3.2 were based on existing incinerators having a capacity of 3000 lb/hour of solids. The number of 3000 lb/hour incinerators required for each disposal option and the resulting operating cost to incinerate the solids are summarized in Table 3-5. The cost of incinerating the liquids may be an additional 2.5 million to 3 million dollars per year, depending on the credit received for the fuel value of the liquids.

3.6 Transportation Costs

The transportation costs incurred by the controlled disposal of PCBs will depend both on the locations of the incinerators and chemical waste landfills and on the point of origin of the PCB items. Almost all of the PCB material will consist of transformer oils and solvents, drained transformers, and capacitors. Both capacitors and transformers are used as an integral part of electrical distribution systems, and it is expected that the number used in any geographical area will be highly correlated with the consumption of electrical power. Table 3-6 summarizes the state-by-state PCB disposal requirements for 1978 on the assumption of correlation between PCB usage and 1973 electrical power consumption. Based on this distribution, preliminary assessment has been made of the appropriate locations of the new incineration facilities which would be needed in 1979. These locations are tabluated in Table 3-7.

Incineration costs would be reduced womewhat by operating fewer, larger incineration plants. However, reduction of the number of incinerators would increase transportation costs of waste PCBs.

Table 3-5

Total Cost of PCBs Solids Disposal by Incineration[1]

EPA Option[2]	Total Annual PCB Solids[3] to Incineration, MM lb	Total No. of Facilities Reqd.	Total Annual Operating Cost
1	258	12	$134,000,000
2	133	6	69,000,000
3	74	4	39,000,000

(1) It is assumed that the waste liquid PCBs would be partly handled in presently existing incineration facilities, and partly blended in the fuel used in the new incineration plants.

(2) As given in Table 3-2.

(3) These quantities are the estimated amounts of solids (from Table 3-2) to be handled in 1979 when the waste capacitors can be no longer placed in chemical landfills. The amounts to be disposed will decline by approximately 7% per year thereafter.

Table 3-6

PCB Disposal Requirements - 1978

	1973 Total Elec. Energy Sales KW-Hours x 10^3	Frac. or Total	1978 Disposals				
			Filled Cap.	Empty Transf.	PCB Liq.	Solv.	Total Liq.
Total U.S.	1,703.2		288.1	22.4	10.50	7.9	18.4
Alabama	41.8	0.0245	7.02	0.55	0.26	0.20	0.46
Alaska	1.6	0.0009	.26	0.02	0.01	0.01	0.02
Arizona	18.7	0.0110	3.15	0.25	0.12	0.09	0.21
Arkansas	16.4	0.0096	2.75	0.22	0.10	0.08	0.18
California	145.4	0.0854	24.46	1.91	0.90	0.67	1.57
Colorado	13.9	0.0082	2.35	0.18	0.09	0.06	0.15
Connecticut	19.3	0.0113	3.23	0.25	0.12	0.09	0.21
Delaware	5.6	0.0033	.95	0.07	0.03	0.03	0.06
District of Col.	(with Md.) —						
Florida	66.9	0.0393	11.25	0.88	0.41	0.31	0.72
Georgia	40.6	0.0238	6.82	0.53	0.25	0.19	0.44
Hawaii	4.9	0.0029	.83	0.06	0.03	0.02	0.05
Idaho	11.7	0.0069	1.98	0.15	0.07	0.05	0.12
Illinois	82.9	0.0487	13.95	1.09	0.51	0.38	0.89
Indiana	46.1	0.0271	7.76	0.61	0.28	0.21	0.49
Iowa	18.6	0.0109	3.12	0.24	0.11	0.09	0.20
Kansas	16.7	0.0099	2.84	0.22	0.10	0.08	0.18
Kentucky	43.6	0.0256	7.33	0.57	0.27	0.20	0.47
Louisiana	37.8	0.0222	6.36	0.50	0.23	0.18	0.41
Maine	6.0	0.0035	1.00	0.08	0.04	0.03	0.07
Maryland + D.C.	34.2	0.0201	5.76	0.45	0.21	0.16	0.37
Massachusetts	30.2	0.0177	5.07	0.40	0.19	0.14	0.33
Michigan	66.3	0.0389	11.14	0.87	0.41	0.31	0.72
Minnesota	25.2	0.0148	4.24	0.33	0.16	0.12	0.28
Mississippi	18.5	0.0109	3.12	0.24	0.11	0.09	0.20
Missouri	31.3	0.0184	5.27	0.41	0.19	0.15	0.34
Montana	8.6	0.0050	1.43	0.11	0.05	0.04	0.09
Nebraska	10.4	0.0061	1.75	0.14	0.06	0.05	0.11
Nevada	7.3	0.0043	1.23	0.10	0.05	0.03	0.08
New Hampshire	4.9	0.0029	.83	0.06	0.03	0.02	0.05
New Jersey	45.5	0.0267	7.65	0.60	0.28	0.21	0.49
New Mexico	6.3	0.0037	1.06	0.08	0.04	0.03	0.07
New York	99.6	0.0585	16.75	1.31	0.61	0.46	1.07
North Carolina	49.4	0.0293	8.39	0.66	0.31	0.23	0.54
North Dakota	3.3	0.0019	.54	0.04	0.02	0.02	0.04
Ohio	106.5	0.0625	17.90	1.40	0.66	0.49	1.15
Oklahoma	20.6	0.0121	3.47	0.27	0.13	0.10	0.23
Oregon	30.2	0.0177	5.07	0.40	0.19	0.14	0.33
Pennsylvania	90.2	0.0530	15.18	1.19	0.56	0.42	0.98
Rhode Island	4.8	0.0028	.80	.06	0.03	0.02	0.05
South Carolina	29.2	0.0171	4.90	.38	0.18	0.14	0.32
South Dakota	3.4	0.0020	.57	.04	0.02	0.02	0.04
Tennessee	64.9	0.0381	10.91	.85	0.40	0.30	0.70
Texas	120.8	0.0709	20.30	1.59	0.74	0.56	1.30
Utah	6.7	0.0039	1.12	0.09	0.04	0.03	0.07
Vermont	3.1	0.0018	.52	.04	0.02	0.01	0.03
Virginia	37.1	0.0218	6.24	.49	0.23	0.17	0.40
Washington	54.9	0.0322	9.22	.72	0.34	0.25	0.59
West Virginia	16.7	0.0098	2.81	.22	0.10	0.08	0.18
Wisconsin	30.0	0.0176	5.04	.39	0.18	0.14	0.32
Wyoming	3.9	0.0023	.66	.05	0.02	0.02	0.04
Puerto Rico	10.5	0.0062	1.78	0.14	0.07	0.05	0.12

Table 3-7

Location of PCBs Incineration Facilities

Disposal Option	Total No. of Facilities Reqd.	No. of Existing Facilities[(1)]	Number of New Facilities	Location of New Facilities
1	12	3	9	No. Calif. - 1
				So. Calif. - 1
				Colorado - 1
				Illinois - 1
				Ohio - 1
				Georgia - 1
				Virginia - 1[(2)]
				New York - 1
				Arkansas - 1
2	6	3	3	California - 1
				Virginia - 1
				Ohio - 1
3	4	3	1	California - 1

(1) These are the three Rollins facilities located respectively in New Jersey, Texas, and Louisiana. These will require the addition of shredder facilities and certain monitoring instrumentation to meet the requirements of the proposed regulations.

(2) This is the proposed kepone incineration facility which would be available upon completion of the kepone destruction program.

The total incineration plus transportation charges were evaluated for several different scenarios to evaluate the sensitivity of the total disposal costs to different numbers and sizes of incinerators. The scenarios were based on three different demand levels corresponding to the solid waste incineration requirements of the disposal options (Table 3-2), and on the incinerator siting locations summarized in Table 3-7. In each case, all solid wastes from each state were assumed to be generated at the center of population of that state and then transported in truckload lots to the nearest incinerator, the transportation costs being taken from Figure 2-5. Ocean shipping charges from Puerto Rico to Jacksonville or Baton Rouge; Honolulu to San Francisco; and Anchorage to Seattle were added to the trucking charges from the part of entry to the incinerator for PCBs wastes from those three areas. The total demand on each incinerator was used as a basis for obtaining per pound incineration costs from Figure 2-2.

The results of the analysis of four different incinerator siting/demand scenarios are summarized in Tables 3-8 through 3-11.

Since it was assumed that all shipments were in truckload lots, the average transportation charges are comparable among the various scenarios. As expected, an increased number of incinerators results in decreased average shipping distances and decreased transportation cost. However, as summarized in Table 3-12, the transportation savings resulting from an increase in the number of incinerators from 4 to 12 is only one-half cent per pound.

The increased transportation costs resulting from longer shipments where there are only a few incinerators are more than offset by the economies of scale achieved by operating larger incinerators. Comparison of Tables 3-9 and 3-10 indicates that a reduction of the number of incinerators from 6 to 4 (thereby increasing the size of each remaining incinerator by 50 percent) results in a decrease of the incineration costs of 2.6¢/lb. This more than compensates for the 0.3¢/lb increase in the average transportation cost.

It is apparent from this analysis that the transportation costs will be more sensitive to the size of the individual shipments than to the size and

Table 3-8

Incinerator/Transportation Cost Scenario #1

Disposal Option: 1
Number of Incinerators: 12

Incinerator Location[1]	PCB Solids Million Lb/Year	Incineration Cost ¢/Lb[2]	Incineration Cost Total: Million $	Transportation Costs[3]
Bridgeport, New Jersey	50.95	47	23.9	$ 859,697
Houston, Texas	18.23	53-1/2	9.8	286,211
Baton Rouge, Louisiana	8.51	61-1/2	5.2	121,045
San Francisco, California	13.81	56	7.7	401,662
Los Angeles, California	25.90	51	13.2	489,258
Denver, Colorado	10.28	59-1/2	6.1	240,293
Chicago, Illinois	23.66	52	12.3	384,689
Sandusky, Ohio	33.04	49-1/2	16.4	501,496
Atlanta, Georgia	44.90	48	21.6	911,418
Richmond, Virginia	15.66	55	8.6	259,650
Niagara Falls, New York	.90	1.30	1.2	22,500
El Dorado, Arkansas	12.86	.57	7.3	286,891
TOTALS	258.7		133.3	$4,764,810

Average incineration cost: .515/lb
Average transportation cost: .0184/lb

(1) Table 3-7
(2) Figure 2-2
(3) Table 2-5, Truckload lots

Table 3-9

Incinerator/Transportation Cost Scenario #2

Disposal Option: 2
Number of Incinerators: 6

Incinerator Location[1]	PCB Solids Million Lb/Year	Incineration Cost ¢/Lb[2]	Incineration Cost Total: Million $	Transportation Costs[3]
Bridgeport, New Jersey	24.11	51	12.3	$ 370,124
Houston, Texas	15.19	55	8.4	317,422
Baton Rouge, Louisiana	16.77	54	9.1	342,558
San Francisco, California	22.92	51.5	11.8	510,133
Sandusky, Ohio	35.02	49	17.2	709,565
Richmond, Virginia	20.92	52.5	11.0	473,188
TOTALS	134.93		69.8	$2,722,990

Average incineration cost: .517/lb
Average transportation cost: .0202/lb

(1) Table 3-7
(2) Figure 2-2
(3) Table 2-5, Truckload lots

Table 3-10

Incinerator/Transportation Cost Scenario #3

Disposal Option: 2
Number of Incinerators: 4

Incinerator Location[1]	PCB Solids Million Lb/Year	Incineration Cost ¢/Lb[2]	Incineration Cost Total: Million $	Transportation Costs[3]
Bridgeport, New Jersey	68.39	46	31.5	$1,587,554
Houston, Texas	14.44	56	8.1	312,796
Baton Rouge, Louisiana	27.91	50.5	14.1	711,884
San Francisco, California	22.26	52	11.6	522,981
TOTALS	133.0		65.3	$3,135,215

Average incineration cost: .491/lb
Average transportation cost: .0236/lb

(1) Table 3-7
(2) Figure 2-2
(3) Table 2-5, truckload lots

Table 3-11

Incinerator/Transportation Cost Scenario #4

Disposal Option: 3
Number of Incinerators: 4

Incinerator Location[1]	PCB Solids Million Lb/Year	Incineration Cost ¢/Lb[2]	Incineration Cost Total: Million $	Transportation Costs[3]
Bridgeport, New Jersey	38.22	48.5	18.5	$ 884,039
Houston, Texas	7.98	62.5	5.0	169,774
Baton Rouge, Louisiana	15.41	55	8.5	377,075
San Francisco, California	12.67	57	7.2	289,324
	74.28		39.2	$1,720,212

Average incineration cost: .528/lb
Average transportation cost: .0232/lb

(1) Table 3-7
(2) Figure 2-2
(3) Table 2-5, truckload lots

Table 3-12

Average Transportation Costs of Shipping Solid PCBs Wastes to Incinerators

Number of Incinerators	Cost per Pound
4	$.0234
6	.0202
12	.0184

locations of the incinerators. Review of Table 2-5 shows that transportation costs for a single drum shipped 400 miles would be \$.07/lb, but the cost would be reduced to \$.02/lb if the drum were consolidated with other waste PCBs to form a truckload shipment. This suggests that the establishment of PCB collection services in large cities that are not near incinerators could result in savings in transportation and an assured demand for the incinerators.

It is not possible to accurately predict the locations of the incinerators and chemical waste landfills that will be used to disperse of PCBs. However, the transportation costs are relatively insensitive to the number and locations of such facilities, and may be expected to average no more than four cents per pound of PCB wastes. This would result in a total transportation cost of not more than \$13.2 million per year (disposal option 1) and more likely a maximum cost of \$7.4 million dollars per year (disposal options 2 and 3).

3.7 Record Keeping Costs

The record keeping and monitoring costs for incinerators and chemical waste landfills were implicitly included in the estimated operating costs. The proposed regulation does not impose any record keeping requirements on the one million small storage areas which will handle only small capacitors.

The 2000 large storage areas will be required to maintain a perpetual inventory of all PCB items or containers in storage. Since the record for each item must include its weight, origin, and date of entry into the area, clerical costs of perhaps two dollars per item might be expected in addition to a cost of \$200 per area to establish the record keeping procedure. It would therefore be expected that initial costs of 400,000 dollars plus an additional one million dollars per year associated with large capacitors and transformers and an additional one million dollars per year associated with containers might be expected. In addition, the annual reports will require about one man week per facility (\$1,000,000 total). Thus, total record keeping costs for storage areas might reasonably be estimated at \$400,000 initially, plus \$3,000,000 per year thereafter.

In addition, owners of transformers and large capacitors must maintain records as to the location of the PCB equipment, estimated date of retirement, and date of disposal. Based on a current usage of 140,000 transformers and 8,000,000 large high voltage capacitors at 400,000 locations, and assuming a cost of $5 per transformer or capacitor location, the initial record keeping costs may be expected to be $2,700,000 the first year, with record maintenance and reporting costs of perhaps an additional million dollars per year.

Total record keeping costs are therefore estimated at $3,100,000 initially plus $4,000,000 per year. This will result in an equivalent increase in clerical employment of over 200 jobs. The costs will be widely distributed across utilities and industrial concerns, and should have little impact on prices or market structure.

4.0 MARKING

4.1 Requirements in Draft Regulations

The proposed regulations establish specific requirements for marking PCB equipment, containers, storage areas, capacitors, transformers, and other items. The marking is required to assure proper clean up action in case of an accidental spill while the item is in service, and to assure proper disposal of the items when they are removed from service. The specified compliance dates are summarized in Table 4-1.

Table 4-1

SUMMARY OF COMPLIANCE DATES
FOR THE DRAFT MARKING REGULATIONS

Regulated Units	Compliance Date
New Articles	January 1, 1978
New Equipment	January 1, 1978
Containers	January 1, 1978
Inventory	
Transformers	January 1, 1978
Large Capacitors	January 1, 1978
Storage Areas	January 1, 1978
Vehicles	March 31, 1978
Large High Voltage Capacitors	July 1, 1978
HID Capacitors	March 31, 1978
Transformers	July 1, 1978

4.2 Methodology

The costs of complying with the draft marking regulations can be divided into two areas: (1) the cost of specified labels and (2) the costs associated with applying the labels. In order to arrive at cost estimates for these two categories, it was necessary to approximate not only the demand for labels by producers and users of PCB transformers and PCB capacitors, but also the magnitude of their respective operations.

The name and location of all U.S. producers of PCB transformers and PCB capacitors is found in Tables 4-2 and 4-3 respectively. All such producers were contacted in order to establish maximum likelihood estimates for producers' marking costs. The users of PCB electrical equipment are utility, industrial, commercial, and residential concerns. Extrapolations were made from available information regarding PCB electrical equipment users to arrive at satisfactory marking cost estimates.

Label costs are based upon manufacturers' retail prices for lots of 1,000. Transportation and labor costs - costs associated with applying the labels - are maximum estimates; they are costs that would be incurred by a full-time marking program.

4.2.1 Containers

In order to arrive at a satisfactory approximation of the total number of containers required for the year ending December 31, 1978, it was necessary to specifically define a PCB container. For marking purposes, a PCB container is defined as a 55 gallon drum constructed of steel, wood fiber, or other material. (Note that this definition differs from that in the proposed regulations.) Implicit in this definition is the assumption that all PCB liquids, solid waste, contaminated materials, etc., will be contained in 55 gallon drums when accumulated for disposal. In fact, there have been and will be other types of containers used for PCB materials. However, information obtained from producers and users of PCB electrical equipment supports the aforementioned assumption - i.e., 55 gallon drums are the primary containment employed by most producers and users of PCB electrical equipment.

Given that most producers of PCB electrical equipment have ceased production of such units already, or will have prior to January 1, 1978, the number of PCB containers required by producers for the year ending December 31, 1978, will be relatively small. Based on telephone conversations with U.S. producers of PCB electrical equipment, it is estimated that approximately 10,000 containers will be required by producers in 1978.

Table 4-2

U.S. Transformer Manufacturing Industry Using PCBs

Company Name	Location of the Plant
Westinghouse Electric Corp.	South Boston, Va. Sharon, Pa.
General Electric Company	Rome, Ga. Pittsfield, Mass.
Research-Cottrell	Finderne, N.J.
Niagara Transformer Corp.	Buffalo, N.Y.
Standard Transformer Co.	Warren, Ohio Medford, Oregon
Helena Corp.	Helena, Alabama
Hevi-Duty Electric	Goldsboro, N.C.
Kuhlman Electric Co.	Crystal Springs, Miss.
Electro Engineering Works	San Leandro, Calif.
Envirotech Buell	Lebanon, Pa.
R.E. Uptegraff Mfg. Co.	Scottsdale, Pa.
H.K. Porter	Belmont, Calif. Lynchburgh, Va.
Van Tran Electric Co.	Vandalia, Ill. Waco, Texas

Source: Versar Inc., PCBs in the United States: Industrial Use and Environmental Distribution, NTIS PB-252 402/3WP, February 25, 1976, p. 89.

Table 4-3

U.S. Capacitor Manufacturing Industry Using PCBs

Company Name (In Order of PCBs Usage)	Location of the Plant
General Electric Company	Hudson Falls, N.Y. Ft. Edward, N.Y.
Westinghouse Electric Corp.	Bloomington, Ind.
Aerovox (AVX)	New Bedford, Mass.
Universal Manufacturing Corp.	Bridgeport, Conn. Totowa, N.J.
Cornell Dubilier	New Bedford, Mass.
P.R. Mallory & Co., Inc.	Waynesboro, Tenn.
Sangamo Electric Co.	Pickens, S. Carolina
Sprague Electric Co.	North Adams, Mass.
Electric Utility Co.	LaSalle, Ill.
Capacitor Specialists, Inc.	Escondido, Calif.
JARD Corp.	Bennington, Vt.
York Electronics	Brooklyn, N.Y.
McGraw-Edison	Greenwood, S. Carolina
RF Interonics	Bayshore, L.I., N.Y.
Axel Electronics, Inc.	Jamaica, N.Y.
Tobe Deutschmann Labs.	Canton, Mass.
Electro Magnetic Filter Co.	Palo Alto, Calif.

Source: Versar Inc., PCBs in the United States: Industrial Use and Environmental Distribution, NTIS PB-252 402/3WP, February 25, 1976, p. 69.

It is expected that residential users of PCB electrical equipment will not require any containers. The underlying assumption is that no single residential dwelling, in the course of one year, will have accumulated sufficient PCB related waste to warrant using a 55 gallon drum.

Estimates of the number of containers required by utilities and industrial and commercial users of PCB electrical equipment for the year ending December 31, 1978, were arrived at as follows:

A) Small PCB capacitors (i.e., HID units):

Available information

1) Utilities - 1,000,000 units
2) Industrial and commercial concerns - 23,900,000 units
3) Annual disposal rate - 6 percent (approximately)
4) Each 55 gallon drum hold approximately 50 small PCB capacitors

$$\begin{array}{r} 1{,}000{,}000 \\ 6\% \\ \hline 60{,}000 \end{array}$$ Number of units disposed of by utilities

$$\begin{array}{r} 23{,}900{,}000 \\ 6\% \\ \hline 1{,}434{,}000 \end{array}$$ Number of units disposed of by industrial and commercial users

60,000/50 = 1,200 Number of containers required by utilities for small PCB capacitors

1,434,000/50 = 28,680 Number of containers required by industrial and commercial users for small PCB capacitors

B) Large PCB capacitors (i.e., low and high voltage units):

Available information

1) Utilities - 8,600,000 units

2) Industrial and commercial users - 19,400,000 units

3) Annual disposal rate - 6 percent (approximately)

4) Each 55 gallon drum holds approximately 3 large PCB capacitors

$$\frac{8{,}600{,}000 \times 6\%}{516{,}000}$$ Number of units disposed of by utilities

$$\frac{19{,}400{,}000 \times 6\%}{1{,}164{,}000}$$ Number of units disposed of by industrial and commercial users

516,000/3 = 172,000 Number of containers required by utilities for large PCB capacitors

1,164,000/3 = 388,000 Number of containers required by industrial and commercial users for large PCB capacitors

C) PCB mixtures (i.e., liquids and solvents - transformers):

Available information

1) Utilities - 11,000,000 lb. of PCB mixtures

2) Industrial and commercial users - 7,400,000 lb. of PCB mixtures

3) Conversion factor - 11.5 lb. of PCB ≅ 1 gallon

11,000,000/11.5 ≅ 956,522 gallons

956,522/55 ≅ 17,391 Number of containers required by utilities for PCB mixtures

7,400,000/11.5 ≅ 643,478 gallons

643,478/55 ≅ 11,700 Number of containers required by industrial and commercial users for PCB mixtures

D) Miscellaneous

Based on telephone conversations with producers and users of PCB electrical equipment, it is estimated that approximately 400,000 55-gallon drums will be required by users of PCB electrical equipment, for the year ending December 31, 1978, to contain clean-up materials, contaminated materials, small appliance capacitors, and fluorescent lighting ballasts. In order to safely divide the additional 400,000 55-gallon drums between utilities and industrial and commercial users, it is necessary to assume proportionality as follows:

For utilities:

$$\frac{1,200 + 172,000 + 17,391}{1,200 + 172,000 + 17,391 + 28,680 + 388,000 + 11,700} = \frac{X}{400,000}$$

$X \cong 123,166$ Miscellaneous containers attributable to utilities

For industrial and commercial users:

$$\frac{28,680 + 388,000 + 11,700}{1,200 + 172,000 + 17,391 + 28,680 + 388,000 + 11,700} = \frac{X}{400,000}$$

$X \cong 276,834$ Miscellaneous containers attributable to industrial and commercial users

In summary, for the year ending December 31, 1978, producers of PCB electrical equipment will require 10,000 containers, utilities and industrial and commercial users will require approximately 314,000 and 705,000 containers respectively, and residential users will not require any.

4.2.2 Storage Areas

It is estimated that approximately 1,000,100 storage areas will be required to temporarily house solid and liquid PCB waste prior to disposal, for the year ending December 31, 1978. This estimate, as well as its distribution among producers and users of PCB electrical equipment, is based on telephone interviews with such producers and users, and on extrapolations from existing data. Specifically, it is anticipated that producers will require approximately 100 storage areas, utilities will need approximately 100 storage areas, utilities will need approximately 796 storage areas, industrial and commercial users will require approximately 999,204 storage areas, and residential users will not require any - i.e., it is assumed that residential users of PCB electrical equipment do not possess sufficient quantities of PCB waste articles to require storage areas.

Extrapolations were made from available information to determine how many of the 1,000,000 estimated storage areas would be allocated to utilities; those remaining are to be distributed to industrial and commercial users. The extrapolation procedure is as follows:

Available information

1) PEPCO's total sales of electric power in KWH's represents 1.01% of total retail sales

2) TVA's total sales of electric power in KWH's represents 37.91% of total wholesale sales

3) PEPCO has 7 storage areas

4) TVA has 39 storage areas

.0101 X = 7
X ≅ 693 Number of retail utilities' storage areas

.3791 X = 39
X ≅ 103 Number of wholesale utilities' storage areas

796 Total number of storage areas required by utilities

1,000,000	Estimated total number of required storage areas
796	required by users
999,204	Number of storage areas allocated to industrial and commercial users

4.2.3 Vehicles

The total number of vehicles that will be required to haul solid and liquid PCB waste to storage and for disposal facilities for the year ending December 31, 1978, was estimated as follows:

Available information

1) Estimated amount of solid and liquid PCB waste requiring disposal by primary users (i.e., utilities and industrial and commercial entities) - 299,400,000 (Table 3-1)

2) Average minimum acceptable truckload at disposal sites - 40,000 lbs

$$\text{NUMBER OF TRUCK LOADS} = {}^{299,400,000}/_{40,000} = 7,485$$

Assuming that each transport vehicle were to carry 40,000 lbs of PCB waste and to make only one trip, the maximum number of trucks would be required by users - i.e., 7,485 vehicles. Based on telephone interviews with producers and users of PCB electrical equipment, it is estimated that actually only 3,000 vehicles will be required by users of PCB electrical equipment. Note that only utilities and industrial and commercial users will require transport vehicles. Residential users will not require transport vehicles because it is assumed that such users do not possess sufficient quantities of PCB waste to warrant trucking operations.

In order to divide the estimated 3,000 vehicles between utilities and industrial and commercial users, it is necessary to assume proportionality as follows:

Available information

1) Utilities' estimated disposal requirements for PCB electrical equipment in 1978 - 71,800,000 lbs.

2) Industrial and commercial users' estimated disposal requirements for PCB electrical equipment in 1978 - 227,600,000 lbs.

$$\frac{71{,}800{,}000}{71{,}800{,}000 + 227{,}600{,}000} = \frac{X}{3{,}000}$$

$X \cong 720$ Number of vehicles attributable to utilities

$$\frac{227{,}600{,}000}{71{,}800{,}000 + 227{,}600{,}000} = \frac{X}{3{,}000}$$

$X \cong 2{,}280$ Number of vehicles attributable to industrial and commercial users

Based on telephone interviews with producers of PCB electrical equipment, it is estimated that each of the 37 plants in the United States which produce such equipment will require approximately 2 transport vehicles.

4.2.4 Transportation and Labor Marking Costs

Estimates of transportation and labor costs associated with marking for the year ending December 31, 1978 were derived from information obtained from telephone interviews with producers and users of PCB electrical equipment and from extrapolations of existing data.

All estimates, <u>except</u> those associated with utilities' transoprtation and labor (marking) costs concerning large high voltage capacitors and transformers, are based on the following assumptions:

1) Labor costs are estimated to be approximately $10 per manhour

2) Transportation costs are estimated to be approximately $5 per location visited for the purposes of applying labels.

Utilities' transportation and labor (marking) costs associated with large high voltage capacitors and transformers are estimates derived by extrapolating from data provided to the EPA by the Tennessee Valley Authority. Table 4-4 outlines the existing data, computations, and subsequent extrapolations.

4.3 Economic Impact

The economic impact of the proposed marking regulations on manufacturers of PCB electrical equipment will be relatively small because most production of such equipment will have ceased prior to January 1, 1978. It is anticipated that two PCB capacitor manufacturers will continue production after January 1, 1978 and hence will be faced with substantial tooling costs - $25,000 - in order to comply with the proposed regulations. The total economic impact of the proposed marking regulations on manufacturers of PCB electrical equipment is expected to be less than $100,000 as calculated and summarized in Tables 4-5 and 4-6 respectively.

The major costs of complying with the proposed marking regulations will be incurred by the present users of PCB electrical equipment. Tables 4-7 through 4-9 summarize the necessary calculations in determining users' marking costs. It is estimated that users of PCB electrical equipment will face marking costs totaling approximately $33.2 million, as summarized in Table 4-10.

The total cost of complying with the proposed marking regulations for the year ending December 31, 1978, will be approximately $33.3 million,

Table 4-4

CALCULATION OF UTILITIES' TRANSPORTATION
AND LABOR MARKING COSTS

	SUBSTATIONS	DISTRIBUTION FEEDERS (POLES)	TRANSFORMERS
TVA: Total Units	345	3710	1350
Transportation Costs	5	10	—
Labor Costs	70 (approx.)	40 (approx.)	15
Total Transportation and Labor Costs	345 x (70 + 5) ≅ 25,000	3710 x (10 + 40) ≅ 185,000	1350 x 15 ≅ 20,000
PEPCO: Total Units	32	1509	64
Total Transportation and Labor Costs	32 (70 + 5) = 2400	1509 x (10 + 40) = 75,450	64 x 15 = 960

TVA's total transportation and labor marking costs are approximately 225,000 (primarily a wholesaler)

PEPCO's Total transportation and labor marking costs are approximately 78,800 (primarily a retailer)

Extrapolation Procedure:

Available information

1) Fiscal year 1976: total retail sales of electrical energy - 1,391,714,575,000 KWH
2) Fiscal year 1976: total wholesale sales of electric energy - 276,681,665,000 KWH
3) Fiscal year 1976: Pepco's total sales (retail) - 14,169,412,000 KWH
4) Fiscal year 1976: TVA's total sales (wholesale) - 104,900,000,000 KWH

$14{,}169{,}412{,}000 / 1{,}391{,}714{,}575{,}000 \cong .0101$

$78{,}810 / X = .0101 / .9899$

$X = 7{,}724{,}160.30$

7,724,160.30
78,810.00
7,802,970.30 Utilities' (retail) transportation and labor marking costs

$104{,}900{,}000{,}000 / 276{,}681{,}665{,}000 \cong .3791$

$225{,}000 / X = .3791 / .6209$

$X = 368{,}510.94$

368,510.94
225,000.00
593,510.94 Utilities' (wholesale) transportation and labor marking costs

7,802,970.30
593,510.94
8,396,481.24 Utilities total transportation and labor marking costs

Table 4-5

Calculation of Electrical Equipment Manufacturers' Marking Costs for the Year Ending December 31, 1978

	Containers	Storage Areas	Vehicles	INVENTORY Transformers	Large Capacitors	New Articles	New Equipment
Total Units	[1]10,000	[2]100	[3]74	10	10,000	[4]NA	[5]NA
Total Label Costs	10,000 x 27¢ ea. = 2700	100 x 27¢ ea. = $27	74 x 27¢ ea. ≅ $20	10 x 27¢ ea. ≅ $3	10,000 x 27¢ ea. = $2700	[6]$25,000	[7]$25,000
Total Transportation and Labor Costs	[8]100 x $15 = $1500	100 x $10 = $1000	74 x $5 = $370	10 x $2 = $20	10,000 x $4 = $40,000	---	---

[1,2,3]Total number of units will decrease at a rate of 40% per year, assuming a 20 year life for PCB units.
[4,5]NA means information or data was not available.
[6,7]This figure represents annual retooling costs for transformer and capacitor production - i.e., the required marking will be stamped into the casing of the PCB unit.
[8]Assuming that containers may be found in 100 locations.

Table 4-6

Electrical Equipment Manufacturers' Total Marking Costs
For the Year Ending December 31, 1978
(in dollars)

	Label Costs	Transportation and Labor Costs	Total
Containers	2,700	1,500	4,200
Storage Areas	27	1,000	1,027
Vehicles	20	370	390
Inventory:			
Transformers	3	20	23
Large Capacitors	2,700	40,000	42,700
New Articles	25,000	—	25,000
New Equipment	25,000	—	25,000
TOTALS	55,452	42,890	98,340

Table 4-7

Calculation of Utilities' Marking Costs for the Year Ending December 31, 1978

	Containers	Storage Areas	Vehicles	Large Low Voltage Capacitors	Large High Voltage Capacitors	Transformers	HID Capacitors
Total Units	[1]314,000	[2]796	[3]740	1,000,000	7,600,000	84,000	1,000,000
Total Label Costs	314,000 x 27¢ ea. = $84,780	796 x 27¢ ea. = $215	740 x 27¢ ea. = $200	[4]100,000 x 27¢ ea. = $27,000	[5]380,000 x $2 ea. = $760,000	84,000 x 27¢ ea. = $22,680	[6]120,000 x 9¢ ea. = $10,800
Total Transportation and Labor Costs	[7]10,000 x $10 = $100,000	796 x $10 = $7960	740 x $5 = $3,700	100,000 x $10 = $1,000,000	[8]$8,396,481		120,000 x $1 = $120,000

[1,2,3]Total number of units will decrease at a rate of 40% per year, assuming a 20 year life for PCB units.
[4]10% of the total number of units are available for marking annually.
[5]Estimated number of locations - i.e., locations may be marked rather than individual units.
[6]12% of the total number of units are available for marking annually.
[7]Assuming that containers may be found in 10,000 locations.
[8]Total transportation and labor costs for marking large high voltage capacitors and transformers by both wholesalers and retailers of electric power.

Table 4-8

Calculation of Industrial and Commercial Entities' Marking Costs for the Year Ending December 31, 1978

	Containers	Storage Areas	Vehicles	Large Low Voltage Capacitors	Large High Voltage Capacitors	Transformers	HID Capacitors
Total Units	[1]705,000	[2]999,204	[3]2,260	19,000,000	400,000	56,000	23,900,000
Total Label Costs	705,000 x 27¢ ea. = $190,350	999,204 x 27¢ ea. = $269,785	2,260 x 27¢ ea. = $610	[4]1,900,000 x 27¢ ea. = $513,000	400,000 x $2 ea. = $800,000	56,000 x 27¢ ea. = $15,120	[5]2,868,000 x 9¢ ea. = $258,120
Total Transportation and Labor Costs	[6]70,000 x $5 = $350,000	999,204 x $5 = $4,996,020	2,260 x $5 = $11,300	1,900,000 x $5 = $9,500,000	400,000 x $5 = $2,000,000	56,000 x $15 = $840,000	2,868,000 x $1 = $2,868,000

[1,2,3]Total number of units will decrease at a rate of 40% per year, assuming a 20 year life for PCB units.
[4]10% of the total number of units are available for marking annually.
[5]12% of the total number of units are available for marking annually.
[6]Assuming that containers may be found in 70,000 locations.

Table 4-9

Calculation of Residential Users' Marking Costs
for the Year Ending December 31, 1978

	Containers	Storage Areas	Vehicles	Large Low Voltage Capacitors	Large High Voltage Capacitors	Transformers	HID Capacitors
Total Units	-0-	-0-	-0-	-0-	-0-	-0-	100,000
Total Label Costs	-0-	-0-	-0-	-0-	-0-	-0-	[1]12,000 x 9¢ ea. = $1,080
Total Transportation and Labor Costs	-0-	-0-	-0-	-0-	-0-	-0-	12,000 X $1 = $12,000

[1]12% of the total number of units are available for marking annually.

Table 4-10

Electrical Equipment Users' Total Marking Costs for the Year Ending December 31, 1978 (in dollars)

	Label Costs	Transportation and Labor Costs	Total
Utilities:			
Containers	84,780	100,000	184,780
Storage Areas	215	7,960	8,175
Vehicles	200	3,700	3,900
Large Low Voltage Capacitors	27,000	1,000,000	1,027,000
Large High Voltage Capacitors	760,000 }		
Transformers	22,680 }	8,396,481	9,179,161
HID Capacitors	10,800	120,000	130,800
TOTALS	905,675	9,628,141	10,533,816
Industrial and Commercial:			
Containers	190,350	350,000	540,350
Storage Areas	269,785	4,996,020	5,265,805
Vehicles	610	11,300	11,910
Large Low Voltage Capacitors	513,000	9,500,000	10,013,000
Large High Voltage Capacitors	800,000	2,000,000	2,800,000
Transformers	15,120	840,000	855,120
HID Capacitors	258,120	2,868,000	3,126,120
TOTALS	2,046,985	20,565,320	22,612,305
Residential:			
Containers	-0-	-0-	-0-
Storage Areas	-0-	-0-	-0-
Vehicles	-0-	-0-	-0-
Large Low Voltage Capacitors	-0-	-0-	-0-
Large High Voltage Capacitors	-0-	-0-	-0-
Transformers	-0-	-0-	-0-
HID Capacitors	1,080	12,000	13,080
TOTALS	1,080	12,000	13,080
GRAND TOTALS	2,953,740	30,205,461	33,159,201

with users' marking costs comprising 99.7 percent of this total. Undoubtedly, a large percentage of total marking costs will be passed along to consumers as higher prices for final goods and/or services. However, some relatively small percentage will be borne by producers and users of PCB electrical equipment.

Estimated label costs are based upon manufacturers' retail prices for lots of 1,000. Unit costs for labels will be extremely small if all labels are manufactured by a few companies rather than many - i.e., economies of scale will give rise to decreasing average costs. Costs associated with applying the labels - transportation and labor costs - are maximum estimates; they are costs that would be incurred by a full-time labelling program. Such costs will be greatly reduced if users' PCB electrical equipment is marked during routine maintenance operations. For example, it would be more economical for a utility company to have its crews mark the various units during their routine visits to substations for periodic checks, servicing, monitoring, etc., rather than sending crews to substations for the sole purpose of marking PCB electrical equipment.

Users' transportation and labor (marking) costs comprise 91.1 percent of their total marking costs. Such costs could be greatly reduced if the proposed regulations were to be changed so that large capacitors and transformers are labelled only when they are retired from service and hence gathered for (eventual) disposal. Tables 4-11 and 4-12 summarize the necessary marking cost calculations regarding users, under this scenario; Table 4-13 summarizes total marking costs. This revision of the proposed regulation would reduce users' total marking costs by approximately 48.2 percent, utilities' marking costs by approximately 71.3 percent, industrial and commercial marking costs by approximately 37.5 percent, and leave residential marking costs unchanged. This revision, having its greatest impact on users' transportation and labor (marking) costs, would reduce that figure by approximately $14.3 million. (Note that users' total marking costs are reduced by approximtely $16 million.)

Table 4-11

Calculations for Utilities' Marking Costs for the Year Ending December 31, 1978*

	Containers	Storage Areas	Vehicles	Large Low Voltage Capacitors	Large High Voltage Capacitors	Transformers	HID Capacitors
Total Units	[1]314,000	[2]796	[3]740	1,000,000	7,600,000	84,000	1,000,000
Total Label Costs	314,000 x 27¢ ea. = 84,780	796 x 27¢ ea. = $215	740 x 27¢ ea. ≅ $200	[4]50,000 x 27¢ ea. = $13,500	[5]456,000 x 27¢ ea. = $123,120	[6]5,040 x 27¢ ea. ≅ $1,361	[7]120,000 x 9¢ ea. = $10,800
Total Transportation and Labor Costs	[8]10,000 x $10 = $100,000	796 x $10 = $7960	740 x $5 = $3,700	50,000 X $5 = $250,000	456,000 x $5 = $2,280,000	5,040 x $5 = $25,200	120,000 x $1 = $120,000

[1,2,3]Total number of units will decrease at a rate of 40% per year, assuming a 20 year life for PCB units.
[4]5% of the total number of units are available for marking annually.
[5,6]6% of the total number of units are available for marking annually.
[7]12% of the total number of units are available for marking annually.
[8]Assuming that containers may be found in 10,000 locations.

*Cost estimates are based on the assumption that large capacitors and transformers are not required to be labelled until removed from service and hence gathered for (eventual) disposal.

Table 4-12

Calculations for Industrial and Commercial Entities' Marking Costs for the Year Ending December 31, 1978*

	Containers	Storage Areas	Vehicles	Large Low Voltage Capacitors	Large High Voltage Capacitors	Transformers	HID Capacitors
Total Units	[1]705,000	[2]999,204	[3]2,260	19,000,000	400,000	56,000	23,900,000
Total Label Costs	705,000 x 27¢ ea. = $190,350	999,204 x 27¢ ea. = $269,785	2,260 x 27¢ ea. = $610	[4]950,000 x 27¢ ea. = $256,500	[5]24,000 x 27¢ ea. = $6,480	[6]3,360 x 27¢ ea. = $907	[7]2,868,000 x 9¢ ea. = $258,120
Total Transportation and Labor Costs	[8]70,000 x $5 = $350,000	999,204 x $5 = $4,996,020	2,260 x $5 = $11,300	950,000 x $5 = 4,750,000	24,000 x $5 = $120,000	3,360 x $15 = $50,400	2,868,000 x $1 = $2,868,000

[1,2,3]Total number of units will decrease at a rate of 40% per year, assuming a 20 year life for PCB units.
[4]5% of the total number of units are available for marking annually.
[5,6]6% of the total number of units are available for marking annually.
[7]12% of the total number of units are available for marking annually.
[8]Assuming that containers may be found in 70,000 locations.

*Cost estimates are based on the assumption that large capacitors and transformers are not required to be labelled until removed from service and hence gathered for (eventual) disposal.

Table 4-13

Electrical Equipment Users' Total Marking Costs
for the Year Ending December 31, 1978*
(in dollars)

	Label Costs	Transportation and Labor Costs	Total
Utilities:			
Containers	84,780	100,000	184,780
Storage Areas	215	7,960	8,175
Vehicles	200	3,700	3,900
Large Low Voltage Capacitors	13,500	250,000	263,500
Large High Voltage Capacitors	123,120	2,280,000	2,403,120
Transformers	1,361	25,200	26,561
HID Capacitors	10,800	120,000	130,800
TOTAL	233,976	2,786,860	3,020,836
Industrial and Commercial:			
Containers	190,350	350,000	540,350
Storage Areas	269,785	4,996,020	5,265,805
Vehicles	610	11,300	11,910
Large Low Voltage Capacitors	256,500	4,750,000	5,006,500
Large High Voltage Capacitors	6,480	120,000	126,480
Transformers	907	50,400	51,307
HID Capacitors	258,120	2,868,000	3,126,120
TOTALS	982,752	13,145,720	14,128,472
Residential:			
Containers	-0-	-0-	-0-
Storage Areas	-0-	-0-	-0-
Vehicles	-0-	-0-	-0-
Large Low Voltage Capacitors	-0-	-0-	-0-
Large High Voltage Capacitors	-0-	-0-	-0-
Transformers	-0-	-0-	-0-
HID Capacitors	1,080	12,000	13,080
TOTALS	1,080	12,000	13,080
GRAND TOTALS	1,217,808	15,944,580	17,162,388

*Cost estimates are based on the assumption that large capacitors and transformers are not required to be labelled until removed from service and hence gathered for (eventual) disposal.

5.0 ECONOMIC IMPACT ANALYSIS

The demand for PCB disposal depends on the number, size and location of transformers and capacitors containing PCBs and similarly of appliances and other equipment containing PCB capacitors, including various lighting equipment - e.g., fluorescent lighting and high-intensity discharge lights. In the U.S. this inventory has been estimated at about 750 million pounds of PCBs in a total of nearly 6 billion pounds of PCB capacitors and transformers. The distribution of these PCBs by size of capacitor and type of owner (residential, commercial and institutional, industrial and utility) is reasonably well known.

In this study, the total weights of PCBs capacitors and transformers were allocated to the 50 states and Puerto Rico. For this purpose, Federal Power Commission data on annual sales of electric power by staes were used to obtain the fraction of the total U.S. electric power consumed in each state. These fractions were then applied to the total weights of various types of PCB equipment. Then the average lives of the various types of PCB-containing units were used to estimate annual disposal needs by year.

Disposal demand derived from capacitors in the non-residential economy has been estimated at 258.7 million pounds for the first year after July 1, 1979. (Large apartment buildings and complexes including such residential use were included in this sector.) This total is expected to decline by about 7 percent a year and thus would become:

240.6 million lb in 1980-81
223.7 million lb in 1981-82
208.1 million lb in 1982-83
193.5 million lb in 1983-84
180.0 million lb in 1984-85, and so forth

5.1 Incineration Costs

If all of these capacitors must be incinerated, as in option 1, 12 incinerators of the type now operated by Rollins near Houston, Texas, Baton Rouge, La. and Bridgeport, N.J. will be required, none of them new. If such plants can be operated 365 days a year for 20 hours a day at 3000 pounds of shredded capacitor solid per hour, as Rollins personnel believe, each plant could incinerate 21.9 million pounds of PCB-containing shredded capacitors per year while also incinerating as much as 3.65 million pounds of PCB liquids. Twelve such plants could incinerate 262.8 million pounds of shredded capacitors and 43.8 million pounds of PCB liquids. This exceeds the maximum demand for solids incineration of 251.5 million pounds and for PCB liquids and solvent of 18.6 million pounds. The total costs, however, would be considerable. Each plant would require $5 million investment and take a year to construct after all approvals have been obtained. Annual capital recovery costs of 10 percent for 10 years would be $814,000 for each plant. Taxes and insurance at 4 percent would average $200,000, making total fixed costs per plant $1,014,000 per year. Total variable costs at the assumed operating rate of 4,300 hours per year would be $10,311,000; hence total annual costs are estimated at $11,325,000 per plant. For all 12 plants this is a total commitment of $134 million resources per year for incineration.

Option 2, which diverts 2/3 of all small capacitors to sanitary landfills, would require only six incinerators, of which 3 would be new. This translates to $69 million total annual incineration costs.

Option 3 goes one step further, and diverts the other 1/3 of fluorescent light ballasts to chemical waste landfills. This option requires only one new incinerator and, even if it were completely new, the total commitment would be reduced to $39 million in annual incineration costs.

Before other costs are considered, it is useful to consider how sensitive these incineration costs are to the assumptions underlying these cost estimates. Two assumptions appear to be more critical than others:

(1) the price of #2 Fuel Oil will be 40¢ per gallon;
(2) each plant can be operated at the rate of 7,300 hours per year.

It is probably fruitless to try to improve the estimate for the price of fuel but it should be noted that such costs represent slightly more than 77 percent of the total annual incineration costs. A one-cent per gallon increase thus would inflate each plant's annual costs by 2.19 percent and an increase to 84.6¢ per gallon would double the total annual costs. Even at 40¢, imports would increase by 105 million dollars for 12 plants. However, if other EPA regulations were to result in an increase in the amount of solvents and waste oils requiring incineration, the use of these liquids as fuel in the PCB incinerators could substantially reduce total fuel costs.

Two safeguards are built into the estimated costs that could alleviate disappointment in ahcieved annual operating factors:

(1) each plant has a "contingency" factor of 20 percent or $830,000 in its capital costs that could be applied to maintenance or to improvements if no other problems intervene and pre-empt these funds;

(2) annual demand for PCB incineration will decline by 7 percent per year. This reduces the required operating factor by 7 percent each year, and provides more time for maintenance or corrective adjustments in operations.

5.2 Other Costs

Total costs for the system include not only incineration costs but also costs of other methods of disposal, transportation costs and storage costs. These three, disposal, transportation and storage are inter-related and should be considered together. Finally, there are marking costs and record costs. Recordkeeping will cost $8 million in 1978 and $4 million a year thereafter and is discussed elsewhere in this report. Marking costs depend upon whether marking can be postponed until scrapping or must be done immediately. If immediate marking is required, outlays of $33.3 million will be required in 1978 (of which $100,000 is capital) and $5 million a year thereafter. If marking can be done upon removal from service, the 1978 outlay is reduced to $17.3 million but the $5 million per year is unchanged.

Transportation costs will probably average 4¢ per pound, and could be reduced if storage at area collection points is used to consolidate shipments and obtain truckload lots. At 4¢ per pound, 335 million pounds of capacitor solids, transformers, and liquids will require $13.2 million in transport costs. This would decline by 7 percent a year because of declining quantities but escalation of transport rates may offset this decrease. The weight of the steel drums containing PCBs will incorease the total weight and make $15 million a year a better estimate of total transportation costs.

Option 2 reduces the PCB solids requirements by diverting 2/3 of the small capacitors to sanitary landfills with negligible transportation costs, but liquid requirements (from transformers) will not be affected. With 155.6 million pounds in solids and 18.6 in liquids (including solvents), transportation costs are reduced to $7.4 million which becomes $8 million a year after allowance for steel drums.

Option 3 allows chemical waste landfill disposal of 1/3 of the fluorescent light ballast. This doubles the costs of chemical waste landfill operations from 1 to 2 million dollars annually in 1969 and later years, but does not reduce transportation costs because these operations are few in number and, therefore, like incinerators, require transportation. Hence, transportation costs are the same as for option 2.

5.3 Annual Attributable Costs of Compliance

The total costs of complying with the proposed regulation will depend both on the disposal and marking options adopted and on the degree of compliance with (or enforcement of) the regulation. The total capital and attributable operating costs of complying with the various options are shown in Table 5-1. These costs are upper bound estimates, and the economic costs may be significantly less if the storage and marking is accomplished in the normal course of operations using otherwise idle storage space and manpower. The major out-of-pocket cost will be fuel for the incinerators, and this may be reduced if waste solvents and oils are used for fuel.

TABLE 5-1

Total Attributable Compliance Costs
Millions of Dollars

	Capital Costs	Annual Operating Costs 1978	Annual Operating Costs 1979 and later[6]
Disposal Option 1[1]			
Incinerator	45		
Chem Waste LF		5	1
Incineration		0	134
Transportation		15	15
Disposal Option 2[2] (probable response to proposed regulation)			
Incinerator	15		
Chem Waste LF		5	1
Incineration		0	69
Transportation		8	8
Disposal Option 3[3]			
Incinerator	5		
Chem Waste LF		5	2
Incineration		0	39
Transportation		8	8
Recordkeeping		8	4
Marking			
New PCBs	0.1		
Existing PCBs			
Option 1[4] (proposed regulation)		33.3	5
Option 2[5]		17.3	5
Storage	4	149	109

(1) Incin. all
(2) 2/3 small cap. to SLF
(3) 1/3 of Fl. Light Ballasts to CWLF
(4) All initially
(5) When removed from service
(6) Costs listed will decrease by 7 percent per year after 1980

The total capital requirements may be as great as $45.1 million in 1978, but will more likely be in the range of $10 million to $20 million. Annual attributable operating costs may be as great as $210.3 million in 1978 and $268 million in 1979, but adoption of the suggested options could reduce these costs to $187.3 million in 1978 and $167 million in 1979. The actual economic costs are expected to be considerably less than these upper bound estimates of the attributable costs.

5.4 Effect on Prices and Market Structure

The impact of the proposed regulations on any specific industry will be proportional to the amount of electricity used, except for electrical equipment service organizations such as contractors, transformer repair shops, and appliance repair shops. Among small business, perhaps as many as 20 transformer repair businesses will either have to stop handling askarel transformers or install special diked work and storage areas. Because most askarel transformers are handled by GE and Westinghouse and because most transformers are oil filled, there should be little effect on small businesses even if the small independent repair shops stop servicing askarel transformers.

The regulations may result in the development of collection and storage services to reduce storage and transportation charges from numerous small generators of PCB wastes. This would result in increased business opportunities for numerous small labor intensive service businesses, resulting in an increase in small business opportunities and employment.

Conceivably the incinerator business could be dominated by Rollins, which has a sister business in trucking, Macklin Trucking. Macklin or Rollins could franchise collector and storage operations in areas that Macklin and Rollins could service. This would also increase small business opportunities by making technical expertise available to small operations. Rollins could then be more confident of a steady supply for their incinerator business and would be more willing to undertake the investments required for new incineration capacity.

The proposed regulations will result in substantial compliance costs for the electric utilities, as this industrial segment has the most intensive use of PCB capacitors and transformers. The utilities will generate about 35 percent of the demand for incineration of capacitors (see Table 3-2, disposal option 2) resulting in a cost to the utilities of $27 million per year after 1979. In addition, much of the costs of complying with the record keeping and marking requirements will be incurred by the utilities. Total attributable costs to the utilities may be in the range of $30 million per year starting in 1978. These costs will be included as a component of the cost basis on which the electric rates are established by state regulatory agencies, and will therefore be recovered from the consumers of electric power. Based on total annual U.S. electrical sales of $53,462,864,000 in 1976,(1) the proposed marking and disposal regulations will cause an average increase in the price of electricity of about 0.06 percent.

Because the use of PCBs is so universally associated with the use of electric power, no specific industry or region will be relatively disadvantaged by the costs of complying with the proposed regulations. Since all segments of industry will be impacted to an equal degree, costs can be recovered from the consumers in the form of higher product prices without resulting in any significant market shifts or price increases.

The only effects on employment will be increases in manpower required to comply with the proposed regulations. Small increases in employment may occur in several categories including: clerical workers to comply with record keeping requirements; plant operators and managers to operate larger or additional incinerators; truck drivers to handle increased transportation demand, and construction workers during the initial construction of storage facilities.

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(1) Personal Communication, Mr. Karl Tobin, Edison Electric Institute, New York, N.Y., April 21, 1977.

5.5 Energy Consumption Requirements

The major increased energy requirement resulting from the proposed regulation will be for fuel oil to operate the incinerators. In addition, energy in the form of fuels or solvents will be required to generate the electric power to operate the incinerators, power the trucks used to haul the PCB equipment to disposal sites, and flush transformers prior to disposal.

Total energy consumption requirements are summarized in Table 5-2 for disposal option 1. The energy requirements are converted into equivalent barrels of crude oil using a loss factor of 3.7 percent during the refining of oil to fuels or solvents and an energy requirement of one gallon of fuel oil per 39.5 kilowatt hours of electricity.

The total energy requirements will probably be considerably less than the upper bound estimate of 17,700 BBL/day. The actual amount of material incinerated will be closer to disposal option 2, and waste solvents and oils will be used to replace part of the incinerator fuel requirements.

5.6 Effect on Supplies of Strategic Materials

The regulations do not directly have any significant affect on the supply or consumption of any strategic materials. However, strict controls on the disposal of transformers may discourage development of reclamation technology for the copper in transformer windings as the GE incinerator will shut down soon and there are no others able to handle copper windings. Not all transformers have copper windings; many of the newer transformers have used aluminum conductors, so there are perhaps 100,000 copper/askarel transformers in service containing 1,000 pounds of copper each. The disposal of these transformers over 40 years into chemical waste landfills would result in the loss of 2,500,000 lbs of copper per year which might otherwise be reclaimed. This is considerably less than 1 percent of the total amount of copper reclaimed each year in the U.S. and is an insignificant portion of the total amount of copper consumed each year.

TABLE 5-2

Annual Energy Requirements of Disposal Regulations
Disposal Option 1 (Incinerate all Capacitors)

Fuel for Incinerators:	
1 gal. fuel oil per lb PCB equipment	258,700,000 gal
1 gal solvent per gallon transformer askarel drained	1,215,000 gal
Electricity (100,000 kwh x 12/39.5 gal/kwh)	30,379 gal
Transportation (.01 gal/lb PCB equipment)	2,587,000 gal
Total Refined Fuel	262,000,000 gal.

Crude oil equivalent: $\frac{262,000,000}{.963} = 271,000,000$ gal.

Crude oil equivalent: $\frac{271,000,000}{42} = 6,452,000$ BBL/year

Crude oil equivalent: $\frac{6,452,000}{365} = 17,700$ BBL/day

APPENDIX A

TOXIC SUBSTANCES CONTROL ACT

Public Law 94-469

90 Stat. 2003 *et seq*

(e) POLYCHLORINATED BIPHENYLS.—(1) Within six months after the effective date of this Act the Administrator shall promulgate rules to— Rules.

(A) prescribe methods for the disposal of polychlorinated biphenyls, and

(B) require polychlorinated biphenyls to be marked with clear and adequate warnings, and instructions with respect to their processing, distribution in commerce, use, or disposal or with respect to any combination of such activities.

Requirements prescribed by rules under this paragraph shall be consistent with the requirements of paragraphs (2) and (3).

(2)(A) Except as provided under subparagraph (B), effective one year after the effective date of this Act no person may manufacture, process, or distribute in commerce or use any polychlorinated biphenyl in any manner other than in a totally enclosed manner.

(B) The Administrator may by rule authorize the manufacture, processing, distribution in commerce or use (or any combination of such activities) of any polychlorinated biphenyl in a manner other than in a totally enclosed manner if the Administrator finds that such manufacture, processing, distribution in commerce, or use (or combination of such activities) will not present an unreasonable risk of injury to health or the environment.

(C) For the purposes of this paragraph, the term "totally enclosed manner" means any manner which will ensure that any exposure of human beings or the environment to a polychlorinated biphenyl will be insignificant as determined by the Administrator by rule. "Totally enclosed manner."

(3)(A) Except as provided in subparagraphs (B) and (C)—

(i) no person may manufacture any polychlorinated biphenyl after two years after the effective date of this Act, and

(ii) no person may process or distribute in commerce any polychlorinated biphenyl after two and one-half years after such date.

(B) Any person may petition the Administrator for an exemption from the requirements of subparagraph (A), and the Administrator may grant by rule such an exemption if the Administrator finds that— Petition for exemption.

(i) an unreasonable risk of injury to health or environment would not result, and

(ii) good faith efforts have been made to develop a chemical substance which does not present an unreasonable risk of injury to health or the environment and which may be substituted for such polychlorinated biphenyl.

An exemption granted under this subparagraph shall be subject to such terms and conditions as the Administrator may prescribe and shall be in effect for such period (but not more than one year from the date it is granted) as the Administrator may prescribe. Terms and conditions.

(C) Subparagraph (A) shall not apply to the distribution in commerce of any polychlorinated biphenyl if such polychlorinated biphenyl was sold for purposes other than resale before two and one half years after the date of enactment of this Act.

(4) Any rule under paragraph (1), (2)(B), or (3)(B) shall be promulgated in accordance with paragraphs (2), (3), and (4) of subsection (c).

(5) This subsection does not limit the authority of the Administrator, under any other provision of this Act or any other Federal law, to take action respecting any polychlorinated biphenyl.

SEC. 6. REGULATION OF HAZARDOUS CHEMICAL SUBSTANCES AND MIXTURES.

15 USC 2605. (a) SCOPE OF REGULATION.—If the Administrator finds that there is a reasonable basis to conclude that the manufacture, processing, distribution in commerce, use, or disposal of a chemical substance or mixture, or that any combination of such activities, presents or will present an unreasonable risk of injury to health or the environment, the Administrator shall by rule apply one or more of the following requirements to such substance or mixture to the extent necessary to protect adequately against such risk using the least burdensome requirements:

(1) A requirement (A) prohibiting the manufacturing, processing, or distribution in commerce of such substance or mixture, or (B) limiting the amount of such substance or mixture which may be manufactured, processed, or distributed in commerce.

(2) A requirement—

(A) prohibiting the manufacture, processing, or distribution in commerce of such substance or mixture for (i) a particular use or (ii) a particular use in a concentration in excess of a level specified by the Administrator in the rule imposing the requirement, or

(B) limiting the amount of such substance or mixture which may be manufactured, processed, or distributed in commerce for (i) a particular use or (ii) a particular use in a concentration in excess of a level specified by the Administrator in the rule imposing the requirement.

(3) A requirement that such substance or mixture or any article containing such substance or mixture be marked with or accompanied by clear and adequate warnings and instructions with respect to its use, distribution in commerce, or disposal or with respect to any combination of such activities. The form and content of such warnings and instructions shall be prescribed by the Administrator.

(4) A requirement that manufacturers and processors of such substance or mixture make and retain records of the processes used to manufacture or process such substance or mixture and monitor or conduct tests which are reasonable and necessary to assure compliance with the requirements of any rule applicable under this subsection.

(5) A requirement prohibiting or otherwise regulating any manner or method of commercial use of such substance or mixture.

(6) (A) A requirement prohibiting or otherwise regulating any manner or method of disposal of such substance or mixture, or of any article containing such substance or mixture, by its manufacturer or processor or by any other person who uses, or disposes of, it for commercial purposes.

(B) A requirement under subparagraph (A) may not require any person to take any action which would be in violation of any law or requirement of, or in effect for, a State or political subdivision, and shall require each person subject to it to notify each State and political subdivision in which a required disposal may occur of such disposal.

(7) A requirement directing manufacturers or processors of such substance or mixture (A) to give notice of such unreasonable risk of injury to distributors in commerce of such substance or mixture and, to the extent reasonably ascertainable, to other persons in possession of such substance or mixture or exposed to such substance or mixture, (B) to give public notice of such risk of injury, and (C) to replace or repurchase such substance or mixture as elected by the person to which the requirement is directed.

Any requirement (or combination of requirements) imposed under this subsection may be limited in application to specified geographic areas.

APPENDIX B

DRAFT PCB MARKING AND DISPOSAL REGULATIONS (4-18-77)

40 CFR 761

It is proposed to establish a new 40 CFR 761 to read as follows:

PART 761 - POLYCHLORINATED BIPHENYLS (PCBs)

Subpart A - General

Subpart B - Disposal of PCBs

Subpart C - Marking of PCBs

Subpart D - (Reserved)

Subpart E - List of Annexes

Subpart A - General

Sec. 761.1 Applicability

(a) This subpart establishes procedures, methods, and other requirements for the disposal, storage, and marking of polychlorinated biphenyls (PCBs).

(b) This subpart applies to all persons who manufacture, process, distribute in commerce, use, or dispose of PCBs, including mixtures and manufactured items which contain PCBs.

(c) The basic requirements of these regulations are set forth in Subpart B - Disposal of PCBs and Subpart C - Marking of PCBs. Subpart E elaborates the requirements which are referred to in the disposal and marking sections. Definitions of words used in all of these sections are found in Subpart A. In particular, Sec. 761.2(p)-(v) of Subpart A define "PCBs" covered by these regulations.

(d) Section 15 of the Toxic Substances Control Act (TSCA) states that failure to comply with these regulations is unlawful. Section 16 imposes liability for civil penalties upon any person who violates these regulations. Section 16 also subjects a person to criminal prosecution for a violation which is knowing or willful.

Sec. 761.2 Definitions

For the purpose of this part:

(a) "Administrator" means the Administrator of the Environmental Protection Agency, or any employee of the Agency to whom the Administrator may either herein or by order delegate his authority to carry out his functions, or any person who shall by operation of law be authorized to carry out such functions.

(b) "Agency" means the United States Environmental Protection Agency.

(c) "Capacitor" means a device for accumulating and holding a charge of electricity, consisting of conducting surfaces separated by a dielectric. Types of capacitors are as follows:

(1) "Small Capacitor" means a capacitor which contains less than 1.36 kg (3 lbs.) of dielectric, except for a capacitor which is defined as an "HID Capacitor."

(2) "HID Capacitor" means a capacitor which contains less than 1.36 kg (3 lbs.) of dielectric and which is used as part of the ballast of a high intensity discharge lighting fixture (e.g., sodium vapor and mercury vapor arc lights).

(3) "Large High Voltage Capacitor" means a capacitor which contains 1.36 kg (3 lbs.) or more of dielectric and which operates at 2000 volts a.c. or above.

(4) "Large Low Voltage Capacitor" means a capacitor which contains 1.36 kg (3 lbs.) or more of dielectric and which operates below 2000 volts a.c.

(d) (1) Except as provided in subparagraph (2), the term "Chemical Substance" means any organic or inorganic substance of a particular molecular identity, including:

(A) any combination of such substances occurring in whole or part as a result of a chemical reaction or occurring in nature, and

(B) any element or uncombined radical.

(2) Such term does not include:

(A) any mixture,

(B) any pesticide (as defined in the Federal Insecticide, Fungicide, and Rodenticide Act) when manufactured, processed, or distributed in commerce for use as a pesticide,

(C) tobacco or any tobacco product,

(D) any source material, special nuclear material, or byproduct material (as such terms are defined in the Atomic Energy Act of 1954 and regulations issued under such Act),

(E) any article the sale of which is subject to the tax imposed by Section 4181 of the Internal Revenue Code of 1954 (determined without regard to any exemptions from such tax provided by Section 4182 or 4221 or any other provisions of such Code), and

(F) any food, food additive, drug, cosmetic, or device (as such terms are defined in Section 201 of the Federal Food, Drug, and Cosmetic Act) when manufactured, processed, or distributed in commerce for use as a food, food additive drug, cosmetic, or device.

(e) "Chemical Waste Landfill" means a landfill at which protection is provided from PCBs deposited therein against risk of injury to health or the environment by locating, engineering, and operating such landfill so as to prevent migration of PCBs to land, water, or the atmosphere.

(f) "Commerce" means trade, traffic, transportation, or other commerce

(1) between a place in a State and any place outside of such State, or

(2) which affects trade, traffic, transportation, or commerce described in clause (1).

(g) "Disposal" means to intentionally or accidentally discard, throw away, or otherwise complete or terminate the useful life of an object or substance. Disposal includes actions related to containing, transporting, destroying, degrading, decontaminating, or confining those substances, mixtures, or articles that are being disposed.

(h) "Distribute in Commerce" and "Distribution in Commerce" when used to describe an action taken with respect to a chemical substance or mixture or article containing a substance or mixture means to sell or to transfer the ownership of the substance, mixture, or article in commerce; to introduce or deliver for introduction into commerce, or the introduction or delivery for introduction into commerce of the substance, mixture, or article; or to hold, or the holding of, the substance, mixture, or article after its introduction into commerce.

(i) "Fluorescent Light Ballast" means a device which electrically controls fluorescent light fixtures and which includes a capacitor containing 0.1 kg or less of dielectric.

(j) "Incinerator" means any installation operated for the incineration of chemical substances, mixtures, or articles.

(k) "Manufacture" means to produce, manufacture, or import into the customs territory of the United States.

(l) "Mark" means the descriptive name, instructions, cautions, or other information applied to chemical substances, mixtures, articles, containers, equipment, or other objects or activities described in these regulations.

(m) "Marked" means the permanent application of a legible mark by painting, fixation of an adhesive label, or other method.

(n) "Mixture" means any combination of two or more chemical substances if the combination does not occur in nature and is not, in whole or in part, the result of a chemical reaction. Such term does include

(1) any combination which occurs, in whole or in part, as a result of a chemical reaction if none of the chemical substances comprising the combination is a new chemical substance and if the combination could have been manufactured for commercial purposes without a chemical reaction at the time the chemical substances comprising the combination were combined,

(2) any combination of chemical substances which is the result of solution or hydration; and

(3) any combination which occurs as a consequence of a reaction which may take place if a chemical substance which functions as a stabilizer, colorant, antioxidant, filler, solvent, carrier, surfactant, or plasticizer is added to another chemical substance and performs as intended.

(o) "Municipal Solid Wastes" means garbage, refuse, sludges, wastes, and other discarded materials resulting from residential and non-industrial operations and activities.

(p) "PCB" and "PCBs" mean one or more of the following: "PCB Chemical Substance", "PCB Mixture", "PCB Article", "PCB Equipment", and "PCB Container."

(q) "PCB Article" means any manufactured item, other than a PCB container, whose surface(s) has been in direct contact with a PCB chemical substance or a PCB mixture, and includes capacitors, transformers, electric motors, pumps, and pipes.

(r) "PCB Article Container" means 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 a PCB chemical substance or PCB mixture.

(s) "PCB Chemical Substance" means any chemical substance which is limited to the biphenyl molecule which has been chlorinated to varying degrees, and includes substances such as Arochlors.

(t) "PCB Container" means any package, can, bottle, bag, barrel, drum, tank, or other device used to contain a PCB chemical substance, PCB mixture, or PCB article, and whose surface(s) has been in direct contact with a PCB chemical substance or PCB mixture.

(u) "PCB Equipment" means 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, television sets, and fluorescent light ballasts and fixtures.

(v) "PCB Mixture" means any mixture, except municipal sewage treatment sludge, which contains 0.05 percent (on a dry weight basis) or greater of a PCB chemical substance, and includes dielectrics, contaminated solvents and oils, rags, soil, paints, and debris.

(w) "Person" means any natural or juridical person including any individual, corporation, partnership, or association, any State or political subdivision thereof, any interstate body and any department, agency, or instrumentality of the Federal government.

(x) "Process" means the preparation or use of a chemical substance or mixture, after its manufacture, for distribution in commerce:

   (1) in the same form or physical state as, or in a different form or physical state from, that in which it was received by the person so preparing such substance or mixture, or

   (2) as part of an article containing the chemical substance or mixture.

(y) "Municipal Sewage Treatment Sludge" means the solid residue resulting from the treatment of municipal sewage.

(z) "Storage for Disposal" means temporary storage of PCBs that have been designated for disposal.

(aa) "Transport Vehicle" means a motor vehicle or rail car used for the transportation of cargo by any mode. Each cargo-carrying body (e.g., trailer, railroad freight car) is a separate transport vehicle.

Subpart B - Disposal of PCBs

Sec. 761.10 Disposal Requirements

These regulations do not require removal of PCBs from service and disposal earlier than would normally be the case. However, when PCBs are removed from service and disposed of, disposal must be undertaken in accordance with these regulations. Future regulations will be directed to the manufacture, use, and distribution in commerce of PCBs and may result in some cases in disposal at an earlier date than would otherwise occur.

(a) PCB Chemical Substances

(1) A PCB chemical substance shall be disposed of in an incinerator which complies with Annex I.

(2) Prior to disposal, a PCB chemical substance shall be stored in a facility which complies with Annex III.

(b) PCB Mixtures

(1) Except as provided in subsections (2) and (3), a PCB mixture shall be disposed of in an incinerator which complies with Annex I.

(2) A non-liquid PCB mixture in the form of contaminated soil, sludge, dredge spoil, rags, or other debris shall be disposed of

(A) in an incinerator which complies with Annex I, or

(B) until July 1, 1979, in a chemical waste landfill which complies with Annex II.

(3) Solid residue from an incinerator used for PCB disposal in accordance with Annex I shall be disposed of

(A) in an incinerator which complies with Annex I, or

(B) in a chemical waste landfill which complies with Annex II.

(4) Prior to disposal, a PCB mixture shall be stored in a facility which complies with Annex III.

(c) PCB Articles & PCB Fluorescent Light Ballasts

(1) A PCB transformer shall be disposed of

(A) in an incinerator which complies with Annex I, or

(B) in a chemical waste landfill which complies with Annex II, provided the transformer is first drained, and flushed internally if necessary, so that no more than two percent of the dielectric liquid volume measured to the fill line remains. PCB chemical substances and PCB mixtures which are removed shall be disposed of in accordance with subsections (a) and (b).

(2) Unless the manufacturer's literature, the label, or chemical analysis indicates that a fluorescent light ballast does not contain a PCB chemical substance or a PCB mixture, the ballast shall be disposed of in an incinerator that complies with Annex I or until July 1, 1979, in a chemical waste landfill that complies with Annex II except that the occupant of a private housing unit may dispose of ballasts used in the housing unit as municipal solid waste.

(3) Other PCB articles shall be disposed of in an incinerator which complies with Annex I.

(4) Except for fluorescent light ballasts used in private housing units, prior to disposal PCB articles shall be stored in a facility which complies with Annex III.

(d) PCB Equipment Other than PCB Fluorescent Light Ballasts

(1) Except as provided in Subsection (2), PCB equipment other than PCB fluorescent light ballasts shall be disposed of

(A) in an incinerator which complies with Annex I,

(B) in a chemical waste landfill which complies with Annex II, or

(C) as municipal solid waste.

(2) Whenever PCB equipment is serviced in a manner which provides direct access to a PCB article such as a capacitor and a decision is made to dispose of the PCB equipment, the PCB article shall be removed from the equipment and disposed of in accordance with Subsection (c).

(e) PCB Containers

(1) Unless decontaminated in accordance with Annex IV, a PCB container shall be disposed of

(A) in an incinerator which complies with Annex I, or

(B) in a chemical waste landfill which complies with Annex II, provided that the PCB container shall first be drained, and flushed internally if necessary, so that remaining PCB chemical substances and PCB mixtures constitute no more than 0.5 percent of the total volume of the container.

(2) Prior to disposal, a PCB container shall be stored in a facility which complies with Annex III.

(f) Spills

(1) Spills and other uncontrolled discharges of PCB chemical substances or PCB mixtures constitute the disposal of PCB chemical substances or PCB mixtures and must comply with this section.

(2) PCB chemical substances and PCB mixtures resulting from spill incidents shall be stored and disposed of in accordance with Subsections (a) and (b) respectively.

(3) This subsection does not exempt owners or operators responsible for a spill from any actions or liability under other statutory authorities, including Section 311 of the Federal Water Pollution Control Act (Pub. L. 92-500) and the Resource Conservation and Recovery Act (94-580).

(g) Municipal solid wastes containing PCBs shall be disposed of as provided in applicable Federal, state, or local laws, regulations, and policies.

(h) A municipal sewage treatment sludge which contains 0.05 percent (on a dry weight basis) or greater PCB chemical substances shall be disposed of

(1) in an incinerator which complies with Annex I, or

(2) until July, 1, 1979, in a chemical waste landfill which complies with Annex II.

Subpart C - Marking of PCBs

Sec. 761.20 Marking Requirements

(a) The following marking requirements shall apply:

(1) Each PCB article manufactured after January 1, 1978, shall be marked at the time of manufacture with mark M_L as described in Annex V - Sec. 761.44(a).

(2) Each item of PCB equipment manufactured after January 1, 1978, shall be marked at the time of manufacture with mark M_L.

(3) Each PCB container, whether new or existing, shall be marked by January 1, 1978, with mark M_L.

(4) Each PCB article, except small PCB capacitors, contained in PCB equipment in inventory after January 1, 1978, shall be marked before it is distributed in commerce with mark M_L.

(5) Each PCB article container used to contain a PCB article that shall be marked under the provisions of (1) or (4) above shall be marked by January 1, 1978, with mark M_L.

(6) Each storage area used to store PCBs for disposal shall be marked by January 1, 1978, with mark M_L.

(7) Each PCB article when removed from use after January 1, 1978, shall at the time of removal either be marked with mark M_L or be placed in a PCB container marked with mark M_L, except for PCBs disposed of as municipal solid waste as provided in Sections 761.10(c)(2), 761.10(d)(1)(c), and 761.10(g).

(8) Each of the following PCB articles using PCB chemical substances or PCB mixtures as internal fluids shall be marked by January 1, 1978, with mark M_L:

(A) Electric motors using PCB coolants.

(B) Hydraulic machinery using PCB hydraulic fluid.

(C) Heat transfer systems (other than transformers) using PCB fluids.

(b) In addition to the requirements of Subsection (a), the following marking requirements shall apply:

(1) Effective March 31, 1978 each transport vehicle loaded with PCB containers with more than 45 kg of PCB chemical substances or PCB mixtures in the liquid phase or with one or more PCB transformers shall be marked with mark M_L.

(2) Each PCB large low voltage capacitor and each PCB HID capacitor that is in use after March 31, 1978, shall be marked with mark M_L as soon after the date as the capacitor is available for marking because of other servicing of the equipment. A capacitor is available for marking when other servicing operations provide the servicing person direct access to the capacitor.

(c) In addition to the requirements of Subsections (a) and (b), the following marking requirements shall apply:

(1) Each PCB transformer shall be marked by July 1, 1978, with mark M_L.

(2) Each PCB large high voltage capacitor shall be identified by July 1, 1978, by at least one of the following methods:

(A) Each individual capacitor is to be marked with mark M_L, or

(B) If one or more PCB large high voltage capacitors are installed in a protected location as on a power pole or structure or behind a fence, the pole, structure, or fence is to be marked with mark M_L and a record or procedure identifying the PCB capacitors is to be maintained by the owner or operator at the protected location.

(d) Where mark M_L is specified but the PCB article or PCB equipment is too small to accommodate the smallest permissible size of mark M_L, mark M_S, as described in Annex V - Sec. 761.44(b), may be used instead of mark M_L.

Subpart D - (Reserved)

Annex I

Sec. 761.40 Incineration

(a) Liquid PCBs

An incinerator used for incinerating PCB chemical substances or liquid PCB mixtures shall be approved by the Agency Regional Administrator pursuant to Subsection (d). Such incinerator shall meet all of the requirements specified in (1) through (9) of this subsection, unless a waiver from these requirements is obtained pursuant to (d)(5). In addition, the incinerator shall meet any other requirements which may be prescribed pursuant to (d)(4).

(1) Combustion criteria shall be either of the following:

(A) maintenance of the introduced liquids for a 2-second dwell time at 1200°C (± 100°C) and 3 percent excess oxygen in the stack gas, or

(B) maintenance of the introduced liquids for a 1 1/2 dwell time at 1600°C (± 100°C) and 2 percent excess oxygen in the stack gas.

(2) Combustion efficiency shall be at least 99 percent computed as follows:

$$\text{Combustion Efficiency} = \frac{C_{CO_2} - C_{CO}}{C_{CO_2}} \times 100$$

where

C_{CO_2} = concentration of carbon dioxide

C_{CO} = concentration of carbon monoxide

(3) The rate and quantity of PCBs which are fed to the combustion system shall be measured and recorded at regular intervals of no longer than 15 minutes.

(4) The temperatures of the incineration process shall be continuously measured and recorded. The combustion temperature of the incineration process shall be based on either direct (pyrometer) or indirect (wall thermocouple-pyrometer correlation) temperature readings.

(5) The flow of PCBs to the incinerator shall stop automatically whenever the combustion temperature drops below the temperatures specified in (1) above.

(6) Monitoring of stack emission products shall be conducted

(A) when an incinerator is first used for the disposal of PCBs under the provisions of this regulation, and

(B) when an incinerator is first used for the disposal of PCBs after the incinerator has been modified in a manner which may affect the characteristics of the stack emission products.

(C) At a minimum such monitoring shall be conducted for the following parameters:

(i) O_2

(ii) CO

(iii) CO_2

(iv) Oxides of Nitrogen (NO_x)

(v) Hydrochloric Acid (HCl)

(vi) Total Chlorinated Organic Content (RCl)

(vii) PCB Chemical Substances

(viii) Total Particulate Matter

(7) At a minimum, continuous monitoring and recording of combustion products and incineration operations shall be conducted for the following parameters whenever the incinerator is incinerating PCBs.

(A) O_2

(B) CO

(C) CO_2

(8) Incinerator operations shall be immediately suspended when any one or more of the following conditions occur:

(A) failure of monitoring operations specified in (7) above,

(B) failure of the PCB rate and quantity measuring and recording equipment specified in (3) above, or

(C) combustion temperature, dwell time, or excess oxygen fall below those specified in (1) above.

(9) Water scrubbers shall be used for HCl control during PCB incineration and shall meet any performance requirements specified by the Regional Administrator. Scrubber effluent shall comply with applicable water quality standards, EPA Water Quality Criteria, and any other state and Federal laws and regulations. An alternate method of HCl control may be used if the alternate method has been approved by the Regional Administrator.

(b) Non-Liquid PCBs

An incinerator used for incinerating non-liquid PCB mixtures, PCB articles, PCB equipment, or PCB containers shall be approved by the Agency Regional Administrator pursuant to Subsection (d). Such incinerator shall meet all of the requirements specified in (1) through (3) of this subsection, unless a waiver from these requirements is obtained pursuant to (d)(5). In addition, the incinerator shall meet any other requirements which may be prescribed pursuant to (d)(4).

(1) The mass air emissions from the incinerator shall be no greater than 0.001g PCB chemical substances/Kg of PCB chemical substance introduced into the incinerator.

(2) Such incinerator shall comply with the provisions of Section 761.40(a) (2),(3),(4),(6),(7),(8)(A) and (B), and (9).

(3) The flow of PCBs to the incinerator shall stop automatically whenever the combustion temperature falls below the temperatures specified in any approvals issued by the Regional Administrator pursuant to Subsection (d) below. Incinerator operations shall stop immediately whenever the excess oxygen measurements fall below those specified in any approvals issued by the Regional Administrator pursuant to (d) below.

(c) Maintenance of Data and Records

All data and records required by this section shall be maintained in accordance with Annex VI - Section 761.45, Records and Monitoring.

(d) Approval of Incinerators

Prior to the incineration of PCBs, the owner or operator of an incinerator shall receive the written approval of the Agency Regional Administrator of the Region in which the incinerator is located. Such approval shall be obtained in the following manner:

(1) Initial Report

The owner or operator shall submit to the Regional Administrator an initial report which contains:

(A) The location of the incinerator.

(B) A detailed description of the incinerator including general site plans and design drawings of the incinerator.

(C) Engineering reports or other information on the anticipated performance of the incinerator.

(D) Sampling and monitoring equipment and facilities available.

(E) Waste volumes expected to be incinerated.

(F) Any local, state, or Federal permits or approvals.

(G) Schedules and plans for complying with the approved requirements of this regulation.

(2) Trial Burn

(A) Following receipt of the report described in (1), the Regional Administrator shall notify the person who submitted the report whether a trial burn of PCBs must be conducted. The Regional Administrator may require the person who submitted the report described in (1) to submit such other information as the Regional Administrator finds to be reasonably necessary to determine the need for a trial burn.

(B) If the Regional Administrator determines that a trial burn must be held, the person who submitted the report described in (1) shall submit to the Regional Administrator a detailed plan for conducting and monitoring the trial burn. At a minimum, the plan must include:

(i) Date trial burn is to be conducted.

(ii) Quantity and type of PCBs to be incinerated.

(iii) Parameters to be monitored and location of sampling points.

(iv) Sampling frequency and methods and schedules for sample analyses.

(v) Name, address, and qualifications of persons who will review analytical results and other pertinent data and perform a technical evaluation of the effectives of the trial burn.

(C) Following receipt of the plan described in (B), the Regional Administrator will approve the plan, require additions or modifications to the plan, or disapprove the plan. If the plan is disapproved, the Regional Administrator will notify the person who submitted the plan of such disapproval, together with the reasons why it was disapproved. That person may thereafter submit a new plan in accordance with (B). If the plan is approved (with any additions or modifications which the Regional Administrator may prescribe), the Regional Administrator will notify the person who submitted the plan of such approval. Thereafter the trial burn shall take place at a date and time to be agreed upon between the Regional Administrator and the person who submitted the plan.

(3) Other Information

In addition to the information contained in the report and plan described in (1) and (2), the Regional Administrator may require the owner or operator to submit such other information as the Regional Administrator finds to be reasonably necessary to determine whether an incinerator shall be approved.

[Note: The Regional Administrator will have available for review and inspection an Agency manual containing information or sampling methods and analytical procedures for the parameters required in Section 761.40(a)(3),(4),(6), and (7) plus any other paramaters he may determine to be appropriate. Owners or operators are encouraged to review this manual prior to submitting any report required in this Annex.]

(4) Contents of Approval

(A) Except as provided in (5), the Regional Administrator may not approve an incinerator for the disposal of PCBs unless he finds that the incinerator meets all of the requirements of (a) and/or (b), whichever is applicable.

(B) In addition to the requirements of (a) and/or (b), the Regional Administrator may include in an approval such other requirements as the Regional Administrator finds are necessary to ensure that operation of the incinerator does not present an unreasonable risk of injury to health or the environment from PCBs. Such requirements may include a fixed period of time for which the approval is valid.

(5) Waivers

An owner or operator of the incinerator may submit evidence to the Regional Administrator that operation of the incinerator will not present an unreasonable risk of injury to health or the environment from PCBs, when one or more of the requirements of (a) and/or (b) are not met. On the basis of such evidence and any other available information, the Regional

Administrator may in his discretion find that any such requirements are not necessary to protect against such risk and may waive such requirements in any approval for that incinerator. Any such finding and waiver must be stated in writing and included as part of the approval.

(6) Persons Approved

An approval will designate the persons who own and who are authorized to operate the incinerator, and will apply only to such persons.

(7) Final Approval

Approval of an incinerator will be in writing and signed by the Regional Administrator. The approval will state all requirements applicable to that incinerator.

Annex II

Sec. 761.41 Chemical Waste Landfills

(a) General

A chemical waste landfill used for the disposal of PCBs shall be approved by the Agency Regional Administrator pursuant to Subsection (c). Such landfill shall meet all of the requirements specified in Subsection (b), unless a waiver from these requirements is obtained pursuant to (c)(4). In addition, the landfill shall meet any other requirements which may be prescribed pursuant to (c)(3).

(b) Technical Requirements

Requirements for chemical waste landfills used for the disposal of PCBs are as follows:

(1) Soils

The landfill site shall be located in thick, relatively impermeable formations such as large-area clay pans. Where this is not possible, the soil shall have a high clay and silt content with the following parameters:

(A)	In-place soil thickness, or		4'
	Compacted soil liner thickness		3'
(B)	Permeability (cm/sec)	≤	$1x10^{-7}$
(C)	Percent soil passing No. 200 Sieve	≥	30
(D)	Liquid Limit	≥	30
(E)	Plasticity Index	≥	15
(F)	Artificial Liner Thickness	≥	30 mil

(Note: In the event that an artificial liner is used at a landfill site, special precautions shall be taken to insure that its integrity is maintained and that it is chemically compatible with PCBs. Soil underlining shall be provided as well as a soil cover).

(2) Hydrology

The bottom of the landfill shall be substantially above the historical high groundwater table. Floodplains, shorelands, and groundwater recharge areas shall be avoided. There shall be no hydraulic connection between site and standing or flowing surface water. The site shall have monitoring wells and leachate collection and shall be at least fifty feet from the nearest groundwater.

(3) Flood Protection

(A) If the landfill site is below the 100-year floodwater elevation, the operator shall provide surface water diversion dikes around the perimeter of the landfill site with a minimum height equal to two feet above the 100-year floodwater elevation.

(B) If the landfill site is above the 100-year floodwater elevation, the operator shall provide diversion structures capable of diverting all of the surface water run-off from a 24-hour, 25-year storm.

(4) Topography

The landfill site shall be located in an area of low to moderate relief to minimize erosion and to help prevent landslipes or slumping.

(5) Monitoring Systems

(A) Water Sampling

(i) The ground and surface water from the disposal site area shall be sampled for use as baseline data prior to the commencement of disposal operations.

(ii) Defined sources shall be sampled at least monthly when the landfill is being used for disposal operations.

(iii) Defined sources shall be sampled indefinitely on a frequency of no less than once every six months after final closure of the disposal area.

(B) Groundwater Monitor Wells

(i) If underlying earth materials are homogeneous, impermeable, and uniformly sloping in one direction, only three sampling points shall be necessary. These three points shall be equally spaced on a line through the center of the disposal area and extending from the area of highest water table elevation to the area of the lowest water table elevation on the property.

(ii) All monitor wells shall be cased and the annular space between the monitor zone (zone of saturation) and the surface shall be completely backfilled or plugged with Portland cement to effectively prevent percolation of surface water into the well bore. The well opening at the surface shall have a removable cap to provide access and to prevent entrance of rainfall or stormwater runoff. The well shall be pumped to remove the volume of liquid initially contained in the well before obtaining a sample for analysis. The discharge shall be treated to meet applicable state or Federal discharge standards or recycled to the chemical waste landfill.

(C) Water Analysis

As a minimum, all samples shall be analyzed for the following parameters, and all data and records of the sampling and analysis shall be maintained as required in Annex VI. Sampling methods and analytical procedures for these parameters shall be as specified in 40 CFR 136 as amended in 41 FR 52779 of December 1, 1976.

(i) PCBs

(ii) pH

(iii) Specific Conductance

(iv) Chlorinated Organics

(6) Leachate Collection

A leachate collection monitoring system shall be installed beneath the chemical waste landfill. Leachate collection systems shall be monitored monthly for quantity and quality of leachate produced. The leachate should be either treated to acceptable limits for discharge in accordance with a state or Federal permit or disposed of by another state or Federal approved method. Water analysis shall be as provided in (5)(C) above. Acceptable leachate collection monitoring/collection systems include, but are not limited to, the following basic designs:

(A) Simple Leachate Collection: This system consists of a gravity flow drainfield installed under the waste disposal facility liner. This design is recommended for use when semi-solid or leachable solid wastes are placed in a lined pit excavated into a relatively thick, unsaturated, homogeneous layer of low permeability soil.

(B) Compound Leachate Collection: This system consists of a gravity flow drainfield installed under the waste disposal facility liner and above a secondary installed liner. This design is recommended for use when semi-liquid or leachable solid wastes are placed in a lined pit excavated into relatively permeable soil.

(C) Suction Manometers: This system consists of a network of porous "stones" connected by hoses/tubing to a vacuum pump. The porous "stones" or suction manometers are installed along the sides and under the bottom of the waste disposal facility liner. This type of system works best when installed in relatively permeable unsaturated soil immediately adjacent to the disposal facility's bottom and/or sides.

(7) Chemical Waste Landfill Operations

(A) PCBs shall be placed in the landfill in a manner that will prevent damage to containers or articles. Other wastes placed in the landfill that are not chemically compatible with PCBs or PCB containers shall be segregated from the PCBs throughout the waste handling and disposal process.

(B) An operations plan shall be developed and submitted to the Regional Administrator for approval as required in Subsection (c). This plan shall include detailed explanations of the procedures to be used for recordkeeping, excavation and backfilling, waste segregation, burial coordinates, vehicle and equipment movement, use of roadways, leachate collection systems, sampling and monitoring procedures, monitoring wells, and security measures to protect against vandalism and unauthorized waste placements. EPA guidelines entitled "Thermal Processing and Land Disposal of Solid Waste" (39 FR 29337 of August 14, 1974) are a useful reference in preparation of this plan.

(C) Records shall be maintained for all PCB disposal operations and shall include the three dimensional burial coordinates for PCBs. Additional records shall be developed and maintained as provided in Annex VI.

(8) Supporting Facilities

(A) A six foot woven mesh fence, wall, or similar device shall be provided around the site to prevent unauthorized persons and animals from entering.

(B) Roads shall be maintained to and on the site which are adequate to operate and maintain the site without causing safety or nuisance problems or hazardous conditions.

(C) The site shall be operated and maintained in a manner to prevent safety problems or hazardous conditions resulting from spilled liquids and windblown materials.

(c) Approval of Chemical Waste Landfills

Prior to the disposal of any PCBs in a chemical waste landfill, the owner or operator of the landfill shall receive written approval of the Agency Regional Administrator of the Region in which the landfill is located. Such approval shall be obtained in the following manner:

(1) Initial Report

The owner or operator shall submit to the Regional Administrator an initial report which contains:

(A) The location of the landfill.

(B) A detailed description of the landfill including general site plans and design drawings.

(C) An engineering report describing the manner in which the landfill complies with the requirements for chemical waste landfills in (b) above.

(D) Sampling and monitoring equipment and facilities available.

(E) Expected waste volumes of PCBs.

(F) General description of waste materials other than PCBs that are expected to be disposed of in the landfill.

(G) Landfill operations plan as required in Subsection (b).

(H) Any local, state, or Federal permits or approvals.

(I) Any schedules or plans for complying with the approval requirements of these regulations.

(2) Other Information

In addition to the information contained in the report described in (1), the Regional Administrator may require the owner or operator to submit such other information as the Regional Administrator finds to be reasonably necessary to determine whether a chemical waste landfill should be approved.

(3) Contents of Approval

(A) Except as provided in (4), the Regional Administrator may not approve a chemical waste landfill for the disposal of PCBs unless he finds that the landfill meets all of the requirements of (6) above.

(B) In addition to the requirements of Subsection (b), the Regional Administrator may include in an approval such other requirements as the Regional Administrator finds are necessary to ensure that operation of the chemical waste landfill does not present an unreasonable risk of injury to health or the environment from PCBs. Such requirements may include a fixed period of time for which the approval is valid.

(4) Waivers

An owner or operator of a chemical waste landfill may submit evidence to the Regional Administrator that operation of the landfill will not present an unreasonable risk of injury to health or the environment from PCBs, when one or more of the requirements of Subsection (b) are not met. On the basis of such evidence and any other available information, the Regional Administrator may in his discretion find that any such requirements are not necessary to protect against such risk and may waive such requirements in any approval for that landfill. Such finding and waiver will be stated in writing and included as part of the approval.

(5) Persons Approved

Any approval will designate the persons who own and who are authorized to operate the chemical waste landfill, and will apply only to such persons.

(6) Final Approval

Approval of a chemical waste landfill will be in writing and will be signed by the Regional Administrator. The approval will state all requirements applicable to that landfill.

Annex III

Sec. 761.42 Storage for Disposal

(a) A PCB article or PCB container stored for disposal before July 1, 1981, shall be removed from storage and disposed of before July 1, 1982. Any PCB article or PCB container stored for disposal after July 1, 1981, shall be removed from storage and disposed of within one year from the date when it was first placed into storage.

(b) Except as provided in (c) below, after October 1, 1977, owners or operators of any facilities used for the storage of PCBs designated for disposal shall comply with the following requirements:

(1) Such facilities shall have:

(A) An adequate roof to prevent rainwater from reaching the stored PCBs.

(B) An adequate floor which has continuous curbing with a minimum six inch high curb. Such floor and curbing must provide a containment volume equal to at least two times the internal volume of the largest PCB equipment or PCB container stored therein or twenty-five percent of the total internal volume of all PCB equipment or containers stored therein, whichever is greater.

(C) No drain valves, floor drains, sewer lines, or other openings that would permit liquids to flow from the curbed area.

(D) Continuous, smooth, and impervious construction for floors and curbing such as Portland cement concrete.

(2) The storage area shall be marked as required in Subpart C - Sec. 761.20(a)(6).

(3) No items of movable equipment used for handling PCBs in the storage facilities shall be removed from the areas unless decontaminated.

(4) All PCB containers shall be checked for leaks at least once every 30 days. All leaking containers and their contents shall be transferred immediately to properly marked non-leaking containers. Any spilled or leaked materials shall be immediately cleaned up using sorbents or other adequate means, and the cleaned materials and residues shall be disposed of in accordance with Subpart B - Sec. 761.10(b).

(5) Any PCB container used for storage of liquid PCB chemical substances or liquid PCB mixtures shall comply with the specifications of the Department of Transportation Materials Transportation Bureau Hazardous Materials Regulations, 49 CFR 173.346 (41 FR 42544, September 27, 1976). Any PCB container used for the storage of PCB articles, PCB equipment, non-liquid PCB chemical substances, and non-liquid PCB mixtures may vary from 49 CFR 173.346 by meeting DOT Spec. 5, Spec. 5B, or Spec. 17C with removable heads.

(6) PCB articles and PCB containers shall be dated when they are placed in storage. The storage shall be managed so that the PCB articles and PCB containers can be located by the date they entered storage.

(7) Owners or operators of storage facilities shall establish and maintain records as provided in Annex VI.

(c) After October 1, 1977, storage facilities storing only small capacitors and having an aggregate storage volume not greater than two fifty-five gallon drums, may limit their compliance to using sound, non-leaking containers and storage of the containers within a building.

Annex IV

Sec. 761.43 Decontamination

(a) A PCB container may be decontaminated by a triple rinsing operation which requires the flushing of the internal surfaces of PCB containers three times with a solvent containing less than 0.05 percent PCB chemical substance in which the solubility of PCBs is five percent or more by weight. Each rinse shall use a volume of the normal diluent equal to approximately ten percent of the PCB container's capacity. The solvent may be reused for decontamination until it contains 0.5 percent PCB chemical substance. The solvent shall then be disposed of as a PCB mixture.

(b) Movable equipment used in storage areas shall be decontaminated by swabbing surfaces that have contacted PCB chemical substances and PCB mixtures with a solvent meeting the criteria of (a) above.

Sec. 761.44 Marking Formats

The following formats shall be used for marking:

(a) Large PCB Mark - M_L

Mark M_L shall be as shown in Figure 1, with black letters and striping on a white background, and shall be sufficiently durable to equal or exceed the life (including storage for disposal) of the equipment or container. The size of the mark shall be at least 15.25 cm (6 inches) on each side. If the PCB equipment is too small to accommodate this size, the mark may be reduced in size proportionately down to a minimum of 5 cm (2 inches) on each side.

(b) Small PCB Mark - M_S

Mark M_S shall be as shown in Figure 2, with black letters and striping on a white background, and shall be sufficiently durable to equal or exceed the life (including storage for disposal) of the equipment or container. The mark shall be a rectangle 2.5 by 5 cm (1 inch by 2 inches). If the PCB equipment is too small to accommodate this size, the mark may be reduced in size proportionately down to a minimum of 1 by 2 cm (.4 by .8 inches).

CAUTION

CONTAINS

PCBs

(Polychlorinated Biphenyls)

A toxic environmental contaminant requiring special handling and disposal in accordance with U.S. Environmental Protection Agency Regulations 40 CFR 761

In case of accident or spill or for disposal information, call toll free the U.S. Coast Guard National Response Center: 800-424-8802.

FIGURE 1

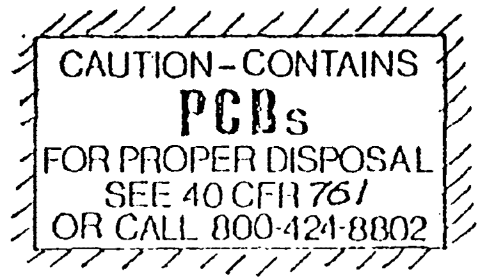
CAUTION - CONTAINS
PCBs
FOR PROPER DISPOSAL
SEE 40 CFR 761
OR CALL 800-424-8802

FIGURE 2

Annex VI

Sec. 761.45 Records and Monitoring

(a) PCBs in Service or Projected for Disposal

By January 1, 1978, each owner or operator of a facility containing forty-five kilograms of PCB chemical substances or PCB mixtures in the liquid phase or fifty or more PCB large high voltage capacitors shall develop and maintain records on the location and disposition of the PCBs. These records shall form the basis of an annual document prepared for each facility by March 1 covering the previous calendar year. Owners or operators with more than one facility which contain PCBs may maintain the records and documents at a single location, provided the identity of this location is available at each facility containing PCBs that is normally manned for eight hours a day. The records and documents shall be maintained for at least five years after the facility ceases containing PCBs at the prescribed quantities. The following information for each facility shall be included in the annual document:

(1) The dates when PCBs are removed from service, are placed into storage for disposal, and are placed into transport for disposal. The quantities of such PCBs shall be indicated using the following breakdown:

(A) Total weight in kilograms of any PCB chemical substances or PCB mixtures in PCB containers, including the identification of container contents, such as liquids, and capacitors.

(B) Total number of PCB transformers and total weight in kilograms of any PCB chemical substances and PCB mixtures contained in the transformers.

(C) Total number of PCB large high voltage capacitors.

(2) For PCBs removed from service, the location of the initial disposal or storage facility and the name of the owner or operator of the facility.

(3) Total quantities of PCBs remaining in service at the end of the calendar year using the following breakdown:

(A) Total weight in kilograms of any PCB chemical substances and PCB mixtures in PCB containers, including the identification of container contents such as liquids and capacitors.

(B) Total number of PCB transformers and total weight in kilograms of any PCB chemical substances and PCB mixtures contained in the transformers;

(C) Total number of PCB large high voltage capacitors.

(b) Disposal and Storage Facilities

Beginning in 1979, each owner or operator of a facility used for the storage or disposal of PCBs shall by March 1 of each year prepare and maintain a document which specifies the manner in which PCBs were handled at the facility during the previous calendar year. Such document shall be retained at each facility for at least five years after the facility is no longer used for the storage or disposal of PCBs, except that in the case of chemical waste landfills such documents shall be maintained at least twenty years after the chemical waste landfill is no longer used for the disposal of PCBs. Such documents shall be available at the facility for inspection by authorized representatives of the Environmental Protection Agency. If the facility ceases to be used for PCB storage or disposal, the owner or operator of such facility shall promptly notify the Agency Regional Administrator of the region in which the facility is located that the facility has ceased storage or disposal operations and shall specify where the documents required to be maintained by this paragraph shall be located. The following information shall be included in each document:

(1) The date when any PCBs are received by the facility during the previous calendar year for storage or disposal, and the identification of the person and facility from whom such PCBs were received.

(2) The date when any PCBs are disposed of at the disposal facility or transferred to another disposal or storage facility, including the identification of the specific types of PCB chemical substances, PCB mixtures, or PCB articles in containers; PCB transformers; and PCB equipment or PCB articles not in containers which were stored or disposed of.

(3) Total weight in kilograms of any PCB containers and the total weight in kilograms of any PCB chemical substances or PCB mixtures contained in any PCB transformers, received during the calendar year, transferred to other storage or disposal facilities during the calendar year, and remaining on the disposal or storage facility site at the end of the calendar year, re-

spectively, including, where applicable, the identification of PCB container contents such as liquids, capacitors, etc. When PCB containers or PCB chemical substances or PCB mixtures contained in a transformer are transferred to other storage or disposal facilities, the identification of the facility to which such PCBs were transferred shall be included.

(4) Total number of any PCB articles or PCB equipment, not in PCB containers, received during the calendar year, transferred to other storage or disposal facilities during the calendar year, and remaining on the facility site at the end of the calendar year, respectively, including the identification of the specific types of PCB articles and PCB equipment received, transferred, or remaining on the facility site. When PCB articles and PCB equipment are transferred to other storage or disposal facilities, the identification of the facility to which such PCB articles and PCB equipment were transferred must be included.

[Note: Any requirements for weights in kilograms of PCBs may be calculated values if the internal volume of containers and transformers is known and included in the reports, together with any assumptions on the density of the PCB chemical substances or PCB mixtures contained in the containers or transformers.]

(c) Incineration Facilities

For each owner or operator of a PCB incinerator facility, the following information is required in addition to the information required in Subsection (b):

(1) When PCBs are being incinerated, the following continuous and short-interval data shall be collected and maintained for a period of five years from the date of collection:

(A) Rate and quantity of PCBs fed to the combustion system, as provided in Annex I - Sec. 761.40(a)(3).

(B) Temperature of the combustion process, as provided in Annex I - Sec. 761.40(a)(4).

(C) Stack emission products to include O_2, CO, and CO_2, as provided in Annex I - Sec. 761.40(a)(7).

(2) When PCBs are being incinerated, data and records resulting from the monitoring of stack emissions as required in Annex I - Sec. 761.40(d)(2), shall be collected and maintained for five years.

(3) Total weight in kilograms of any solid residues generated by the incineration of PCBs during the calendar year, the total weight in kilograms of any solid residues disposed of by such facility in chemical waste landfills, and the total weight in kilograms of any solid residues remaining on the facility site shall be retained for five years.

(4) When PCBs are being incinerated, additional periodic data shall be collected and maintained as specified by the Regional

Administrator pursuant to Annex I - Sec. 761.40(d)(4).

(5) A document shall be prepared on any suspension of the operation of any incinerator by the owner or operator thereof, as required in Annex I - Sec. 761.40(a)(8). The document shall, at a minimum, include the date and time of the suspension and an explanation of the circumstances causing the suspension of operation.

(d) Retention of Special Records by Storage and Disposal Facilities

In addition to the information required to be maintained by Subsections (b) and (c), each owner or operator of a PCB storage or disposal facility shall collect and maintain for the time period required in (c) the following data:

(1) All documents, correspondence, and data provided to the owner or operator by any state or local government agency that pertain to the storage or disposal of PCBs at such facility.

(2) All documents, correspondence, and data provided by the owner or operator of such facility to any state or local government agency that pertain to the storage or disposal of PCBs at such facility.

(3) Any applications and related correspondence sent by the owner or operator of such facility to any local, state, or Federal authorities in regard to wastewater discharge permits, solid waste permits, building permits, or other permits or authorizations, such as those required by Annex I - Sec. 761.40(d) or Annex II - Section 761.41(c).

APPENDIX C

CHEMICAL WASTE LANDFILLS

Address: Casmalia Disposal Site
P.O. Box 5275
Santa Barbara, CA 93108
(805) 969-4703

Location of Landfill:
Santa Barbara, CA

Contact: Mr. Hunter or Mr. Cole

Waste Streams:

1. Exclusion: Radioactive waste.
2. Accept: PCB-contaminated solid wastes, primarily oily wastes, oil field wastes, pesticides, and etchant wastes.
3. Volume: Unknown.

Site Area: 300 acres with 1,000 acres buffer.

Disposal Price: $ .40/42 gal. barrel - oily wastes
$ .05/gal for special wastes

Estimated Landfill Life: Indefinite

Expansion Potential: Good, the firm is interested in expanding service to handle all hazardous chemical wastes.

Site Information: The site is equipped with monitoring wells and leachate surveillance facilities.

Licensed By: State of California, Class I site.

Comments: Petroleum industry and some electronics are currently the only generators of waste chemicals in this area.

Address: Chancellor & Ogden, Inc./BKK
3031 East I Street
Wilmington, CA 90744
(213) 432-8461

Location of Landfill:
City of West Covina, CA

Contact: Mr. William Shearer

Waste Streams:
1. Exclusions: Radioactive wastes.
2. Accept: PCB-contaminated solid wastes, Group I wastes as defined by the State of California.
3. Volume: Upwards to 500,000 gals./day.

Site Area: 600 acres

Disposal Price: Variable

Estimated Landfill Life: 45 years

Expansion Potential: None

Site Information: Acids are accepted but discharged in a separate location. The site meets state requirements for Class I materials. It has a natural clay strata with three monitoring wells placed in bed rock to monitor leachate activity.

Licensed By: State of California, Class I site.

Address: Chem-trol Pollution Services, Inc.
Subsidiary of SCA Services, Inc.
P.O. Box 200, 1550 Balner Rd.
Model City, NY 14107
(716) 754-8231

Landfill Location:
Model City, N.Y.

Contact: Dr. Robert Stadelmaier

Area Served: U.S. & Canaca,
chiefly 30 eastern states, Ontario and Quebec

Waste Streams:

1. Exclusions: radioactive wastes, shock-sensitive explosions
2. Accept: PCB-contaminated solid wastes, most types of chemical wastes including solvents/cleaners, halogenated hydrocarbons, paint 7 costing sludges, oils and oily waste, toxic acids, alkalis, plating/etching wastes, cyanides, heavy metal solutions & residues, pesticides/PCBs, carcinogens, sludges and solids, arsenic and mercury wastes.
3. Volume: Capacity in excess of 100 million gallons annually at Model City facilities.

Site area: 800 acres, 25 acres in use.

Disposal Prices:

	Contract	Non-contract
bulk	$5.00/ft^3$	< 50 ft^3 $6.50/ft^3$
55 gal drums	$28.00/drum	$30.00/drum

any PCB capacitor < 1 ft^3 can be landfilled as is, any larger must be drummed.

Estimated Landfill Life: 150-200 years

Expansion Potential: Similar facility scheduled to be on stream in 1-2 years in New Jersey. Actively considering sites and markets in several industrialized states.

Site Information: The site has reinforced membrane-lined clay cells that receive solids, sludges, and chemically fixed wastes. An internal sump within each cell collects leachate for treatment. Three-dimensional inventories of buried wastes are maintained for possible recovery at later date.

Address: County Sanitation Districts of Los Angeles County
P.O. Box 4998
Whittier, CA 90607
(213) 699-7411

Location of Landfill: Palos Verdes
City of Rolling Hills Estates, CA

Contact: Mr. Van Huit

Area Served: Los Angeles County

Waste Streams:

1. Exclusions: Wastes with pH less than 4 and greater than 11. Highly odorous, highly flammable, explosive and high temperature wastes. Magnesium. Loads containing a wide variety of chemical wastes, each in relatively small quantities and separate containers.
2. Accept: PCB-contaminated solid wastes, all group I wastes, except as noted.
3. Volume: Palos Verdes landfill - 1,300,000 tons of solid waste and 280,000 tons of liquids annually.

Site Area: 207 acres

Disposal Price: $3.50/ton with $2.00 minimum charge.
No special fee for loads delivered in drums.

Estimated Landfill Life: January 1981

Expansion Potential: None

Site Information: The site meets geological conditions described for Class I sites, and it has monitoring wells for leachate surveillance. At Palos Verdes, wastes are typically delivered by vacuum tanker truck and discharged into a diked area of municipal refuse. Front-end loaders are not used in landfilling operations. The area is covered at the end of each day.

Licensed By: State of California, Class I site.

Address: County Sanitation Districts of Los Angeles County
P.O. Box 4998
Whittier, CA 90607
(213) 699-7411

Location of Landfill: Calabasas Landfill located near the town of Agoura, CA

Contact: Mr. Van Huit

Area Served: Los Angeles County

Waste Streams:
1. Exclusions: Explosives and magnesium loads containing highly odorous or highly flammable wastes, concentrated acids and alkalines.
2. Accept: PCB-contaminated solid wastes, all Group I wastes except as noted.
3. Volume: Calabasas landfill - 320,000 tons of liquid annually.

Site Area: 416 acres

Disposal Price: $3.50/ton with $2.00 minimum charge.
No special fee for loads delivered in drums.

Estimated Landfill Life: 25-30 years

Expansion Potential: District personnel are investigating various alternatives for disposing of liquid industrial wastes.

Site Information: The site meets geological conditions described for Class I sites. Monitoring wells are provided for leachate surveillance. Front end loaders are not used in landfilling operations. The area is covered at the end of each day.

Licensed By: State of California, Class I Site.

Address: Fresno County Department of Public Works
4499 East Kings Canyon Rd.
Fresno, CA 93702
(209) 488-3820

Location of Landfill:
Fresno, CA

Contact: K.D. Swarts

Area Served: Central California, operated by Fresno County.

Waste Streams:
1. Exclusions: Bulk liquid wastes.
2. Accept: PCB-contaminated solid wastes, pesticide and fertilizer containers.
3. Volume: Approximately 11,000 yd^3 to date after 3 site openings.

Site Area: 32 acres

Disposal Price: \$0.75/yd^3 plus state fee based on \$ .60/ton equivalent.

Estimated Landfill Life: 40-50 yrs. (< 1% of site capacity has been used).

Expansion Potential: No expansion beyond the existing site is anticipated at this time.

Site Information: The site is located on tightly packed clay in a low rainfall area (8 to 10 inches/year). The ground water depth is 400-500 feet and no monitoring is required. The site is open only twice a year, two weeks in the spring and two weeks in the fall. Site operators have been briefed by agricultural inspector to recognize and handle various agricultural-chemical containers.

Licensed By: State of California, Class I site.

Comments: This site was specifically set up for the disposal of pesticide containers.

Address: Hollister Disposal Site
Hollister, California 95203
(408) 637-4491

Location of Landfill:
Hollister, CA

Contact: Mr. Grimsley
San Benito City Hall

Area Served: Operated by county, customers restricted to San Benito County.

Waste Streams:
1. Exclusions: Unknown
2. Accept: PCB-contaminated solid wastes, pesticide containers, off-spec missile propellant.
3. Volume - Unknown

Site Area: 115 acres (section of a sanitary landfill).

Disposal Price: $10. + $ .60/ton

Estimated Landfill Life: 40 years

Expansion Potential: Unknown

Site Information: The hazardous waste site is an isolated section of a sanitary landfill (115 acres). The water table lies 220 feet under low permeability clay. No special engineering was incorporated in establishing the area. Eight feet of fill is used daily to cover the fill site. All site run off is collected for treatment.

Licensed By: Licensed Class I disposal site by the state of California. Waste haulers must be approved by City Hall.

Address: Nuclear Engineering Co., Inc.
P.O. Box 158
Sheffield, IL 61361
(815) 452-2624

Location of Landfill:
Sheffield, IL

Contact: Mr. Bickford

Waste Streams:
1. Exclusions: Highly reactive sodium and potassium.
2. Accept: PCB-contaminated solid wastes, radioactive wastes, pesticides, organic wastes, miscellaneous toxic chemicals, heavy metals, (solids primarily, liquids accepted following state review).

Site Area: 40 acres

Disposal Price: Transportation - \$1.00/mi per 40,000 lb. truck
Disposal - \$1.25 to 1.75/ft^3

Estimated Landfill Life: Newly opened - unlimited

Expansion Potential: Ample land available.

Site Information: The burial sites consist of clay strata of low permeability and clay liners. The waste drums are buried in 30 ft. trenches with three times their volume of dry clay. Monitoring wells for the site are checked every two weeks.

Licensed By: Licensed by State of Illinois Health and Environmental Authorities.

Address: Nuclear Engineering Co., Inc.
Beatty, NV 89003
(815) 454-2624

Location of Landfill:
Beatty, NV

Contact: Mr. Bickford

Waste Streams:

1. Exclusions: Highly reactive sodium and potassium.
2. Accept: PCB-contaminated solid wastes, radioactive wastes, pesticides, organic wastes, miscellaneous toxic chemicals, heavy metals, (solids primarily, liquids accepted following state review).
3. Volume: No specific limit - depends on type and composition.

Site Area: Unknown

Disposal Price: Transportation - $1.00/mi per 40,000 lb. truck
Disposal - $1.25 to 1.75/ft^3

Estimated Landfill Life: Unlimited

Expansion Potential: Ample land available.

Site Information: The burial sites consist of clay strata of low permeability and clay liners. The waste drums are buried in 30 ft trenches with three-times their volume of dry clay. At the Beatty site there is 350 feet to ground water with 150 ft of clay below the trenches. Rainfall is only 2-4 inches per year and monitoring wells are checked every two weeks.

Licensed By: State of Nevada Health and Environmental Authorities.

CHEMICAL WASTE LANDFILL INFORMAITON

Address: NEWCO Chemical Waste Systems, Inc.
Subsidiary of Niagara Recycling, Inc.
4626 Royal Avenue
Niagara Falls, New York 14303
(716) 285-6944

Location of Landfill:
Niagara Falls, N.Y.

Contact: Mr. Edward Shuster

Waste Streams:
1. Exclusions: No radioactive or shock sensitive explosives.
2. Accept: PCB-contaminated solid wastes, most wastes considered including hazardous and toxic.
3. Volume: Unknown.

Site Area: 400 acres
5 acres secure
1 acre active

Disposal Price: \$52/55 gal or 6.50/ft^3

Estimated Landfill Life: 5 year plus

Expansion Potential: Indefinite

Site Information: This site is monitored by three wells, has leachate collection and treatment facilities as we-1 as liners to prevent ground water contamination.

Licensed By: New York State Department of Environmental Conservation.

Address: Richmond Sanitary Service
1224 Nevin Avenue
Richmond, CA
(415) 236-8000

Location of Landfill:
Richmond, CA

Contact: Mr. Nuti

Area Served: Serves San Francisco Bay Area.

Waste Streams:

1. Exclusions: Exceptions as noted in California Class I landfill regulations and other wastes depending on analysis.
2. Accept: PCB-contaminated solid wastes, refinery wastes, acid plating solutions, tetra-ethyl lead sludge, solvents, pesticide and chemical containers, and other state of California group I wastes.
3. Volume: Unknown.

Site Area: 890 acres of marshland, tidelands and bay fill

Disposal Price: \$18.90 per yd^3 or \$5.00 per 55 gallon drum

Estimated Landfill Life: indefinite

Expansion Potential: Space available, long range plans include use of available space.

Site Information: Drummed wastes are buried as is. Bulk wastes are discharged into holding ponds and filled. Discharge of uncontainerized group I wastes is prohibited. Conditions such as low permeability, confined conditions, and an upward direction of flow, appear to preclude leachate migration to useable ground water. In addition, annual runoff and flooding conditions are controlled.

Licensed By: State of California, Class I site.

Comments: State Department of Public Health has noted a reluctance on the part of Richmond management to comply with the letter and spirit of existing statutes.

Address: San Diego County Refuse Disposal
555 Overland Road
San Diego, CA
(714) 565-5703

Location of Landfill:
San Diego County, CA

Contact: Mr. Eric Lewis

Area Served: San Diego County

Waste Streams:
1. Exclusions: Cyanide, explosives, and radioactive wastes.
2. Accept: PCB-contaminated solid wastes if containerized, pesticides and other chemical wastes.
3. Volume - unknown.

Site Area: 516 acres

Disposal Price: $0.20/ft^3$ plus $.60/ton or $1.00 min. proposed to go up as of July 1, 1977 to $2.50 ft^3$.

Estimated Landfill Life: indefinite

Expansion Potential: Management plans to seek permission to fill certain sludges following neutralization or other chemical degradation treatment. Plan to improve site operations by employing a site operator that is familiar with hazardous wastes. An operations manual is also being prepared.

Site Information: All wastes to be buried are drummed and placed in an abandoned mine excavation (native bentonite clay) 2-3 ft. of bentonite used as cover on each cell. Liquid wastes are discharged into 2 large unlined evaporative ponds (one pond currently full). To date, it has not been necessary to remove pond residues, but the issue will have to be addressed in near future since one pond is nearly full.

Licensed By: State of California, Class I site.

Comments: Area flood during winter of 73-74 caused the holding ponds to overflow (oil wastes). Extra material has been added to pond berm to prevent overflow. Some leachate migration was noted the year prior to the flood. Currently drilling a test well to determine ground water level. Site is located near county landfill.

Address: Texas Ecologists, Inc.
Subsidiary of Nuclear Engineering Co., Inc.
Robstown, TX
(512) 387-3518

Location of Landfill: Robstown, TX

Contact: Mr. Dowell Buckner, Gen. Mgr.

Waste Streams:

1. Exclusions: Highly reactive sodium and potassium
2. Accept: PCB-contaminated solid wastes, radioactive wastes, pesticides, organic wastes, miscellaneous toxic chemicals, heavy metals, (solids primarily, liquids accepted following state review).
3. Volume: No specific limit - depends on type and composition.

Site Area: 240 acres

Disposal Price: Transportation - $1.00/mile per 4,000 lb. truck
Disposal - $1.25-1.75/ft^3

Estimated Landfill Life: 30-40 years

Expansion Potential: Unknown

Site Information: The site meets Class I regulations. It has a natural clay strata of 35 feet. The landfill has trenches 17-19 feet deep lined with 10-15 feet of natural clay. Three monitoring wells are provided for leachate surveilance.

Address: Ventura Regional County Sanitation District
P.O. Box AB
Ventura, CA
(805) 648-2717

Location of Landfill:
Ventura County, CA

Contact: John A. Lambie

Area Served: Ventura County
Los Angeles County
Santa Barbara County
Kern County

Waste Streams:

1. Exclusions: Radioactive materials and materials considered unsafe through the screening procedure.
2. Accept: PCB-contaminated solid wastes, other wastes accepted based upon review and screening or clearance procedure. Accepted wastes include solvent sludges, pesticide containers, epoxy, chlorinated biphenols, cyanide, plating wastes, polyester resins, acids, etc.
3. Volume - varies.

Site Area: 80 acres

Disposal Price: $7.70/ton plus $0.60/ton for State Health Department fee ($1 min.) $25.00 application fee charged to hauler for each new waste received. Lab costs and any additional disposal costs are extra.

Estimated Landfill Life: 10 years

Expansion Potential: Unknown

Site Information: Waste burial plots are mapped and inventoried. Well monitoring is practiced. Bulk liquids are spread on soil in thin layer and allowed to dry off, and highly toxic wastes are buried in containers that are used to transport them.

Licensed By: State of California, Class I site. Site geology, hydrology and monitoring meet all state prerequisites for Class I sites.

Address: Wes Con, Inc.
P.O. Box 546
409 Shashonee St. So.
Twin Falls, ID 83301
(208) 734-7711

Location of Landfill:
Grandview, ID

Contact: Mr. Rinebolt

Area Served: Northwest and intermountain region

Waste Stream:
1. Exclusions: Radioactive wastes, poison gases (chemical warfare).
2. Accept: PCB-contaminated solid wastes, class B pesticides, potato sprout inhibition chemical, caustic sludge.
3. Volume: Very small, trying to establish contacts.

Site Area: 120 acres

Disposal Price: $60/ton, may vary depending on waste.

Estimated Landfill Life: 10 years

Expansion Potential: Develop some of site's 120 acres for sanitary landfill, current arrangements with local agencies preclude this development.

Site Information: Wastes are disposed of in old missile silos. There are 13 holes with 6 ft. walls and 13 ft. floors of reinforced concrete on a 120 acre site providing 1.5×10^6 $ft.^3$ capacity. Bentonite clay is also available to contain liquids, if necessary. The depth to ground water is 3,200 ft.

Licensed By: State of Idaho

Comments: New site to be started.

APPENDIX D

PCB INCINERATION

POLLUTION SERVICES, INC.

PCB PRICE LIST

CHEMICAL DISPOSAL OF POLYCHLORINATED BIPHENYLS (PCB"S)

(Some Trade Names Used Are Pyranol, Inerteen, Askarel, Arochlor 1242, 1254, 1260)

PO BOX 200 MODEL CITY, NEW YORK 14107 • TELEPHONE 716 – 754-8231

GENERAL DESCRIPTION OF WASTE PRODUCT FOR DISPOSAL.

LIQUIDS - POLYCHLORINATED BIPHENYLS (PCB'S) AS IS OR MIXED WITH OTHER WASTE OILS AND SOLVENTS.

SOLIDS - CLEAN-UP ABSORBENTS AND RAGS SATURATED WITH PCB'S: EARTH OR GRAVEL FROM SPILL CLEAN-UP: CAPACITORS AND MISCELLANEOUS DEBRIS INCLUDING VARIOUS ELECTRICAL EQUIPMENT

PACKAGING AND SHIPPING.

LIQUIDS - IN TANK TRUCK QUANTITIES AND 55 GALLON OR LESS NON-RETURNABLE STEEL DRUMS.

SOLIDS - IN 55 GALLON NON-RETURNABLE OPEN-HEAD STEEL DRUM WITH TIGHT FITTING COVERS.

SEE - GUIDE TO PACKAGING AND IDENTIFICATION OF WASTE PRODUCTS FOR UNUSUAL PACKAGING REQUIREMENTS.

DISPOSAL: IN ACCORDANCE WITH STATE AND FEDERAL POLLUTION CONTROL REGULATIONS.

PRICING.

LIQUID PCB PRICE SCHEDULE

Container	Contract Price	Non-Contract Price
Bulk, T/T	$0.07 per pound	$0.075 per pound
Drums, 55 gallon *	$52.00 per drum	$54.00 per drum
Drums, less than 55 gal *	$35.00 per drum	$37.00 per drum

* - Minimum 15 drums. 14 drums or less add $25.00 handling, Minimum order $200.00.

SOLID PCB PRICE SCHEDULE

Container	Contract Price	Non-Contract Price
Bulk **	$5.00 per cubic foot	< 50 Cu Ft. $6.50/Cu. Ft. > 50 Cu Ft. $5.00/Cu. Ft.
Drums, 55 gallon	$25.00 per drum	$30.00 per drum

* - Minimum 15 drums, 14 drums or less add $25.00 handling, Minimum order $200.00
** - Pricing based on outer measurement of overwrap or array.

TERMS. NET 30 DAYS - F.O.B. MODEL CITY, NEW YORK, PRICES ARE SUBJECT TO CHANGE

SHIPPING ADDRESS: CHEM-TROL POLLUTION SERVICES, INC., 1550 BALMER ROAD, MODEL CITY, NY

EFFECTIVE DATE: NOVEMBER 15, 1979

SCA SERVICES SUBSIDIARY

ROLLINS ENVIRONMENTAL SERVICES, INC.
Bridgeport, New Jersey (609) 467-3100
Baton Rouge, Louisiana (504) 778-1234
Houston, Texas (713) 479-6001

Rollins Environmental Services, Inc.

An Indemnified Disposal Service for the Disposal of Polychlorinated Biphenyls (PCB's) (Askarels)

PCB PRICE LIST

General Description of Waste Product for Disposal:

Liquids: Polychlorinated Biphenyls (Askarels) as is or mixed with other waste oil and solvents.

Solids: Clean-up absorbents and rags saturated with PCB's... earth or gravel from spill clean-up, transformers, capacitors, and miscellaneous debris including various electrical equipment.

Packaging and Shipping:

Liquids: In tank truck quantities and 55 gallon open head, non-returnable steel drums with secure lids and meeting DOT specifications.

Solids: In 30 gallon non-returnable fiber pack drums with polyethylene liners and secure lids.

Disposal Method: All combustible material will be high temperature incinerated with sufficient residence time to insure complete destruction of the PCB's.

LIQUID PCB PRICE SCHEDULE

Container	Price
Bulk, T/T	$0.10 per pound
Drums, 55 gallon	$75.00 per drum

SOLID PCB PRICE SCHEDULE

Drums, 30 gallon fiber Maximum 200 pounds per drum	$40.00 per drum
Palletized loads	$0.25 per pound

Capacitors and other electrical equipment are to be packaged and bonded to pallets. Cartons are not to exceed 200 pounds each nor have a diameter in excess of 20 inches. *(Equipment in excess of one foot in height is excluded from this category.)

PRICE SCHEDULE FOR DECONTAMINATION OF PCB CONTAINERS (EMPTY)

Container	Price
55 gallon steel drum	$25.00 per drum
35 gallon steel drum	$18.00 per drum
5 gallon steel drum	$ 7.50 per pail

QUALIFICATIONS:

1. All drums must be labeled "CAUTION: Contains PCB's (Polychlorinated Biphenyls) That Are Environmental Contaminants", along with a code number provided by RES.
2. RES transportation fleet is available to service your transportation needs.
3. *Prices for the disposal of transformers, capacitors, and various other electrical equipment in excess of one foot are based upon the specific characteristics of the equipment.

Prices effective December 1, 1976. Prices are subject to change without notice.

REFERENCES

American National Standards Institute, Guidelines for Handling and Disposal of Capacitor- and Transformer-Grade Askarels Containing Polychlorinated Biphenyls, ANSI C107.1-1974, New York: 1974.

Battelle Pacific Northwest Laboratories, Program for the Management of Hazardous Wastes, (EPA Contract No. 68-01-0762), Richland, WA: July 1973.

California State Water Resources Control Board, Disposal Site Design and Operation Information, Sacremento: March 1975.

Environmental Science and Engineering, Inc., Report on PCB Emissions from Sanford Unit No. 4, Florida Power and Light Company, May 1976.

Interstate Commerce Commission, Cost of Transporting Freight by Class I and II Motor Common Carriers of General Commodities, 1975, Bureau of Accounts Statement No. 201-75, Washington, D.C.: December 1976.

McDonald, L.P., (St. Lawrence Cement Co.), D.J. Skinner (Environment Canada), F.J. Hopton and G.H. Thomas (Ontario Research Foundation), Burning Waste Chlorinated Hydrocarbons in a Cement Kiln for the Petroleum and Industrial Organics Chemicals Division, Water Pollution Control Directorate, Environmental Protection Service, Environment Canada, Report No. EPS 4-WP-77 (unpublished report).

Midwest Research Institute, Guidelines for the Disposal of Small Quantities of Unused Pesticides, EPA-670/2-75-057, Cincinnati, Ohio: National Environmental Research Center, U.S. EPA, June 1975.

Office of Solid Waste Management Programs. Report to Congress: Disposal of Hazardous Wastes. (SW-115) Washington: Environmental Protection Agency, 1974.

TRW Systems Group, Destructing Chemical Wastes in Commercial Scale Incinerators, (Report No. 27033-6005 RV-00) Technical Summary: NTIS PB-257 709 (Vol. I); Facility Test Plans: NTIS PB-257 710 (Vol. II); July 1, 1975.

U.S. Environmental Protection Agency, Hazardous Waste Management Facilities in the United States (EPA/530/SW-146.3), NTIS PB-262 917/8WP, January 1977.

Versar Inc. Assessment of the Environmental and Economic Impacts of the Ban on Imports of PCBs. EPA 560/6-77-007 (unpublished Draft Report). February 1, 1977.

Versar Inc. Destruction of Polychlorinated Biphenyls in Sewage Sludge During Incineration, NTIS PB-258 162, 1976.

Versar Inc. PCBs in the United States: Industrial Use and Environmental Distribution. NTIS PB-252 402/3WP. February 1976.

Versar Inc. Usage of PCBs in Open and Semi-Closed Systems and the Resulting Losses of PCBs to the Environment. EPA 560/6-77-009 (unpublished Draft Report). September 1, 1976.

BIBLIOGRAPHIC DATA SHEET	1. Report No. EPA 560/6-77-013	2.	PB 267 833

4. Title and Subtitle Microeconomic Impacts of the Proposed Marking and Disposal Regulations for PCBs	5. Report Date April 26, 1977 6.
7. Author(s)	8. Performing Organization Rept. No. 474-7
9. Performing Organization Name and Address Versar Inc. 6621 Electronic Drive Springfield, Virginia 22151	10. Project/Task/Work Unit No. 11. Contract/Grant No. 68-01-3259
12. Sponsoring Organization Name and Address Office of Toxic Substances U.S. Environmental Protection Agency Washington, D. C.	13. Type of Report & Period Covered Final Task Report 14. 599/98

15. Supplementary Notes

EPA Project Officer: Mr. David E. Wagner

16. Abstracts

This report summarizes the estimated economic impacts of the marking and disposal regulations for PCBs which are being proposed in fulfillment of the requirements of Section 6(e) of the Toxic Substances Control Act.

17. Key Words and Document Analysis. 17a. Descriptors

PCBs
Capacitors
Transformers
Incinerators
Chemical waste landfills
Disposal costs

17b. Identifiers/Open-Ended Terms

17c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report)	21.
Release Unlimited	UNCLASSIFIED	
	20. Security Class (This Page) UNCLASSIFIED	22. Price PC A09 - A01