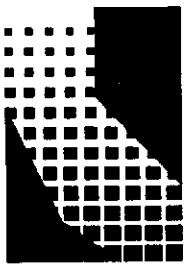
APPENDICES

METALLIC DISCARDS MANAGEMENT PLAN



INTEGRATED WASTE MANAGEMENT BOARD

AUGUST 1993

APPENDICES TO THE METALLIC DISCARDS MANAGEMENT PLAN
PREPARED FOR THE CALIFORNIA INTEGRATED WASTE MANAGEMENT BOARD

California Integrated Waste Management Board
8800 Cal Center Drive
Sacramento, CA 95826

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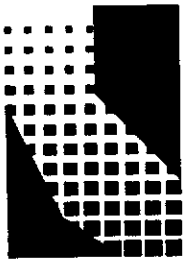
APPENDIX A

METALLIC DISCARDS IN CALIFORNIA



INTEGRATED WASTE MANAGEMENT BOARD

AUGUST 1993

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Appendix A:

"Metallic Discards in California,"

Science Applications International Corporation,

August 1993

ACKNOWLEDGMENTS

This report was written under the direction of the Policy, Research and Technical Committee.

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EXECUTIVE SUMMARY

Metallic discards that contain materials that require special handling (i.e., special materials) present unique problems and challenges to solid waste disposal and recycling systems. These problems include the amount of landfill space consumed by disposal of major appliances, vehicles, and other metallic discards, and hazards associated with handling, processing and recycling of metallic discards with special materials (chlorofluorocarbons and polychlorinated biphenyls).

In 1991, the California Legislature passed Assembly Bill 1760 (hereafter referred to as AB 1760), which addresses the problems associated with metallic discards.

AB 1760, codified in Sections 42160-42185 of the Public Resources Code, prohibits solid waste facilities from accepting for disposal, after January 1, 1994, any major appliance, vehicle, or other metallic discard which contains enough metal to make salvaging it economically feasible as determined by a solid waste facility operator. Effective January 1, 1994, AB 1760 also mandates that materials requiring effective special handling be removed from the appliances and vehicles in which they are contained prior to crushing for transport or transferring to a baler or shredder for recycling.

To accommodate the imminent landfill ban and the management of special materials, AB 1760 requires the submittal of a management plan for the removal of special materials from vehicles and major appliances.

In order to satisfy this legislative mandate, this report prepared by Science Applications International Corporation for the California Integrated Management Board (CIWMB) studies metallic discards management in California. Based on direction from the CIWMB, this report has two main purposes: 1) to provide background information for the development of a metallic discards management plan mandated by AB 1760, including options for the administration and financing of the removal of special materials from metallic discards and 2) to address issues related to this management plan, including generation of metallic discards, current metallic discards management in California including cost and revenues, hazards associated with special materials and federal and state metallic discards management programs.

The management options focus on who should be subject to permitting, certification, or other approvals, and the need for government-sponsored training to ensure proper removal of special materials. Financing may also be important if the cost of removing special materials reduces the economic feasibility of recycling metallic discards. Financing methods include public sector initiatives to finance handling and processing, such as advance disposal fees.

FINDINGS

In 1991, approximately 3.38 million major household appliances (268,000 tons) and 301,500 tons of other metallic discards (e.g., wood-burning stoves, metal furniture) were discarded. Appliances and other metallic discards (not including vehicles) constitute approximately 1 percent of the solid waste generated each year in California.

Published recycling rate estimates for household appliances range from 25 percent to 40 percent. Findings of this study indicate higher recycling rates for large appliances, especially refrigerators, freezers, washing machines, and dryers. Most microwave ovens, hot water

heaters, and dishwashers, however, are likely landfilled.

In 1991, approximately 1.63 million vehicles (2.76 million tons) were discarded. Vehicles are estimated to be recycled at rates exceeding 90 percent. This estimate does not include motorcycles, scooters, and bicycles, which are believed to be recycled at much lower levels. The recycling rate for vehicles is higher than for appliances because of the amount of scrap metal in a vehicle and the relatively well-established system for recycling vehicles.

Perhaps the most significant finding of this report is that controls or measures beyond those authorized by existing legislation on the handling and processing of appliances that include PCB-containing capacitors and CFCs are necessary to protect human health and the environment. Although most businesses and organizations that manage refrigerators, air conditioners, and freezers that contain CFCs comply with the federal Clean Air Act by properly recovering and reclaiming CFCs, (i.e., not venting the CFCs to the atmosphere), a significant number of generators (e.g., households and businesses) and smaller appliance handling operations violate these requirements. In addition, CFC regulation, whether at the federal, state, regional, or local level, does not control or prevent the release of CFCs during appliance collection and transportation; the stage of the discarded appliance management system where releases are most likely.

The removal of PCB-containing capacitors and ballasts from major appliances before appliances are crushed for transport or transferred to a baler or shredder does not commonly occur. PCB-containing capacitors are typically found in pre-1978 microwave ovens, air conditioners and residential furnaces. These appliances make up about 6.25 percent of the major appliance waste stream. This percentage will decline significantly by 1998 when most pre-1978 appliances are expected to be discarded.

Additional controls that are needed based on these findings include safeguards on the handling of appliances and methods to ensure that PCB-containing capacitors are removed from major appliances. The CIWMB, other appropriate agencies, and industry associations could encourage these additional controls voluntarily by education and outreach with existing funding or regulatory changes. Alternatively, new controls could be imposed under a new permitting program for handling and processing appliances which would require new legislation to implement. Respondents to the mail survey conducted for this report suggested both non-regulatory (e.g., education) and regulatory controls on appliance handling and processing, similar to those briefly discussed below.

Some form of financing and/or responsible entity program (i.e., manufacturer responsibility) may be necessary to subsidize appliance handling and processing costs. Financing or manufacturer-supported handling and processing is especially needed in rural areas of the state where illegal dumping of appliances can be significant if fees charged to generators for proper handling and processing are too high. Several survey respondents, including the County of San Bernardino, expect illegal dumping to be a problem especially in rural areas if compliance costs are too high.

Other hazardous materials or wastes may be found in some appliances. These materials include ammonia and sulfur dioxide refrigerants, mercury-containing switches in certain appliances, and cadmium which is found in vehicle and appliance paint. If processing requirements are established for CFCs and PCBs, the state may also wish to require proper removal of ammonia and sulfur dioxide refrigerants and removal and proper handling of other wastes and materials.

For vehicles, hazards associated with management of sodium azide canisters in discarded automobile air bags are not prevalent at this time due to the limited number of

automobiles with air bags entering metal recycling facilities. However, with the current and future legal requirements to install air bags as safety devices in automobiles, automobile dismantlers and recyclers will come in contact with increasing numbers of undeployed sodium azide canisters. Although studies that have been conducted on the potential hazards of sodium azide show human health risks, contradictory information still exists on the explosion potential for sodium azide canisters in shredding equipment, the effects of sodium azide residue in shredder fluff and the hazards associated with the removal of unactivated air bag systems for automobiles. Due to these uncertainties, further study should be conducted before removal of sodium azide canisters is regulated.

Management Options

Management approaches build on, and are consistent with, existing programs such as the federal Clean Air Act. Because the federal Clean Air Act and corresponding state, regional and local air quality regulation require removal of CFCs from discarded appliances and vehicles, all requirements, standards, and reports developed to implement AB 1760 must be compatible with these existing controls. Accordingly, all of the options incorporate Clean Air Act CFC removal and reporting requirements.

Most management options include new requirements for handling that are not included in the Clean Air Act or California air quality programs. Some options include provisions for new funding, such as advance disposal fees (ADFs), and for manufacturer responsibility for appliance handling and processing. Several states, including Minnesota, Wisconsin and Illinois, have appliance management programs that require permitting and certification of appliance handlers and processors. Wisconsin's legislation has powerful enforcement and penalty authorities. Many states have or are investigating ADFs; many have grant and loan programs to support local appliance management programs.

To administer the permit program under most of the management options, five or six full-time equivalent (FTE) positions at the state level and an average of about 1/3 FTE for each county would be necessary. FTE estimates are based on Minnesota and Wisconsin's program staffing.

Based on program administration costs and the incremental costs of new requirements imposed on appliance management (primarily $11 million for removal of PCB-containing capacitors), approximately $11 to $14 million of new funding would be necessary to cover the costs of the options that involve new permitting controls. Only $3 million for administrative costs would be necessary if it is assumed that appliance handlers and processors could recover their costs with fees charged to generators. Also, at least $5 million in additional funding should be made available for grants and loans and other financial assistance, especially in rural areas where the illegal release of PCBs and CFCs, and the illegal dumping of appliances may be more prevalent than in urban areas. Given that about 3.5 million new appliances are sold each year in California, a $3.00 to $5.00 ADF would probably be adequate to finance programs. This fee level would probably cover costs associated with collecting and administering the ADF. It should be noted that these funding estimates are very preliminary and not based on a formal fiscal analysis.

Recommendations

Because of the need to develop and implement a metallic discards management program in a coordinated manner, the report recommends that the CIWMB form a Metallic Discards Management Task Force. The Task Force should include representatives of the CIWMB, Department of Toxic Substances Control (DTSC), California Air Resources Board (CARB), other appropriate agencies within the California EPA, local enforcement agencies and

air pollution control districts, U.S. EPA, appliance and solid waste collectors and processors, vehicle dismantlers, the scrap metal industry, CFC industry, appliance/vehicle manufacturers, new and used appliance dealers, citizens, environmental groups and legislators. The Task Force would have appliance and vehicle subcommittees.

The Task Force should be formed as soon as possible to discuss and provide advice and recommendations to legislators, CIWMB staff and other state agency staff on the options and recommendations for metallic discards management as provided in this report. This report does not recommend a specific management option (i.e., Options 1-5 as presented in Chapter 7) in order to give the state an opportunity to collect more information on the merits of each option and to seek advice through the Task Force process. In addition to considering the management options, specific issues to be considered by the Task Force should include the following legislative and administrative recommendations.

Legislative Recommendations

Modifications to AB 1760 that are needed to further define the scope and coverage of the legislation include:

1. Designate responsible state agencies for program implementation.

2. Give implementing agencies the discretion in administrative regulations to define major appliances.

3. Give implementing agencies the discretion in administrative regulations to define the major appliances that contain PCBs and would, therefore, be subject to regulation.

4. Delete sodium azide canisters in unspent air bags from the definition of special materials and require implementing agencies to study hazards associated with sodium azide canisters in unspent air bags. The legislature should give the implementing agencies discretion to define sodium azide canisters as a special material based on this study.

5. Change the definition of "materials that require special handling" in AB 1760 to clarify the meaning of special materials with respect to hazardous waste definitions.

Administrative Recommendations

A. Monitor the effectiveness of selected management options and determine if further action is needed. Examine the need for and potential mechanisms for funding the removal of special materials on a state-wide basis.

B. Implementation of an effective metallic discards management system requires outreach and education, training, and investigating additional topics and issues. The DTSC, CIWMB, other agencies of the California EPA and possibly educational institutions (e.g., University of California Extension), will have roles in the system administration. In addition, federal and other state agencies engaged in metallic discards management will play vital roles, especially in education and outreach, training and additional research. Some of the problems associated with the existing vehicle and appliance management systems may be addressed by education, training and outreach programs. Specific recommendations are:

   1. Train DTSC, CIWMB and other state and local staff to better enable them to implement the program and provide information on metallic discards management issues. Providing better information to citizens and businesses involved in metallic discards management will increase compliance rates. Training should include

information on establishing appliance processing facilities and capabilities, CFC evacuation equipment information, proper PCB capacitor, electrical ballast, and sodium azide canister removal techniques, and general regulatory background on metallic discards management issues. The DTSC/CIWMB should develop fact sheets to distribute to participants in the metallic discards management system on these and other issues. Additionally, the DTSC/CIWMB should disseminate information on proper metallic discards management through hotlines.

C. Study of Issues

The management of metallic discards will continue to become a more prominent issue. Proper management presents many technical and regulatory challenges. In order to make informed decisions, legislators and government officials in the state of California, already on the forefront of waste management and metallic discards management, will need to further define issues and clarify technical uncertainties. Activities to further study outstanding issues include:

1. Improving knowledge of which appliances are not likely to contain PCBs. These appliances would then not be subject to regulation provided they do not contain other special materials.

2. Investigating proper handling and disposal of mercury switches found in certain appliances.

3. Investigating proper handling and disposal of sulfur dioxide and ammonia from certain types of refrigeration equipment.

4. Investigating proper handling and disposal of cadmium in certain paints occasionally found in appliances and vehicles.

5. Evaluating appliance processing capacity statewide in order to identify shortages.

6. Coordinating with other state and federal agencies, and industry on the issues of regulation of CFC foam and alternative refrigerants.

7. Entering into a dialog with appliance manufacturers on making appliances that can be disassembled more easily.

8. Entering into a dialog with vehicle manufacturers to encourage the reuse and recyclability of metal, plastic, air bags and other components of vehicles.

9. Conducting fiscal/economic impact analyses of ADF, guaranteed acceptance, and responsible entities options, if these options are pursued further.

10. Investigating the generation and management of discarded motorcycles, scooters, and bicycles.

11. Exploring steps that can be taken to enhance hot water heater, microwave oven, and dishwasher recycling.

12. Developing suggested methods or criteria to determine economic feasibility for salvaging metallic discards.

CHAPTER ONE

INTRODUCTION

1.1 Purpose

In 1991, the California Legislature passed Assembly Bill (AB) 1760, (hereafter referred to as AB 1760), which addresses metallic discards in California's solid waste stream. AB 1760 was approved by the Governor in October 1991. Metallic discards, as defined in AB 1760, are large post-consumer products (i.e., major appliances, vehicles, metal furniture, machinery). In adopting AB 1760, the Legislature recognized the substantial amount of metallic discards in the solid waste stream, the hazards posed by special (and sometimes hazardous) materials found in some metallic discards, and the importance of a healthy world market for scrap metal.

AB 1760, codified in Sections 42160-42185 of the Public Resources Code, prohibits solid waste facilities from accepting for disposal, after January 1, 1994, any major appliance, vehicle, or other metallic discard which contains enough metal to make salvaging it economically feasible as determined by a solid waste facility operator. Effective January 1, 1994, AB 1760 also mandates that materials requiring special handling be removed from the appliances and vehicles in which they are contained prior to crushing for transport or transferring to a baler or shredder for recycling.

To accommodate the imminent landfill ban and the management of special materials, AB 1760 requires the submittal of a management plan for the removal of special materials from vehicles and major appliances.

In order to satisfy this legislative mandate, this report prepared by Science Applications International Corporation for the California Integrated Management Board (CIWMB) studies metallic discards management in California (Based on direction from the CIWMB, this report has two main purposes: 1) to provide background information for the development of a metallic discards management plan mandated by AB 1760 including options for the administration and financing of the removal of special materials from metallic discards and 2) to address issues related to this management plan including generation of metallic discards, current metallic discards management in California including cost and revenues, hazards associated with special materials and federal and state metallic discards management programs.

1.2 Objectives

This report attempts to present a clear understanding of the current management system for major appliances and vehicles in order to identify the need for new and expanded management programs to ensure compliance with the requirements of AB 1760. These objectives are largely addressed by answering the following questions:

- What are the current generation and recycling rates of metallic discards in California?
- What are the existing management systems and associated problems for discarded major appliances and vehicles?
- What are the environmental and public health hazards associated with the special materials that are contained in major appliances and vehicles?

- What are the costs and revenues of the existing management system?
- What are the probable economic impacts associated with the implementation of AB 1760?
- What does "economically infeasible to salvage" mean as stated in AB 1760?
- How can AB 1760's implementation be financed and administered?

1.3 Approach, Data Sources, and Report Limitations

Each step of the management system--handling, processing, and recycling--was evaluated to define problems in the system and associated environmental hazards, and estimate the costs, revenues, and economic impact associated with implementation of AB 1760. Several information sources were used. Literature searches, site visits, and a mail survey were conducted to characterize the metallic discards management system currently employed in California.

Surveys were mailed to a total of 243 auto dismantlers, appliance retailers and service companies, landfill facilities, electric utilities, recyclers and reclaimers, and local enforcement agencies. The survey requested information on the types of metallic discards handled, processing and storage capabilities, fees, and equipment. Those surveyed were also asked for their knowledge of standards and regulation and their thoughts on how the existing system might be improved to increase diversion in an environmentally sound manner.

Responses were received from 56 of those surveyed representing each of the types of businesses and organizations, and indicate that businesses within the metallic discards management system are aware of the requirements to recover and/or remove special materials. Recommendations included educating local governments and the public on the impact of regulations on the existing metallic discards system and hazards of special materials and suggestions for permitting and financing programs. The survey form and specific survey results are provided in Appendix A-1. Findings from the survey are also discussed in several chapters of this report, particularly Chapters 3 and 4.

The findings contained in this report are limited by gaps and uncertainties in the data and information that were available. For example, most of the surveys responded to were only partially completed. Additionally, because only six site visits were performed, information gathered from these site visits provide an incomplete picture of metallic discards management in California. Although this report provides a comprehensive overview of the study questions listed above, further research on many specific issues is needed to develop and implement an effective metallic discards management program.

1.4 Overview

Chapter 2 estimates the number and type of appliances and the number of vehicles discarded in the state in 1991. These estimates are based on appliance and vehicle sales, average weight of various appliances and vehicles, and life span information.

Chapter 3 describes the systems for handling and processing appliances and vehicles, the recycling process for most metals, including appliances and vehicles, trends in the system, and the potential effects of AB 1760 on the existing system. This information is supported by the mail survey, phone interviews, and site visits to several facilities.

Chapter 4 identifies the costs the generator incurs within the existing system, system revenues, the costs of complying with AB 1760 and the effects of AB 1760's implementation on metallic discards recycling.

Chapter 5 characterizes the environmental and public health hazards of the special materials that are contained within appliances and vehicles. This evaluation discusses the hazards associated with handling, processing, and recycling appliances and vehicles that contain special materials and the methods to mitigate such hazards.

Chapter 6 describes federal and California legislation and regulations that govern handling, processing, and recycling of appliances and vehicles and, particularly, the special materials they contain. A review of regulations and legislation in Wisconsin, Minnesota, Illinois, Florida, Connecticut, Maine, and Massachusetts also appears in Chapter 6.

Chapter 7 presents findings, management plan options and recommendations. Each option, including the current management system, involves a varying level of administrative and regulatory involvement and associated financial assistance. The chapter provides recommendations on legislative changes, training and outreach, and a multi-group Task Force to assist in developing a metallic discards program. However, a recommendation on a preferred management option is deferred in order to collect more information on the merits of each option and to seek advice through the Task Force process.

1.5 Definitions

1.5.1 Terms

Many terms and acronyms are used throughout this report. The following list contains the definitions for these terms as they apply to this report.

Capacitor means a device for accumulating and holding a charge of electricity. This device may contain PCBs.

Chlorofluorocarbons (CFCs) is a group of synthetic compounds that contain chlorine, fluorine and carbon. They are used in appliances and vehicles as a refrigerant gas or a blowing agent for foam insulation in appliances.

CFC Recovery means removing refrigerant in any condition from a system and storing it in an external container without necessarily testing or processing it in any way.

CFC Recycling means a process to reduce contaminants in used refrigerant by oil separation and single or multiple passes through devices which reduce moisture, acidity, and particulate matter, such as replaceable core filter-driers. This term usually applies to procedures implemented at the field job site or at a local service shop.

CFC Reclamation means reprocessing refrigerant to new product specifications by methods which may include distillation. Chemical analysis of the refrigerant is required to determine that appropriate product specifications are met. This term usually implies the use of processes or procedures available only at a reprocessing or manufacturing facility.

Discarded appliance processing means a service which includes (1) the removal and proper disposal of capacitors and electrical ballasts which may contain PCBs; (2) the recovery of CFCs and hydrochlorofluorocarbons (HCFCs) from refrigerators, freezers, air-conditioners, and dehumidifiers; (3) the removal of other contaminating materials which may include mercury switches, ammonia, and others; (4) the recovery of other materials (e.g., plastics, aluminum); and (5) the delivery of the metal appliance shell to a metal recycler.

Feeders refers to metal recyclers, salvage and junk yards, and scrap yards.

Major appliance, as defined in AB 1760, means any domestic or commercial device, including, but not limited to, a washing machine, clothes dryer, hot water heater, dehumidifier, conventional oven, microwave oven, stove,

refrigerator, freezer, air-conditioner, trash compactor, and residential furnace. However, commercial appliances are not addressed in this report.

Materials which require special handling (or special materials), as defined in AB 1760, means sodium azide canisters in unspent air bags which are determined to be hazardous by federal and state law or regulation, encapsulated polychlorinated biphenyls (PCBs) in major appliances, and chlorofluorocarbons (CFCs) injected in air-conditioning/refrigeration units or any other hazardous waste or hazardous material regulated by the Department of Toxic Substances Control.

Metallic discard, as defined in AB 1760, means any large metal article or product, or any part thereof, including, but not limited to, metal furniture, machinery, major appliances, electronic products, and wood-burning stoves.

Metallic discards handling means collection, transportation, and storage of major appliances and vehicles.

Metallic discards management system means the combination of elements and services used to handle, process, and recycle appliances and vehicles including removal and handling of PCBs, CFCs, and other contaminants, and the baling or compaction of appliances and vehicles for transport, and the shredding prior to reuse of the metals.

Metallic discards processing means the removal of special materials.

Metallic discards recycling means metal shredding, baling and recovery, CFC reclamation.

Polychlorinated biphenyls (PCBs) is a group of synthetic compounds found in some capacitors and electrical ballasts in appliances. PCBs were used in these components where thermal stability, resistance to corrosive, inertness, and fire-retardant properties were required. The stability of these compounds has made PCBs highly persistent in the environment which has led to accumulating levels of PCBs in the food chain. Among the detrimental effects on humans is the potential to cause cancer.

Salvage, as defined in AB 1760, means the controlled removal of metallic discards from the solid waste stream at a permitted solid waste facility for the express purpose of recycling or reuse.

Small collector refers to an individual or service that collects appliances from households and businesses, often for little or no fee, and delivers the appliance to a scrap yard or metal shredder, usually without processing.

Solid waste facility, as defined in Section 40194 of the California Public Resources Code, includes a solid waste transfer station or processing station, a composting facility, a transformation facility, or a disposal facility.

Solid waste landfill, as defined in Section 46027 of the California Public Resources Code, means a disposal facility that accepts solid waste and which meets the requirements of a Class III landfill pursuant to Section 2533 and 2541 of Title 23 of the California Code of Regulations.

Vehicle, as defined in AB 1760, means any device used for transportation. *Vehicle* includes bicycles, airplanes, and other transportation devices not used on highways, and automobiles and other vehicles, as defined in Section 670 of the California Vehicle Code. For purposes of this report, vehicles include passenger cars, trucks, and vans only.

White goods means any household appliance that once was traditionally white in color, including, but not limited to, a refrigerator, stove, washing machine, freezer, dryer, and water heater.

1.5.2 Acronyms

ACGIH	American Conference of Governmental Industrial Hygienists
ADF	Advance disposal fee
ADRA	Automotive Dismantlers and Recyclers Association
AHAM	Association of Household Appliance Manufacturers
AQMDs	Air Quality Management Districts
ARCA	Appliance Recycling Centers of America
ARI	Air Conditioning and Refrigeration Institute
BAAQMD	Bay Area Air Quality Management District
BOFs	Basic oxygen furnaces
CCR	California Code of Regulations
CFCs	Chlorofluorocarbons
CFR	Code of Federal Regulations
CIWMB	California Integrated Waste Management Board
DATCP	Department of Agriculture, Trade and Consumer Protection (Wisconsin)
DEP	Department of Environmental Protection (Connecticut, Maine, Massachusetts)
DER	Department of Environmental Resources (Florida)
DILHR	Department of Industry, Labor and Human Resources (Wisconsin)
DNR	Department of Natural Resources (Wisconsin)
DMV	Department of Motor Vehicles (California)
DOT	Department of Transportation (U.S.)
DTSC	Department of Toxic Substances Control (California)
EAFs	Electric arc furnaces
EPA	Environmental Protection Agency (U.S.)
FAC	Florida Administrative Code
FTE	Full-time equivalent
HCFCs	Hydrochlorofluorocarbons
HFCs	Hydrofluorocarbons
IAC	Illinois Administrative Code
IRS	Illinois Revised Statutes
ISIS	Institute of Scrap Iron and Steel
ISRI	Institute of Scrap Recycling Industries
MPCA	Minnesota Pollution Control Agency
MSDSs	Material safety data sheets
MVMA	Motor Vehicle Manufacturers Association
NADA	National Automotive Dealers Association
NHTSA	National Highway Traffic Safety Administration
OBW	Oversize bulky wastes
OSHA	Occupational Safety and Health Administration
OWM	Office of Waste Management (Minnesota)
PCBs	Polychlorinated biphenyls
PPM	Parts per million
RCRA	Resource Conservation and Recovery Act
SAE	Society of Automotive Engineers
SCAQMD	South Coast Air Quality Management District
SMUD	Sacramento Municipal Utility District
SRRE	Source Reduction and Recycling Element
SWMA	Solid Waste Management Act
TLV	Threshold limit value
TSCA	Toxic Substances Control Act
UV	Ultraviolet
WMA	Waste Management Agency (Maine)
WTE	Waste-to-energy

CHAPTER TWO

METALLIC DISCARDS QUANTIFICATION

2.1 Overview

This chapter estimates the amount of metallic discards generated in California, with a focus on the number and types of vehicles and major appliances, and the amount generated in each county. In 1991, approximately 3.38 million appliances (268,000 tons) and 1.63 million vehicles (2.76 million tons) are estimated to have been discarded (Ref. 1).

As noted earlier, AB 1760 targets "major appliances, vehicles, and other metallic discards." Major appliances identified in this report are residential appliances and do not include commercial appliances. The types of metallic discards judged to occur in significant enough quantities to evaluate are provided in Table 2.1. The following sections describe the methodology used to estimate the number of discarded appliances and vehicles, and to identify the estimated number of each discarded in 1991.

2.2 Methodology

The quantities of discarded appliances and vehicles are based on the following assumptions (Ref. 1):

- Approximately 99 percent of all appliances and vehicles will be replaced or discarded within 20 years after purchase.

  Although certain appliances have longer life expectancies than others (e.g., gas ranges vs. microwave ovens), the length of ownership study referred to in this chapter did not break down age data for appliances over 20 years old. Therefore, those appliances which were over 20 years old and replaced are accounted for within the 20-year life expectancy used to estimate replaced quantities.

  While the data reviewed during this analysis indicates that 55 to 60 percent of passenger vehicles (i.e., cars, trucks, and vans) are replaced within 12 years after purchase, it is assumed that the remaining 40 to 45 percent would be replaced in the next 8 years (i.e., approximately 99 percent replaced in 20 years). Information on the number of cars in operation from a given production year was used to determine the life expectancy of newly registered vehicles. The Motor Vehicle Manufacturers Association (MVMA) has reported the number of passenger cars in operation by production year for the past 13 years and, therefore, the median age of vehicles on the road was used as a guideline to compare with the estimated life of a vehicle. Additionally, Department of Motor Vehicles (DMV) personnel indicated that in the last few years, overall registration has increased faster than new vehicle registration. In other words, more people are keeping their current vehicles longer; therefore, fewer new cars are being sold, and fewer new vehicles are entering the state.

- The life span distributions of appliances are based on an Association of Household Appliance Manufacturers (AHAM) study conducted in 1990 and, therefore, includes newer appliances which, in some cases (e.g., water heaters, microwave ovens), are assumed to have useful life spans that are slightly longer than older models. This may

skew results for those products where substantial design or manufacturing improvements have occurred.

- Although not addressed in this analysis, seasonal variations may occur in the quantities of appliances discarded. For instance, spring and fall cleanups commonly sponsored by municipalities may result in larger quantities of discarded appliances being generated than at other times of the year.

- The length of ownership data used in this analysis are from the AHAM national study; consequently, California appliance ownership data could vary for certain appliances (e.g., air conditioners). Also, although the data from the analysis were broken down into yearly percentages for the purpose of estimating generated quantities, the data were initially reported in age brackets, indicating that the respondents may have been reporting the approximate age of an appliance as opposed to the actual age.

Table 2.1

Types of Metallic Discards

Major Appliances (3) Air Conditioners Dehumidifiers Freezers Refrigerators Dishwashers Clothes Dryers Microwave Ovens Residential Furnaces Washing Machines Ranges/Ovens Hot Water Heaters Trash Compactor	**Vehicles** Bodies and Parts **Other Metallic Discards** Wood Burning Stoves Other Bulky Wastes (1) Other Special Wastes (1) Other and Unsorted (1) Machinery Electronic Products Metal Furniture CFC Containing Metals (2) PCB Containing Metals (2)

Notes:
1. As shown and defined in the "CIWMB Interim Database Report, Estimated Average 1990 Waste Stream Composition, Including Diversion of Excluded Waste Types", revised November 23, 1992.
2. Considered to be a portion of vehicles and appliances.
3. Data were not available on Trash Compactors.

Source:
Material Processing Questionnaire, CIWMB, November 6, 1992

2.2.1 Appliances

The estimated number of discarded appliances generated in California in 1991 is based on the number of appliances sold in the state for a given year, by type, and the number of those appliances replaced in 1991 based on life span data. The total weight of appliances discarded in 1991 is estimated using an average appliance weight, by type, multiplied by the number discarded. AHAM maintains an extensive database on estimated annual new appliance sales in California and also conducts periodic surveys of retailers, manufacturers, and households to gather information on various aspects of appliance use, including length of ownership, replacement practice, and other service-related information. Sales records for the appliance types identified in Table 2.1, where available from AHAM, were assembled for the 20-year period ending 1991. Table 2.2 shows the estimated number of appliances sold in California in 1991 as reported by AHAM. Several appliance types had not been tracked and recorded by AHAM to the extent necessary to estimate the number or weight of discards. Appliances for which AHAM data are not adequate are water heaters, microwave ovens, and residential furnaces. For these appliances, sales data were estimated based on sales records and saturation levels of similar appliances and/or national sales quantities (Ref. 1).

The number of appliances discarded in a given year is assumed to be synonymous with the number that is replaced in a given year. The percentage of appliances in a given age bracket that is replaced (in a given year), as reported in an AHAM length of ownership study, is used to estimate the number of appliances (in a given age bracket) replaced for each consecutive year after the year of sale based on a straight-line extrapolation of the ownership (life span) data, except for water heaters. The replacement rate of water heaters, for this study, is assumed to be the same as the replacement rate for automatic washers. Exhibits A-1 through A-3 (see Appendix A-2) provide a graphical presentation of the relative percentage of appliances in a given age bracket that are replaced in a given year. The number of replaced (discarded) appliances was calculated for each appliance type for the 20-year period ending 1991 (Ref. 1). A 20-year life span was used based on AHAM data on average appliance life (including second-hand use). Tables A-1 through A-3 (see Appendix A-2) present examples of how the number of appliances replaced in 1991 was calculated using the life span data for automatic washers, room air conditioners, and refrigerators.

Average appliance weights by type change over time (generally becoming lighter) and were determined by a straight-line extrapolation of average weights reported by AHAM (Ref.1). Table 2.3 shows the change in appliance weights over time.

2.2.2 Vehicles

The estimated number of discarded vehicles generated in 1991 is based on the number of vehicles sold in the state in a given year and the number of those vehicles replaced in 1991 based on life span data. The total estimated weight of discarded vehicles is determined by multiplying the total number of discarded vehicles by an average weight. Sources for vehicle data used in estimating the number of vehicles discarded include the DMV, MVMA, the National Automotive Dealers Association (NADA) and the Institute of Scrap Recycling Industries (ISRI).

Approximately 1.75 million new vehicle registrations were recorded in California in 1991. To estimate the number of new vehicle registrations in previous years, vehicle registration data from the DMV were also used to the extent possible. The DMV maintains only a short historical record of new vehicle registration data. Registration data for previous years were estimated for some years by using the percent change in the population for the state and back calculating for the number of vehicles registered in a year for which complete data were available (Ref. 1).

Table 2.2

Estimated Number of Appliances Sold in California (1991)

Appliance	Number	Percent (%) of total sold(1)
Air Conditioners	90,000	2.0
Dehumidifiers	Not Available	
Freezers		
Upright	45,000	1.0
Chest	26,900	0.6
Refrigerators	837,400	18.6
Dishwashers		
Portable	12,400	0.3
Built-in	430,100	9.5
Clothes Dryers		
Electric	210,000	4.7
Gas	241,900	5.4
Microwave Oven	1,025,000	22.8
Residential Furnaces	Not Available	
Washing Machines	588,000	13.1
Ranges		
Electric (free-standing)	154,300	3.4
Electric (built-in)	90,800	2.0
Gas (free-standing)	285,500	6.3
Gas (built-in)	28,600	0.6
Hot Water Heaters	437,796	9.7
Total	4,503,696	100

Notes:
1. Percent of total number known. Does not account for data not available. Numbers may not add due to rounding.

Source:
Association of Home Appliance Manufacturers

Information on the number of vehicles in operation for a given production year was used to determine the life expectancy of newly registered vehicles. The MVMA reported the number of passenger vehicles in operation by production year for the past 13 years. The median age of vehicles on the road was used as a guideline to estimate the life of a vehicle, which is assumed to average 20 years. Exhibit A-4 (see Appendix A-2) provides a graphical presentation of the relative percentage of vehicles in a given age bracket that are replaced in a given year. The number of replaced vehicles was calculated for each year of a 20-year period ending 1991 (Ref. 1) (see Table A-4, Appendix A-2). As is the case with appliances, the number of replaced vehicles is assumed to be synonymous with the number discarded.

The weight of an average vehicle (see Table 2.3) for each year was based on straight-line interpolation of the average reported weights for 1972 vehicles and for 1991 vehicles (Ref. 2).

The estimated tonnage of vehicles discarded in 1991 was calculated by multiplying the average weight by the number discarded (Ref. 1).

2.2.3 Other Metallic Discards

In addition to vehicles and major appliances, other metallic discards, as identified in AB 1760, were quantified. Quantities of other metallic discards were not estimated in the same manner as automobiles and appliances due to the lack of pertinent published data. Instead, other metallic discards were assumed to consist of 10 percent of the total generated tonnage of the combined oversized bulky wastes (OBW), other & unsorted waste, and other special waste (Ref. 2) as reported in the California Integrated Waste Management Board's (CIWMB) statewide Source Reduction and Recycling Element (SRRE) tally (Ref. 3). Other metallic discards are, therefore, estimated at 301,500 tons in 1991.

Table 2.3

Average Weights (lb) for Metallic Discards (1)

Metallic Discard	1972	1977	1982	1991	1992
Air Conditioners	132				105
Auto Bodies and Parts	3,942			2,896	
Freezers	345		280		250
Refrigerators	345		258		235
Dishwashers					
Portable	170		160		135
Built-in	120		105		95
Clothes Dryers		150			135
Microwave Ovens			75		55
Washing Machines	195				175
Ranges/Ovens	180		170		175
Hot Water Heaters	150				130

Notes:
1. Average weights are midpoints of ranges on manufacturers specification sheets, unless otherwise noted.

Sources:
Manufacturer specification sheets provided by Association of Home Appliance Manufacturers, and Cal Recovery, Inc., December, 1992.

2.3 Metallic Discards Quantities

The estimated number and tons of discarded major appliances and vehicles is shown in Table 2.4. Approximately 3.38 million discarded appliances, or 268,000 tons, were generated in 1991. The estimated number of discarded vehicles is 1.63 million, or 2.76 million tons (Ref. 1). The actual amount of scrap metal generated in 1991 from these discarded appliances and vehicles is less than the combined (appliances and vehicles) total of approximately 3.03 million tons due to the nonmetal portions (fluff) of appliances and vehicles. Fluff is currently landfilled.

To estimate the quantity of metallic discards by county, the total tons of discarded appliances, vehicles, and other metallic discards were apportioned among all counties in the state using each county's percentage of the state's population based on the California Department of Finance's population data (Ref. 1). The breakdown of metallic discards by county is shown in Table 2.5.

To test the validity of a main assumption used in this analysis, a comparison was made between the weight of units generated for discard and weight sold in a given year. Based on the assumption that a new unit replaces an old unit, the total quantity of units generated (landfilled plus recycled) was compared to the quantity of appliances estimated to have been purchased in 1991.

A recent report estimates that the total generated quantity of "white goods" in California in 1991 was approximately 266,000 tons (Ref. 3). This analysis estimates that 268,000 tons of appliances were generated in 1991. The estimated weight of new appliances sold in 1991, which is shown in Table 2.2, is 249,300 tons.

All three estimates are within ± 10 percent of each other which reinforces the assumption that a new appliance replaces an old appliance (which is then discarded).

The total weight for vehicles newly registered in 1991 is estimated to be 2.52 million tons (based on an average vehicle weight of 2,900 pounds. The 1991 total quantity of discarded vehicles generated was determined in this analysis to be approximately 2.76 million tons. The difference between these two quantities is also within ± 10 percent (Ref. 1) which again reinforces the assumption that a new unit replaces an old unit.

2.4 Current Metallic Discards Diversion

A definitive estimate of the number (or tons) of appliances currently diverted from disposal in landfills is difficult. Past studies and current information indicate varying rates of appliance diversion. The CIWMB, based on a compilation of city and county SRREs, estimates that 26 percent of white goods generated in 1990 were diverted (Ref. 2). A recent study conducted for the U.S. Environmental Protection Agency (EPA) estimates that, nationwide, 40 percent of appliances are being recycled (Ref. 4).

However, based on survey information, site visits, and phone conversations conducted to support this report, the percentage of appliances diverted from disposal is believed to be significantly higher, on the whole, than either previous study indicates. Current information indicates that, because of their relatively high metal content, very few larger appliances, particularly refrigerators, freezers, washing machines, and clothes dryers, are being landfilled. Most landfills are known not to place larger appliances in the fill, but rather to divert them to a metals recycler. Other appliances, including microwave ovens, hot water heaters, dishwashers, and dehumidifiers are probably largely landfilled because of their limited metal content. In fact, water heaters are rarely diverted from a landfill because of their minimal amount of metal as compared to their overall weight.

Table 2.4
Quantification of Metallic Discards in California

Major Metallic Discard		1991 Units Discarded (1)	Average Weight (lbs)	Tons Discarded (1)
Appliances				
Air Conditioners		129,899	126	8,184
Dehumidifiers (2)				
Freezers		71,007	211	7,491
Refrigerators		557,136	281	78,277
Dishwashers		338,821	108	18,296
Clothes Dryers		342,497	144	24,659
Microwave Ovens (3)		615,155	66	20,300
Residential Furnaces				not available
Washing Machines		437,796	186	40,715
Ranges/Ovens		451,413	174	39,273
Hot Water Heaters (3)		437,796	141	30,865
	Subtotal	3,381,520		268,060
Vehicles				
Bodies and Parts		1,628,195	3,386	2,756,534
Other Metallic Discards (4)				
Wood Burning Stoves (5)				
Other Bulky Wastes				4,500
Other Special Wastes				23,000
Other and Unsorted				274,000
Machinery				not available
Electronic Products (6)				
Metal furniture (5)				
	Subtotal			301,500
	TOTAL	**5,009,715**		**3,058,034**
CFC Containing Metals (7)		758,042	not available	93,951
PCB Containing Metals (8)		845,380	not available	16,750

Notes:
1. Discarded includes units recycled or landfilled.
2. Negligible, not considered to be a major appliance.
3. Assumed state sales based on national sales.
4. Number of units is not known.
5. Negligible number.
6. Not considered to have a high metallic content.
7. Includes refrigerators, freezers, air conditioners. Excludes vehicle air conditioners. Not included in TOTAL.
8. This is based on the number of pre-1978 appliances discarded in 1991 (25% of total appliances). Not included in TOTAL.

Source:
Quantification of Metallic Discards In California, Cal Recovery, Inc., 1992. Numbers are rounded.

Table 2.5
Quantities of Metallic Discards by County

County	CA. Dept. of Finance Population	Percent (%) Population	Metallic Discards (tons) Appliances	Autos	Other	Total
Alameda	1,313,300	4.24	11,358	116,813	12,777	140,948
Alpine	1,200	0.00	10	107	12	129
Amador	32,150	0.10	278	2,860	313	3,450
Butte	191,200	0.62	1,654	17,006	1,860	20,520
Calaveras	35,700	0.12	309	3,175	347	3,831
Colusa	17,000	0.05	147	1,512	165	1,825
Contra Costa	836,900	2.70	7,238	74,439	8,142	89,819
Del Norte	27,600	0.09	239	2,455	269	2,962
El Dorado	137,200	0.44	1,187	12,203	1,335	14,725
Fresno	713,700	2.30	6,172	63,481	6,944	76,597
Glenn	25,800	0.08	223	2,295	251	2,769
Humboldt	123,600	0.40	1,069	10,994	1,203	13,265
Imperial	117,400	0.38	1,015	10,442	1,142	12,600
Inyo	18,750	0.06	162	1,668	182	2,012
Kern	584,100	1.88	5,051	51,953	5,683	62,688
Kings	107,500	0.35	930	9,562	1,046	11,537
Lake	54,100	0.17	468	4,812	526	5,806
Lassen	28,700	0.09	248	2,553	279	3,080
Los Angeles	9,087,400	29.32	78,591	808,289	88,414	975,293
Madera	97,200	0.31	841	8,646	946	10,432
Marin	237,000	0.76	2,050	21,080	2,306	25,436
Mariposa	15,600	0.05	135	1,388	152	1,674
Mendocino	83,400	0.27	721	7,418	811	8,951
Merced	187,100	0.60	1,618	16,642	1,820	20,080
Modoc	10,150	0.03	88	903	99	1,089
Mono	10,400	0.03	90	925	101	1,116
Monterey	366,600	1.18	3,170	32,608	3,567	39,345
Napa	114,800	0.37	993	10,211	1,117	12,321
Nevada	83,600	0.27	723	7,436	813	8,972
Orange	2,512,200	8.11	21,726	223,450	24,442	269,618
Placer	186,900	0.60	1,616	16,624	1,818	20,059
Plumas	20,750	0.07	179	1,846	202	2,227
Riverside	1,289,700	4.16	11,154	114,714	12,548	138,415

Table 2.5 (continued)
Quantities of Metallic Discards by County

County	CA. Dept. of Finance Population	Percent (%) Population	Metallic Discards (tons) Appliances	Autos	Other	Total
						continued
Sacramento	1,099,100	3.55	9,505	97,761	10,693	117,959
San Benito	38,150	0.12	330	3,393	371	4,094
San Bernardino	1,530,600	4.94	13,237	136,141	14,892	164,270
San Diego	2,602,200	8.40	22,505	231,456	25,317	279,278
San Francisco	728,700	2.35	6,302	64,815	7,090	78,207
San Joaquin	502,000	1.62	4,341	44,651	4,884	53,876
San Luis Obispo	221,900	0.72	1,919	19,737	2,159	23,815
San Mateo	670,100	2.16	5,795	59,603	6,520	71,918
Santa Barbara	379,000	1.22	3,278	33,711	3,687	40,676
Santa Clara	1,531,800	4.94	13,247	136,248	14,903	164,398
Santa Cruz	231,600	0.75	2,003	20,600	2,253	24,856
Shasta	157,700	0.51	1,364	14,027	1,534	16,925
Sierra	3,340	0.01	29	297	32	358
Siskiyou	44,800	0.14	387	3,985	436	4,808
Solano	364,700	1.18	3,154	32,439	3,548	39,141
Sonoma	407,200	1.31	3,522	36,219	3,962	43,702
Stanislaus	393,400	1.27	3,402	34,991	3,827	42,221
Sutter	69,000	0.22	597	6,137	671	7,405
Tehama	52,700	0.17	456	4,687	513	5,656
Trinity	13,450	0.04	116	1,196	131	1,444
Tulare	330,000	1.06	2,854	29,352	3,211	35,417
Tuolumne	51,700	0.17	447	4,599	503	5,549
Ventura	686,900	2.22	5,941	61,097	6,683	73,721
Yolo	149,200	0.48	1,290	13,271	1,452	16,013
Yuba	61,100	0.20	528	5,435	594	6,557
Total	**30,989,040**	**100**	**268,003**	**2,756,354**	**301,500**	**3,325,857**

Note:
Numbers may not add due to rounding.
Source:
Quantification of Metallic Discards in California, Cal Recovery, Inc., 1992.

Vehicles, on the other hand, have been found to be diverted from disposal at a rate exceeding 90 percent over the state. Vehicles have a much higher scrap metal value simply due to the amount of metal contained in each vehicle compared to an appliance, and the higher per ton price that can be obtained for exclusively vehicle scrap metal (Ref. 5). Additionally, most landfill facilities in the state prohibit the disposal of vehicles, thereby providing an additional incentive to recycle them. Although this study did not focus on bicycles, scooters, and motorcycles, these vehicles are probably not recycled in large numbers at the end of their useful life (or that of their component parts). Recycling information was not available for other vehicles such as airplanes, jets, or trains.

References

1. *Quantification of Metallic Discards in California*, Cal Recovery, Incorporated, December 1992.

2. Estimated by Cal Recovery, Inc., December 1992, based on experience with California's solid waste stream composition.

3. *Estimated Average 1990 Waste Stream Composition Including Diversion of Excluded Waste Types*, California Integrated Waste Management Board (CIWMB) Interim Database Report, Revised November 23, 1992.

4. *Characterization of Municipal Solid Waste in the United States*, U.S. Environmental Protection Agency, 1992 update, final report, July 1992.

5. Telephone conversation between Donald Gambelin, SAIC, and representative of the American Metal Market, January 1993.

CHAPTER THREE

EXISTING MANAGEMENT SYSTEM FOR DISCARDED APPLIANCES AND VEHICLES

3.1 Overview

Currently, the management system for discarded appliances and vehicles diverts a large portion of these items from disposal in solid waste landfills due to the value of scrap metal each discard contains, the decreasing availability of landfill space to dispose of such materials, and the operational difficulties (for the landfill) caused by the bulkiness of these discards. Recycling of metallic discards occurs in most areas of the state; however, the removal of special materials contained in these discards, prior to scrap metal recovery, varies considerably.

Based upon the information obtained from the site visits and survey conducted, solid waste facilities, appliance retailers, feeders, and special programs located in California are largely in compliance with the requirements of the Clean Air Act for the evacuation of chlorofluorocarbons (CFCs) from appliance refrigeration units. But, small collectors generally violate those requirements either because they are not aware of the appropriate laws and regulations or have not purchased the equipment needed to conduct such operations. PCB-containing capacitors are largely not being removed by the existing management system prior to shredding.

In most cases, CFCs are being removed properly from vehicles since vehicle dismantlers, who are generally responsible for CFC evacuation, are aware of the regulatory requirements and industry standards that require the removal of CFCs. One new concern is the presence of sodium azide canisters used to inflate air bags. While the majority of cars currently entering dismantling facilities or metal shredders do not contain air bags since older vehicles were not equipped with such devices, the new car models may have one or two such devices. Metal shredding facilities will not accept vehicles with intact air bags, and dismantlers are generally not aware of the proper procedures for removing the air bags.

As described in Chapter 1, sources of information used to describe the metallic discards management system include a review of the literature, responses to a mail survey, site visits and phone conversations with numerous businesses and facilities engaged in metallic discards management.

The majority of survey respondents are aware of the Clean Air Act's requirements for the recovery of CFCs from refrigeration units and had either purchased recovery equipment or were contracting for recovery services. Vehicle dismantlers were also aware of regulations and industry standards requiring the removal and handling of fluids and other special materials.

Survey respondents recommended educating local governments on how the existing system works and on the impact of new regulations. They also recommended educating the public on the problems with improper handling of appliances containing special materials. Respondents also suggested permitting of collectors, fees, incentives, and guidelines to improve the existing management system.

In addition to the survey, site visits were made to six facilities including a vehicle dismantler, metal shredder, metal recycler, reuse center, and a special program.

The sections that follow describe the existing system for metallic discards management in California. For appliances and vehicles, handling and processing are discussed

separately. Because of similarities in CFC recovery and reclamation systems, and metal shredding (i.e., recycling) for both appliances and vehicles, this information is presented together for both types of discards.

3.2 Major Appliance Management

Discarded major appliances are currently managed by a combination of methods: disposal, recycling, and special materials handling. A discarded major appliance is a unit that has been removed permanently from service and, therefore, is treated as a waste. This definition does not include appliances that are rebuilt, stored, or reused, or commercial appliances. The most common discarded major appliances in California (shown in Table 2.1) include clothes dryers, washing machines, refrigerators, freezers, air conditioners, microwave ovens, dishwashing machines, hot water heaters, ranges, and ovens.

Major appliances are largely diverted from disposal in solid waste landfills because of their scrap metal value and the problems they pose for disposal site operations. However, not all appliances that contain special materials, particularly CFC-containing appliances, are being properly processed and handled. In the existing system, the costs to generators for proper management of the special materials appear to lead to some illegal processing, (i.e., venting of CFCs to the atmosphere), of CFC-containing appliances.

This section focuses on the existing complex system for handling, processing, and recycling appliances from the point of generation to the recovery of the metal portion of the appliances. The system is summarized in Figure 3.1. The recycling stage of the appliance management system, which is similar for vehicles, is discussed in Section 3.4.

3.2.1 Handling

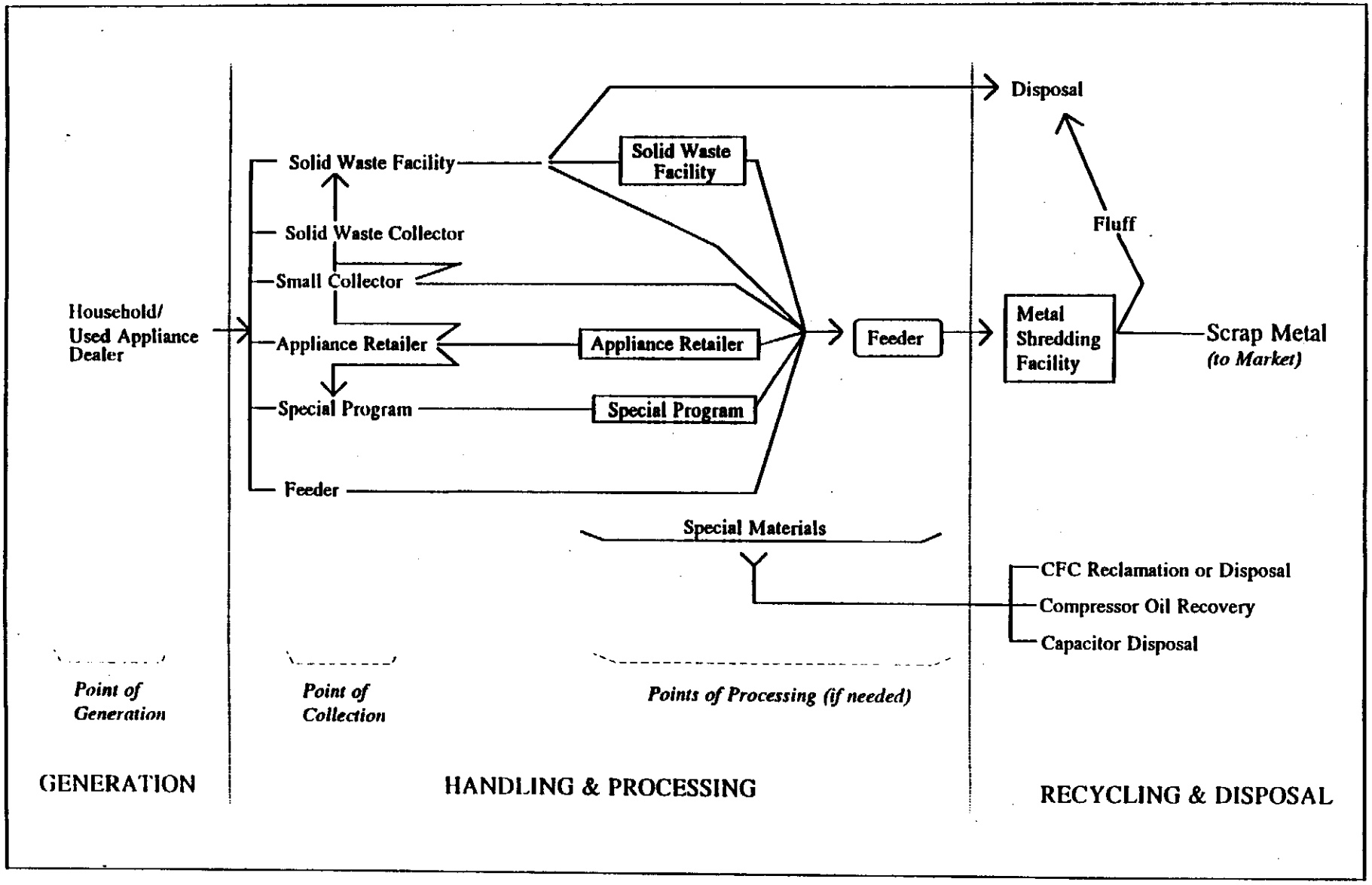
Appliance handling encompasses the collection, storage, and transport of discarded appliances from the point of generation to delivery to a metal shredding facility. The handling system consists primarily of solid waste facilities, retailers of new appliances, small collectors, solid waste collectors, special programs, and metals recyclers and scrap yards (hereafter referred to as "feeders" because metals recyclers and scrap yards feed scrap metal to metal shredding facilities).

Households and used appliance dealers are the two main generators of appliances. The point of generation is when an appliance leaves one of these two sources and enters the handling system. Households generate the majority of appliances. Used appliance dealers do not regularly generate appliances since they will not typically acquire an appliance that is not working or cannot be repaired and/or resold. Some used appliance dealers even stipulate that if the used appliance is not working or cannot be repaired for resale, the unit will be returned to the party from which it was acquired. Nevertheless, some discarded appliances are still generated by used appliance dealers. Appliance repair companies, especially one-person shops, tend to service appliances in-home whenever possible. These repair companies do not want to service an appliance out of a household and run the risk of having to dispose of a nonrepairable appliance. Appliance repairers are not considered a generator of appliances.

From the point of generation, appliances that are not landfilled enter one of several paths, depending on the point of collection. Based on the survey and site visits, the paths, regardless of their length and complexity, lead to a feeder. The various points of collection and associated paths to the feeder are described below. Appliance processing, which may be one step along a given path, is described later in this chapter. In general, the handling stage of the existing system is where accidental or intentional

Figure 3.1

Discarded Major Appliance Management System



(and illegal) venting of CFCs from refrigeration units most often occurs. Other special materials, including PCB-containing capacitors, may also be accidentally or intentionally released during handling.

Transportation

Transportation of appliances is accomplished by a variety of means. Vehicles used by solid waste collectors or other operators for transport may include garbage collection packer trucks, specialized recycling vehicles, semitrailer vehicles, roll-off boxes, flat-bed, stake-body or box trucks. Loading and unloading of appliances onto these vehicles at the household or at the processing facility may also be performed in several ways. Appliances may be loaded or unloaded by direct dumping, manual lifting, or using a two-wheeled dolly, a power-lift gate, a clamshell arm, a forklift, a conveyor, or a front-end loader.

Solid Waste Facilities

Most solid waste facilities (i.e., landfills, transfer stations, material recovery facilities), whether publicly or privately owned and/or operated, accept appliances from generators, appliance retailers, solid waste collectors, and small collectors. Any person who transports solid waste to the solid waste facility is typically required to identify appliances in incoming loads so that they can pay a specific appliance discharge fee (if required) and be directed to the appropriate discharge area. Solid waste facilities often charge a special fee for appliances because of their specific handling needs. Appliances can also arrive at solid waste facilities in roll-off (debris) boxes. Such appliances, when identified, are picked out of the roll-off box load after it has been discharged. Appliances are typically stockpiled at the facility until a number of them are collected, at which time they are sent to a feeder. Appliances collected at landfill facilities are usually not disposed in the landfill. The types of appliances stockpiled at a solid waste facility depend on the types that will be accepted by whichever feeder the facility is using. Appliances can be transported by the facility operator or collected, sometimes under contract, by a feeder. Transportation arrangements, whether or not the appliance has been processed, and whether the appliance is crushed or whole are key factors in determining if the solid waste facility will be paid by the feeder for the appliances, if the feeder will collect a fee, or if no money will change hands.

A solid waste facility's service area for the collection of discarded appliances is typically the same area it serves for the disposal of municipal solid waste. Solid waste disposal facility service areas can either be defined, such as a city, county, or region or can be undefined and thus unofficially determined by hauling distances and gate fees. For example, a generator of an appliance may be located closer to one solid waste facility but may transport an appliance for disposal to a more distant solid waste facility because the latter has a substantially lower gate fee.

Solid Waste Collectors

Solid waste collectors are locally and regionally franchised, contracted, or public municipal solid waste collectors. Such collectors are responsible for the regular pickup of residential and/or commercial waste in a given city, county, or region. Service areas for appliance collection are the same as service areas for regular municipal waste collection. Solid waste collectors usually do not accept appliances on their normal established collection routes. However, in some jurisdictions of the state, the local residential solid waste collector has an established collection program for appliances. The logistics of the various programs differ, but are usually operated on an on-call basis for a fee. Some solid waste collectors allow regular customers to dispose of an appliance along with their regular refuse for no additional fee during a specified regular collection period. Solid waste collectors transport the collected appliances to a solid waste facility.

Small Collectors

Small collectors, found in many areas in the state, provide an on-call service to individual households. A small collector is best described as a local (or regional) small rubbish hauling business not limited to hauling appliances. Transport is usually accomplished with a pickup or flat-bed truck or by an automobile pulling a trailer. The small collector may or may not charge a fee for the service which basically includes pickup of the appliance and transportation to a feeder or solid waste facility. Some feeders will pay small collectors for the appliances. Small collectors do not process the appliances they collect since this step would have a severe impact on the economics of their operations. Small collectors' service areas vary substantially; they commonly encompass a city or small region. Service areas in rural communities may be larger than service areas in urban areas.

Special Programs

Special programs are designed to collect, process, and transport appliances to a feeder. For the purpose of this discussion, special programs are defined as ones that collect appliances in order to support an overlying purpose or program. For example, the Sacramento Municipal Utility District (SMUD) initiated an incentive program to conserve energy by removing older, inefficient refrigerators from households. This incentive program includes rebates for purchasing energy-efficient refrigerators. To support this incentive program, SMUD also initiated a special program to collect the old working refrigerators (up to two per household). SMUD pays residents and retailers for each refrigerator that is brought to SMUD's refrigerator processing facility. After processing, SMUD arranges for the refrigerators to be transported to a feeder. Special program service areas can vary in size substantially. In the case of SMUD's program, the service area is technically defined by SMUD's service area.

Appliance Retailers

Retailers of new appliances often collect discarded appliances. Typically, a retailer will collect the used appliance when a new unit is delivered to the purchaser (household). A retailer may consider the appliance to be a used one that is available for resale or a discarded one that is managed as a waste material. Depending on the number of discarded units collected (e.g., on a daily basis) and the processing capabilities of the retailer, the retailer will either transport the appliances to a solid waste facility, feeder, or special collection program, or the retailer will house the units temporarily and/or process them. Costs or revenues to the retailer for "transferring" the discarded appliances to another facility (solid waste facility, feeder, special program) are variable and depend on the facility or program. Some feeders and special programs will pay a collector for the appliances. Solid waste facilities typically charge a fee. Payments and fees are discussed in Chapter 4. The service area for appliance retailers is the same as their area of appliance sales, and varies substantially among appliance retailers.

Feeders

Feeders, which include metal recyclers, salvage and junk yards, and scrap yards, are the recipients of all appliances, both processed and unprocessed, from solid waste facility operators, retailers, solid waste collectors, special program operators, and small collectors. Many feeders will also receive appliances directly from generators. The practice of accepting processed and unprocessed appliances varies depending on the preference of the feeder. Some feeders require that special materials, particularly CFCs and compressor motor oils, be removed before they will take the appliance. Others have processing capabilities and will accept unprocessed appliances. Some feeders will not accept appliances. There are no regulations or standards for feeders governing the acceptance of appliances. The requirements of the Clean

Air Act apply to feeders who receive unprocessed CFC-containing appliances (see Chapter 6). The CFCs from such appliances must be properly recovered before the appliance can be crushed and baled for transport to a shredder or other feeder.

The condition of the appliance when the feeder receives it also varies depending on the feeder's preference. Appliances can be received whole, with or without the special materials removed, or already crushed and baled. One other variable is whether the feeder collects and transports the appliances or handles only appliances delivered to it. It is not uncommon for feeders to provide containers to collectors for storing or stockpiling appliances or travel to facilities where appliances have been stockpiled, crush the appliances using a portable crusher, and bale and ship them back to their facilities. Payment and fees vary considerably depending on the feeder, contractual agreements, hauling distances, volume, and other variables. Feeders have been found to both pay for appliances (on a per ton basis) and charge a fee (on a per unit basis) for handling appliances. Payment and fee levies do not necessarily coincide with the condition of the appliance, including whether or not it has been processed. Payments and fees tend to be based more on the volume of appliances received from a given collector, the hauling distance, and the market value for scrap metal (see Chapter 4). Feeder service areas can vary substantially. According to the survey, feeders were servicing areas nearly 200 miles from their facility. Further information on feeders is provided in Section 3.3 which discusses vehicle handling and processing.

3.2.2 Processing

Appliance processing includes the removal and proper management of capacitors and ballasts which may contain PCBs, the removal of CFCs, hydrochlorofluorocarbons (HCFCs), ammonia, and sulfur dioxide in refrigeration units, or compressor motor oil, and other special materials (e.g., mercury-containing switches in certain appliances). Chapter 5 discusses special materials commonly found in appliances in detail. CFC removal is required under the provisions of the Clean Air Act, effective July 1, 1992, and since then the intentional venting, release, or disposal of CFCs or HCFCs to the environment is prohibited. Since the provisions of AB 1760 do not become effective until January 1, 1994, requirements of the Clean Air Act and other hazardous waste regulations currently provide the reason for processing appliances. Based on the survey, one reason for previously removing PCB-containing capacitors was that many feeders and shredders would not accept appliances unless the capacitors were removed. Currently, feeders and shredders tend to accept appliances with the capacitors intact due to the low probability that the capacitors contain PCBs and because verifying their removal is difficult and expensive.

Currently, appliance processing occurs at one of several points depending on the collection and transportation path, limitations imposed by feeder facilities (some require CFCs to be evacuated) and requirements of the Clean Air Act. Typical processing points were identified in the discussion of the handling system (Section 3.2.1) and are indicated on Figure 3.1.

From the mail survey and phone interviews of appliance recyclers, those collectors that are processing appliances were found to be aware of the laws and regulations governing the handling of special materials. Collectors that handle appliances but do not process them were also found to be largely aware of the laws and regulations affecting special material handling. In general, collectors who are not complying with the laws and regulations, particularly the requirements of the Clean Air Act for the handling of CFCs, are small collectors.

Some generators of discarded appliances may also be intentionally venting CFCs.

Refrigeration Units

To a large extent, CFCs are properly evacuated from refrigeration units before the appliance (air conditioner, refrigerator, freezer) is transferred to a feeder. Solid waste facilities, appliance retailers, and special programs are largely in compliance with the requirements of the Clean Air Act for evacuation of CFCs from refrigeration units. Many have purchased the proper recovery equipment and are performing the evacuation process themselves. Others contract for CFC recovery services with service providers, most of whom are operating equipment that comply with current and future EPA standards (see Chapter 6). Feeders that receive unprocessed CFC-containing appliances typically do so because they have recovery equipment, or contract for recovery services. A detailed description of the CFC recovery process is presented in Section 3.5.

Based on site visits conducted to prepare this report, there is no evidence that insulating foam (containing CFC-11) is being removed before the appliance is sent to a feeder or shredder. There is no legal requirement to conduct such a practice since the recovery of CFC-11 in insulating foam is not required under the Clean Air Act or current state regulations.

Small collectors are probably not in compliance with the Clean Air Act, based on survey and site visit findings. For example, one small collector who was delivering appliances to a feeder that requires CFCs to be removed prior to acceptance claimed that he does not collect appliances that still contain CFCs. From this discussion with the collector, it can be concluded that either the households using the collector's services or the collector is illegally venting the CFCs from the refrigeration units before they are brought to the feeder. This conclusion is based on the assumption that neither households nor the collector has contracted with a vendor to recover CFCs or has purchased CFC recovery equipment. This conclusion is supported by the feeder, based on the feeder's frequent transactions with numerous small collectors.

The replacement of CFCs in refrigeration units with HCFCs initially, and other refrigerants in the future, and compliance with the requirements of AB 1760 are likely to affect the existing management system. The existing management system is designed to process refrigeration units containing CFCs. With the upcoming ban on the CFC production and use in appliances, new and different refrigerants will be used. Appliances containing alternative refrigerants will require processing separate from CFC-containing units in order to prevent the contamination of recovered CFCs with other refrigerants and to facilitate the recovery and recycling of alternative refrigerants. In the future, although CFC-containing appliances will no longer be discarded (approximately 20 years after the ban on the use of CFCs given the life span of refrigerators, freezers, and air conditioners), the system that is developed for handling the CFCs from appliances may still be necessary to properly manage the alternative refrigerants which may also present hazards to the environment and human health.

Processing facilities handling ammonia and sulfur dioxide-containing refrigeration units were not found in the survey and from other available information. Nevertheless, the processing of such refrigeration units is necessary to remove and neutralize the liquid ammonia and sulfur dioxide safely. Currently, Appliance Recycling Centers of America (ARCA) has a mobile refrigerant recovery unit that is capable of recovering sulfur dioxide and ammonia from cooling systems and preparing the material for reuse by industry. Because ARCA primarily operates in the midwest, providing this service in California may be extremely costly. Information on this service is provided in Appendix A-4.

Most facilities that process appliances with refrigeration units also remove compressor motors from the appliances and drain the oil

found in the compressor motors. This is done after the CFCs have been evacuated. The oil, which is managed as a hazardous waste, is typically drained into 50-gallon drums. A number of drums may be accumulated before a certified transporter is contacted to remove the drums from the processing facility and deliver them to a Class I hazardous waste treatment, storage, or disposal (TSD) facility.

Incentives for removing compressor motors and draining their oil are provided by feeders. For instance, some feeders will not accept appliances with compressor motors intact. Feeders also tend to pay a slightly higher price (per pound) for separated (and drained) compressor motors. Where feeders accept appliances with compressor units intact (with or without CFCs), compressor motors are generally removed and the oil is drained before the appliances are sent to a shredding facility.

Although the current processing capacity for refrigeration units is difficult to quantify, currently there does not appear to be a shortage. It is known that, with few exceptions, processing facilities are not continually processing appliances. Most facilities find it necessary to stockpile appliances over time in order to obtain a number of units to make it cost effective to process them. In other words, there is no known case of a processing facility being unable to handle its load of refrigeration units. It appears that the current processing system can handle additional units that are not currently processed, although it would require processing facilities to commit additional time to refrigeration unit processing. Additional time (including labor) commitments can affect the ability of some processors to continue processing appliances economically.

It is unknown, however, how the increased supply of refrigeration units and the potentially large numbers of PCB-containing appliances, as AB 1760 is implemented, will impact processing capacity. Several organizations contacted to prepare this report, including the Counties of San Diego and San Bernardino, were concerned about the impacts of the CAA and AB 1760 on future processing capacity.

Capacitors and Ballasts

The removal of capacitors and ballasts from appliances (regardless of the type and age) before the units are crushed, baled, and sent to a shredding facility does not commonly occur. Therefore, when removal of PCB-containing capacitors is required by AB 1760 (January 1994), processing capacity must be expanded. Capacitor removal could be performed at facilities that currently process CFCs.

Although all feeders and metal shredding facilities contacted for this report have a policy that requires generators to remove PCB-containing capacitors, removal generally does not occur. This is for several reasons including the difficulty with identifying PCB-containing capacitors (i.e., even though only a small percentage of appliances have PCB-containing capacitors, most appliances have to be inspected because it is not apparent which appliances contain these special materials), the fact that feeders and shredders typically do not verify capacitor removal, and the cost to remove the capacitors from the appliances. Processors (solid waste facilities, special programs, feeders) that do remove the capacitors during processing tend to manage the capacitors as a hazardous waste (without verifying their PCB content) since testing capacitors to determine if PCBs are present is expensive and often not cost-effective. Disposal as a solid waste would require that capacitors be verified as being free of PCBs.

With the methods and controls that California solid waste facilities currently operate under, fluff management and disposal do not pose an environmental or regulatory compliance problem. In order to dispose of shredder fluff as solid waste, shredding facilities must certify to a solid waste disposal facility that the fluff is not a hazardous waste. Solid waste disposal facility operators, because of liability and

regulatory factors, will not accept shredder fluff for disposal unless the fluff has been stabilized and this certification can be made.

Despite the regulation for PCB-contaminated fluff, the practice of leaving all electrical capacitors and ballasts in place in appliances will have to change by January 1, 1994 in order to be in compliance with the requirements of AB 1760. Many processors are unfamiliar with the safe removal and handling of the capacitors. Compliance with the requirements of AB 1760 will necessitate training personnel in safety and removal procedures. Capacitor removal will likely take on a limited role in appliance processing after 1998 when the majority of appliances that could have PCB-containing capacitors installed are no longer in circulation (based on a 20-year appliance life span).

3.3 Vehicle Management

Discarded vehicles are currently managed by a combination of disposal, recycling, and special materials handling within the vehicle dismantling and metal shredding industries.

Vehicle recycling has been in existence since the 1930s. Previously, vehicles were burned in the open to remove nonmetallic components and other combustible materials before reclaiming their more valuable parts. The emergence of the environmental movement in the 1960s ended the open burning of vehicles and led to the practice of compressing vehicles into cubes and sending them to steel mills. The present management system has evolved further. This section focuses on the existing system for handling, processing, and recycling vehicles from the point of generation to the recovery of the metal portion of the vehicles and identifies factors which may influence the recycling of such metallic discards. The existing system is illustrated in Figure 3.2. The recycling stage of the existing system is discussed in Section 3.4 with the recycling stage for appliances since the two are similar.

3.3.1 Handling

Vehicle handling involves the collection, storage, and transport of discarded vehicles to a metal shredding facility. The handling system is composed of vehicle dismantlers and feeders. Vehicles enter dismantling facilities and feeders from insurance companies, salvage pools owned by independent businessmen contracted by insurance companies, or owners of vehicles.

Vehicle Dismantlers

Vehicle dismantlers are registered with the Department of Motor Vehicles and are required to have a dismantling license. Dismantling facilities remove parts of the vehicles that can be sold. The removal of vehicle components varies significantly from automobiles, light trucks, and vans and depends upon the condition of the vehicle when received. Light trucks differ from automobiles and vans since they are component-type vehicles. Virtually all parts of a light truck can be recovered for reuse. Automobiles and vans, on the other hand, are not component-type vehicles and only parts that can be reused and sold are removed before the vehicle is transported to a feeder or metal shredding facility.

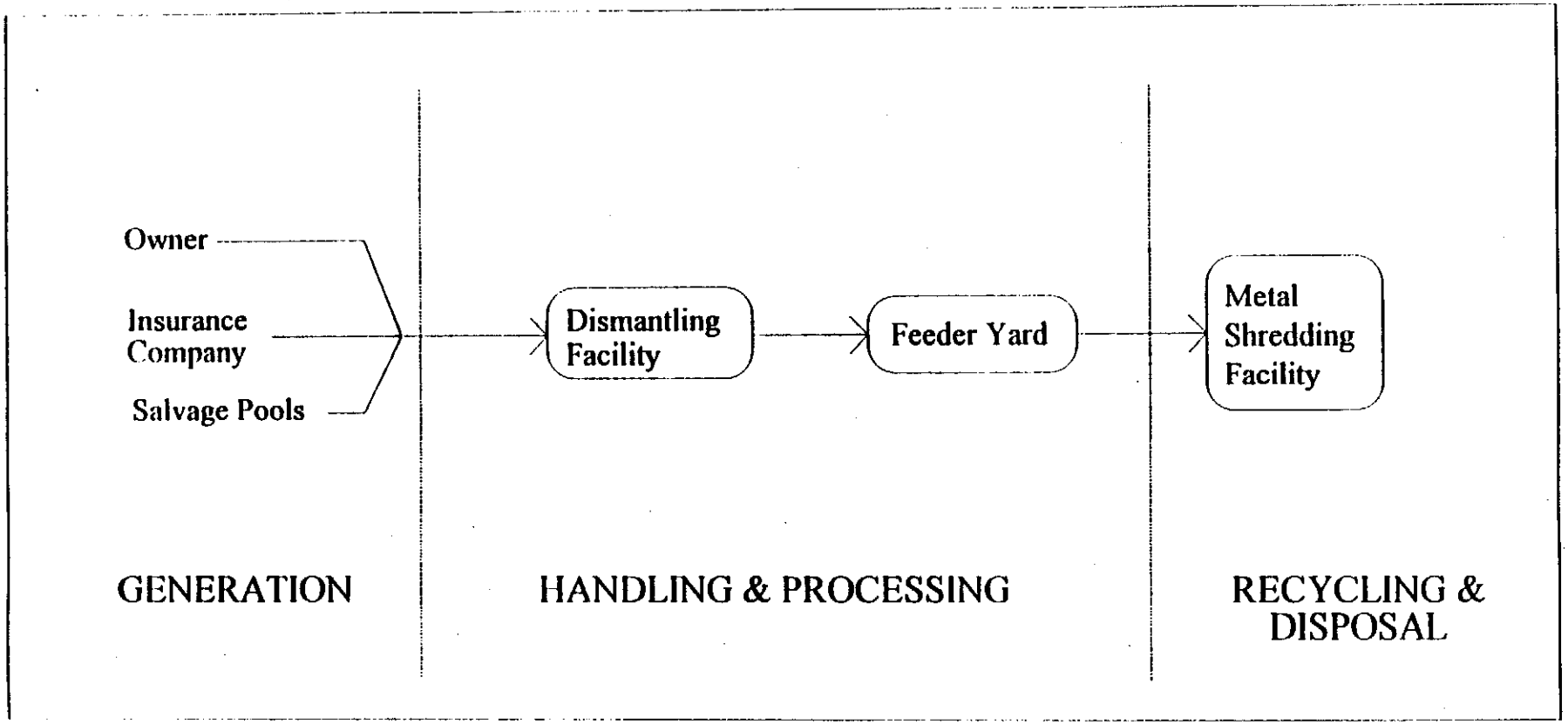
Feeders and Shredders

Feeders store metallic goods and recover precious metals in a cost-effective manner before transporting them to a metal shredding facility. Vehicles are processed or dismantled prior to drop-off at a feeder since feeders and shredders do not process vehicles. Feeders will pay less for vehicles that have not been properly dismantled. Proper dismantling of vehicles is explained in Section 3.3.2.

Shredding facilities and feeders are generally located in industrialized areas of California. Feeders are open to the public, operate as drop-off centers of metallic goods and discards and recover iron and nonferrous metals including copper, lead, aluminum, tin, and nickel.

Figure 3.2

Discarded Vehicle Management System



Feeders may conduct some processing of vehicles, but generally, feeders only store dismantled vehicles prior to shipment to a metal shredder. Feeders will also accept and temporarily store components that shredders will not accept if contained in the vehicle. These include motor blocks and gasoline tanks if not removed by the vehicle dismantler. Motor blocks can be recycled (e.g., sheared) more cost-effectively at a feeder yard and gasoline tanks are bailed since the tanks may explode in a shredder if gasoline is still present in the tank.

Stripped vehicles, removed from dismantling facilities or feeders, are flattened for transportation efficiency and sent to shredders. Trucks that can hold six full-sized automobiles can accommodate 18 compacted cars. Due to the component-type nature of light trucks, they are generally not transported to shredding facilities. As mentioned previously, virtually all components of light trucks that can be reused are sold to the public at dismantling facilities, salvage yards, or salvage pools.

Some feeders have shredders on-site and conduct shredding operations. Vehicles that are transported to feeders with shredding equipment are shredded on-site and are not transported to a metal shredding facility. For purposes of this report, feeders with shredding equipment are treated as metal shredding facilities. Other feeders have shearers and bailers to reduce the size of large metallic discards including large pipes, railroad cars, and appliances.

3.3.2 Processing

Vehicles that are no longer in service are first taken to dismantling facilities to be processed. Results from the survey indicate that vehicle dismantlers located throughout California process anywhere from 1 to 6,000 vehicles per year and some dismantlers only accept certain types of vehicles, (e.g., Porsches), due to the high value of replacement parts.

Processing, in addition to the removal of special materials that require special handling, involves the removal of components that have monetary value including glass, seats, and parts and components that metal shredding facilities will not accept which include lead-acid batteries, tires, gasoline tanks, and vehicle fluids.

Guidelines established by The Institute of Scrap Iron and Steel (ISIS), a trade association for the U.S. ferrous scrap metal industry, control the processing of vehicles. ISIS has led the industry's shift toward tighter control over what comes into metal shredding facilities. In 1988, ISIS recommended that shredder operations refuse to accept any scrap-containing items including batteries, gas tanks, tires, loose mufflers and tail pipes, catalytic converters, unspent air bag containers, and other explosive materials (Ref. 1). The objective of this policy was to prevent residue associated with an inbound material from contaminating an otherwise nonhazardous processing residue. ISIS and other associations, including the Automotive Dismantlers and Recyclers Association (ADRA), enhance the self-regulatory process that exists within the automotive dismantling and metal shredding industries by recommending practices and procedures to protect these industries from environmental liability.

Vehicle Air Conditioners

Information received from the survey indicates that vehicle dismantlers are aware of the requirements to recover CFCs and have either purchased equipment necessary for the recovery operation or have contracted with independent businesses who recover CFC-12 which is used in both appliances and vehicle air conditioners. A brief description of the equipment used to recover and recycle CFCs appears below. Descriptions of the equipment used and the specifications that have been developed for the recovery and recycling of CFCs are provided in Section 3.5.

(DILHR); and Agriculture, Trade and Consumer Protection (DATCP).

Statutes and Regulations

During the 1989 session of the Wisconsin Legislature, two bills passed that directed how discarded appliances were to be handled in the state. Act 294 prohibits the venting of CFCs from appliances when they are recycled effective July 1, 1992 (Ref. 8).

Act 335 prohibits the land disposal or incineration of major appliances beginning January 1, 1991. (Major appliances were defined as residential or commercial air conditioners, clothes dryers, clothes washing machines, dishwashing machines, freezers, microwave ovens, ovens, stoves, and refrigerators.) This legislation neither directs that the appliance should be recycled nor indicates how the appliance should be handled. Most believe the intent of the legislation is to encourage appliance recycling (Ref. 9).

Program Summary

Act 284 requires the DNR to promulgate rules for the administration of Section 144.422, Recovery of Ozone-depleting Refrigerants. The draft rules, Chapter NR488, were issued in spring 1992. They required that 1) appliance salvagers/dismantlers register annually with the state and certify that CFCs will be recovered from discarded appliances using state-approved equipment operated by individuals who have attended state-approved training; 2) any person who transports discarded appliances that may contain CFCs must register with the DNR annually and provide information on transport equipment and loading procedures used; and 3) only certified appliance salvagers/dismantlers may sell or give CFC-containing appliances to a scrap metal processor with written certification that the CFCs have been recovered. The proposed fees for annual certification are $250 for appliance salvagers/dismantlers and $75 plus $25 per vehicle for appliance transporters. These fees will be used to fund CFC enforcement staff at DNR. The proposed penalties are not less than $100 nor more than $1,000 for each violation.

The DILHR developed guidelines for DILHR-approved refrigerant handler training in late 1991. Organizations wishing to provide DILHR-approved training submitted a course description and instructor qualifications for department approval. There are currently 13 approved training courses offered through technical colleges, unions and private companies around the state. DILHR officials estimate over 3,000 people in the state had been trained to handle refrigerants from appliances and vehicles by mid-1992.

The DATCP developed rules governing the sale of mobile air-conditioners containing ozone-depleting refrigerant and the sale of recycled refrigerant from mobile air-conditioners in vehicles. The rules also govern the servicing of mobile air conditioners.

The state of Wisconsin has assigned staff people in all three agencies, DNR, DATCP and DILHR, to work on the appliance and CFC issues. It is estimated that each agency has devoted one-third to one-half of an FTE to the appliance issue and DNR has committed one-third of an FTE for appliance-related CFC issues. Enforcement is the responsibility of DNR's district offices. It is estimated that less than one FTE is allocated to the appliance program in each of the DNR's six district offices (Ref. 7).

6.4.3 Connecticut

A representative of the Connecticut Department of Environmental Protection (DEP) indicated that, despite the absence of a formal disposal or landfill ban, the vast majority of discarded appliances (white goods) are currently recycled in the state (Ref. 10). The state does have a resource recovery program requiring the recycling of all scrap metal (including that

method of sodium azide is by incineration under carefully controlled conditions and that undeployed units should not be reclaimed (Ref. 8). Consequently, auto dismantlers will be increasingly faced with either removing sodium azide canisters or activating the canisters prior to the shredding of the vehicles.

Although information must be provided to dismantlers on how to activate or remove the air bags safely, auto manufacturers are considering replacing sodium azide with other inflatants. In 1991, Ford was required to recall 165,000 vehicles with defective sodium azide air bag systems and since then, Ford, General Motors, and Chrysler have been experimenting with pressurized argon gas to inflate the air bag (Ref. 5). In addition, TRW and Morton International, the dominant suppliers of the sodium azide-based air bag, are working on their own argon system. Therefore, auto dismantlers will need to know what type of air bag system is contained in the vehicle and the proper removal procedures associated with the air bag deployment system.

An argon air bag system costs 25 percent less than sodium azide air bags (Ref. 5). The downside of argon air bags is that they do not inflate as quickly as sodium azide air bags. It takes 40 to 45 milliseconds for sodium azide air bags to inflate compared to 50 to 55 milliseconds for argon.

3.4 Appliance and Vehicle Recycling

The ultimate destination for appliances and vehicles which are handled and processed for recycling is a metal shredding facility. Metal shredding facilities process appliances and vehicles, much like any other scrap metal item, to recover and separate the metal portions from the nonmetallic materials (mostly foam and plastic).

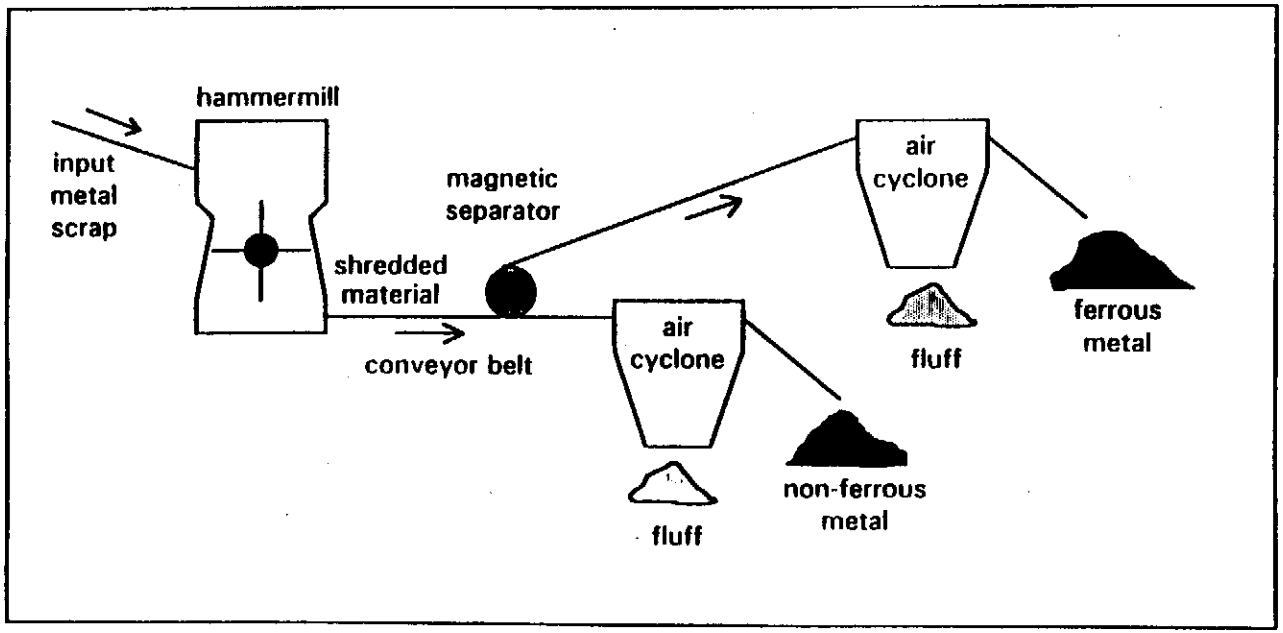
Feeders represent the only path (collection point) available for appliances going to shredding facilities. Based on the survey and site visits, metal shredders will not accept appliances from facilities other than feeders. Feeders process and prepare appliances (crushing and baling), as necessary, for shipment to a metal shredding facility. Shredders either purchase vehicles from licensed dismantlers that have junk slips from the DMV, or they receive vehicles from a feeder associated with the shredding facility. This practice is done to ensure that the vehicles entering the shredding facility were properly dismantled and that the shredder is not shredding a stolen vehicle.

At a shredding facility, vehicles and appliances are fed to a hammermill which shreds the metallic discards into hand-sized pieces. The pieces are transported onto conveyor belts and over magnets that segregate the ferrous and nonferrous components. Figure 3.3 provides a schematic of shredding operations. Additional separation is achieved via air cyclone or water separation; ferrous and nonferrous pieces are segregated and recovered from shredder fluff, the by-product of the shredder operations. Shredder input consists of vehicles (80 percent), household appliances (10 percent), and other industrial and consumer scrap (10 percent) including discarded farm equipment, building demolition debris, defective auto parts, piping, and lighting parts (Ref. 8). Shredder output is divided into piles of ferrous metal, nonferrous metal, and fluff. Shredder output has been estimated to be 78 percent ferrous metal, 4 percent nonferrous metal, and 18 percent fluff (Ref. 9). Large shredding facilities can shred 700 to 800 vehicles per day.

Approximately 500 pounds of fluff are generated from the shredding of each vehicle and this figure is expected to increase to over 570 pounds by the year 2000 (Ref. 2). The increase in fluff is attributed to the greater use of plastics to make vehicles lighter and, therefore, more fuel efficient. The average shredder generates 15,000 tons per year of fluff, larger shredders can produce 60,000 to 100,000 tons of fluff annually (Ref. 9). The United States generates 1.5 to 3 million tons per year of fluff. Nationally, the current flow of fluff into

Figure 3.3

Schematic Illustration of the Shredding Process



municipal landfills is 2.4 million tons per year (Ref. 10). In pilot studies, samples of fluff were found to be contaminated with PCBs, lead, and cadmium at levels subjecting the waste to regulation under both the Toxic Substances Control Act, (TSCA) and the Resource Conservation and Recovery Act (RCRA) (Ref. 10).

With the increase in fluff generation, alternatives to disposal are being investigated. Potential alternatives for vehicle shredder residue include landfill covers and sources of energy. Nonmetallic shredder residues have heat values estimated at 16.6 mg/kg (34,692 Btu/lb). Other studies have suggested an even higher heat value of 24 mg/kg (50,158 Btu/lb). This could, in principle, yield residual energy which could be used to generate in-plant power and improve the economics of the shredder by significantly reducing energy costs. However, obtaining air permits to burn shredder fluff is a major obstacle to taking advantage of the energy value of this material.

A factor which may affect the existing management system of vehicle recycling is the increased use of plastics in autos. Twenty years ago, typical American cars weighed 4,000 pounds. Now they weigh 2,400 pounds. Of this, 180 pounds are plastic of as many as 60 different types (Ref. 11). The increased use of plastics diminishes profits for auto dismantlers and shredders who primarily rely on the ferrous and nonferrous content of automobiles for their revenue.

Although the use of plastics is increasing in vehicles, auto manufacturers are placing more emphasis on conservation and recycling once the product's useful life is over. In 1988, BMW introduced a limited production model whose plastic body parts were designed to be removed easily (Ref. 2). In June 1991, the plastic parts of the BMW cars were stamped to be grouped together for recycling (Ref. 2). If auto manufacturers begin to use plastics that can be easily removed for recycling, shredders will generate less fluff in the shredding of vehicles, thereby increasing the recyclability of vehicles and decreasing the quantity of fluff that must be landfilled. Thermoplastics can be melted and reused while thermosets can be ground and used as filler materials (Ref. 11). Currently, plastics residue from recycled vehicles accounts for more than one million tons of the nation's solid waste landfill annually (Ref. 12).

In addition to BMW, The Vehicle Recycling Partnership, created by Ford, Chrysler, and General Motors was formed to set up voluntary guidelines for material use to ease recycling programs and move toward material unification (Ref. 2). Original equipment manufacturers hope that materials used in manufacturing processes will eventually be designed of similar materials which will reduce the material variation problems at the dismantling level and encourage the use of interchangeable components. Corvette's 1993 models use post-consumer auto plastic for the inner panels, DuPont is reusing and recycling radiator caps, and General Electric and Ford are recycling bumpers (Ref. 12). American Commodities, located in Flint, Michigan is working with an automotive resin supplier and one of the big three auto manufacturers to use dismantled plastic body parts as a feed stock for their resin reclamation process (Ref. 13).

Appliance and vehicle recycling is profitable due, in part, to the emergence and popularity of minimills. Minimills receive scrap that has been shredded. Shredding allows efficient packing of the materials into minimill furnaces. The material is small in size and can fill the furnace more completely than large bales of compacted appliances and vehicles. Minimills differ from steel mills. Steel mills use basic oxygen furnaces (BOFs) whereas minimills use electric arc furnaces (EAFs) to make steel. Although BOFs account for approximately 59 percent of the U.S. steel production, none are located in California (Ref. 14). Generally, BOFs are located in large integrated steel mills that produce flat rolled steel for use in vehicles and

appliances. Mills with EAFs, commonly known as minimills, use 100 percent scrap metal and gained popularity in the 1970s. They require 74 percent less energy to make steel from scrap than virgin ore (Ref. 15). The U.S. metal shredding industry generated 12 to 14 million tons of steel scrap in 1991 (Ref. 10). In 1989, 11.4 million tons of steel scrap were exported to Japan and Korea (Ref. 15). Ninety percent of the steel output is from the 8 to 10 million vehicles that are disposed in the U.S. every year.

3.5 Chlorofluorocarbon (CFC) Recovery

Two types of machines recover CFCs including CFC-12, the dominant refrigerant used in both appliances and vehicles. These are recover/recycle equipment and recover-only equipment. Technicians repairing or servicing motor vehicle air conditioners or refrigerators must use either refrigerant recover/recycle or recover-only equipment approved by the EPA.

Recover/recycle equipment both recovers the refrigerant from the motor vehicle or appliance and processes it through an oil separator, a filter, and a dryer. EPA approved recover/recycle machines meet the technical specifications of the Society of Automotive Engineers (SAE) Standard J-1990 and must have the capacity to purify used refrigerant to SAE Standard J-1991 for safe and direct return to the air conditioner following repairs.

Recover-only equipment removes the refrigerant from the air conditioner unit or appliance as specified by SAE Standard J-2209 and transfers it into a holding tank. Under the Clean Air Act, technicians are then required to either recycle the used refrigerant on site or send it to an off-site reclamation facility to be restored to Air Conditioning and Refrigeration Institute (ARI) Standard 700-88 before it can be used to recharge the refrigeration unit equipment.

Most certified equipment will be labeled to SAE standards. Technicians must be trained and certified by an EPA-approved organization (Ref. 16). Training programs must cover use of recycling equipment in compliance with SAE Standard J-1989, the regulatory requirements, the importance of refrigerant containment, and the effects of ozone depletion. Facilities must certify to EPA that they own approved equipment. If refrigerant is recovered and sent to a reclamation facility, the name and address of that facility must be retained.

Independent businesses often contract with vehicle dismantlers and appliance processors to recover CFCs. They generally operate recover-only equipment. As previously stated, CFC-12 in air conditioning and refrigeration systems can become contaminated with moisture, air, and compressor oil. Collected CFC-12 is stored in holding tanks and sent to industries which purify the collected CFC-12 for reuse. Individuals are paid for collected CFCs. A higher price is paid for noncontaminated CFCs.

Substitute refrigerants are currently being tested. HCFCs and hydrofluorocarbons (HFCs) are undergoing toxicity testing in order to be used as alternative refrigerants. HCFCs have ozone depleting potential but not as great as CFCs. HFCs have no ozone depleting potential but are much more expensive than CFCs and HCFCs (Ref. 17).

With the manufacturing phase-out of CFC-12, reusable CFC-12 will have a high demand. Vehicles and appliances that have internal cooling systems designed for CFC-12 will require this reusable resource. Therefore, CFC recovery is expected to increase due to favorable market conditions and as more information becomes available on the recycling of CFCs. Regarding alternative cooling agents, HFC-134a already is being used in a few new vehicle air conditioners in place of CFC-12. U.S. car manufacturers plan to phase it into all of their models during the next few years. The use of HFC-134a involves a major redesign. HFC-134a operates at higher pressure and needs a different lubricant.

Problems may be encountered in the arena of servicing CFC-12 air conditioners in older cars once CFC-12 is no longer available. Car manufacturers have been upgrading the hoses and O-rings in air-conditioning systems since the late 1970s. New refrigerants and lubricants need to be compatible. System durability may decrease if HFC-134a is placed in air conditioners designed for CFC-12. Car owners may get a system that never cools quite as well as it did with CFC-12 which it was designed for.

Although these alternative cooling agents may pose problems for vehicle dismantlers or shops servicing appliances, information and outreach programs could possibly combat these difficulties. Programs were developed to aid dismantlers and appliance servicers with the requirements of CFC recovery and these could be duplicated to address alternative refrigerants. Examples of these programs are described below.

In addition, Air Quality Management Districts (AQMDs) throughout the United States are expanding their plans to privatize part of the rule compliance process (Ref. 18). Auditors, certified by the AQMD's Small Business and Area Sources Division, are checking equipment for leaking CFCs. The certification is part of a new approach to have business comply with air quality rules through education and prevention. Businesses must pay for the review but benefits include saving money on detecting and correcting problems before AQMD inspectors arrive to evaluate the operations at the facility. Violations are referred to the AQMD, but the businesses are allowed time to correct the deficiencies.

A potential area of concern exists over individuals or small businesses purchasing vehicles at auctions or salvage pools and conducting their own vehicle renovations. These businesses or individuals may not be aware that venting CFCs to the atmosphere is illegal. As of November 15, 1992, the sale of containers of CFCs under 20 pounds to anyone other than certified technicians is prohibited (Ref. 16). The provision is intended to discourage the do-it-yourselfers who recharge their own air conditioners. Although this mechanism is meant to prevent individuals from servicing or recharging their vehicle air conditioners, information about the requirements of CFC recovery and the fines imposed for violating these requirements needs to be provided to small businesses and individuals who purchase vehicles at auctions or salvage pools.

Although the recycling of CFC-12 is on the rise and will continue to grow over the coming years, CFC-11, used as the blowing agent for foam insulation in refrigerators and freezers, is not currently recovered or recycled. Nearly 80 percent of the CFC content of a refrigerator is in the foam insulation. The practice of baling or crushing appliances may constitute a release of CFCs to the atmosphere, although the Clean Air Act does not consider the crushing of appliances with foam insulation to constitute a release of CFC-11 to the atmosphere. If future regulations state that this practice releases CFCs to the atmosphere, guidance on recovering CFC-11 in foam insulation will need to be provided to appliance processors. The existing management system of recycling appliances will then need to be revised to address the recycling of foam insulation and prevent the additional release of CFCs to the atmosphere.

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CHAPTER FOUR

COSTS AND REVENUES

4.1 Overview

The complexity of the existing management system for discarded appliances, particularly handling and processing, causes difficulty in identifying system expenditures, establishing the funding of the current system, and determining costs to appliance generators. Varying fees, prices paid per ton, appliance type, and processing requirements are some of the factors that create this complexity. By comparison, the management system for vehicles readily facilitates the determination of expenditures and funding. Despite the differences in funding complexity, the primary driving force behind the recycling of both appliance and vehicle discards is the presence of a worldwide market for their metal content.

The Legislature recognized the overriding importance of a market for metallic discards by allowing their landfilling if they cannot be economically diverted from disposal. Diversion for appliances with significant metal content (i.e., refrigerators, freezers, washing machines, clothes dryers, and stoves) will be economically feasible provided collectors and processors are able to charge fees (or collect reimbursement) for their services that cover all costs, and a healthy market remains for scrap metal. If collectors and processors are limited in the fee amount that can be charged (in order to prevent illegal disposal), some other funding method to cover their expenses would have to be available to maintain an increased appliance recycling rate.

With very few exceptions, diversion for automobiles and trucks from landfilling should be economically feasible. This is because of the high reuse value for parts and the quantity of metal in these discards. However, diversion of bicycles, scooters and motorcycles may not be economically feasible in all cases.

In addition to the demand for scrap metal, other factors that influence recycling include laws and regulations that affect their disposal and the cost of disposal. One of the greatest differences between the appliance and vehicle management systems is that there is a cost (estimated at $86.6 million in 1991) to appliance generators because revenue from the sale of scrap metal does not cover all system expenditures. The vehicle management system is funded entirely from revenues from the sale of scrap metal.

AB 1760 is anticipated to impact the economics of the current appliance recycling system because it will require the removal of all special materials from appliances before appliances are crushed for transport or transferred to a baler or shredder for recycling. The removal of PCB-containing capacitors and ballasts will be a significant new cost to the existing management system.

The existing vehicle management system currently ensures that, except for sodium azide canisters in air bag systems, special materials are removed, although not always properly. The economic effects on the vehicle management system associated with the removal of sodium azide canisters are anticipated to be absorbed by the system because of the market value of intact air bags and relatively high value of discarded vehicles.

The purpose of this chapter is to determine the economic effects of AB 1760, if any, by identifying the costs, revenues, and funding for the current system and comparing them to

anticipated additional costs of being in compliance with the requirements of AB 1760. This chapter also discusses the reasons only certain areas of the existing system are expected to be affected by AB 1760. Finally, the potential impact of AB 1760 on recycling rates is discussed.

4.2 Major Appliances

This section discusses the expenses and funding of the current major appliance management system and estimates the cost of system operation. Expenses are incurred at each step in the system, although the method of funding the various expenses differs considerably. This section also estimates the cost on the existing system of coming into compliance with the requirements of AB 1760 and discusses potential effects on recycling.

4.2.1 System Expenses

The existing management system for discarded appliances incurs expenses associated with the collection and transportation, processing, shredding, and disposal of appliances, components, and residuals. Expenses are realized from the point of collection to the point at which the scrap metal is delivered to market. For purposes of this report, the market is shredded or baled scrap metal delivered to a buyer. Figure 4.1 shows a generalized existing management system, by identifying the point of collection, the scrap metal market, and the stages in between.

Appliance collectors, including solid waste facilities, solid waste collectors, appliance retailers, small collectors, special programs, and feeders incur expenses for the collection and transportation of appliances. Collection and transportation expenses for collectors begin at the point of collection and include transportation to a processor (if necessary) and delivery of the appliances to a feeder. Feeders not only incur expenses for transporting appliances to a metal-shredding facility but also for receiving appliances and preparing them (crushing and/or baling) for delivery to the shredding facility. Metal-shredding facilities incur transportation expenses for delivering scrap metal to market and miscellaneous expenses associated with receiving the appliances, shredding, and separating fluff for disposal. Metal-shredding facilities also incur expenses for transporting and disposing of the fluff at a waste facility.

Appliances which contain refrigeration units (refrigerators, freezers, and air conditioners) must be processed in accordance with the requirements of the Clean Air Act and other hazardous waste regulations for special materials which are removed. Other appliances, at this time, are not processed because they do not contain special materials or the special materials they may contain are not currently required to be removed.

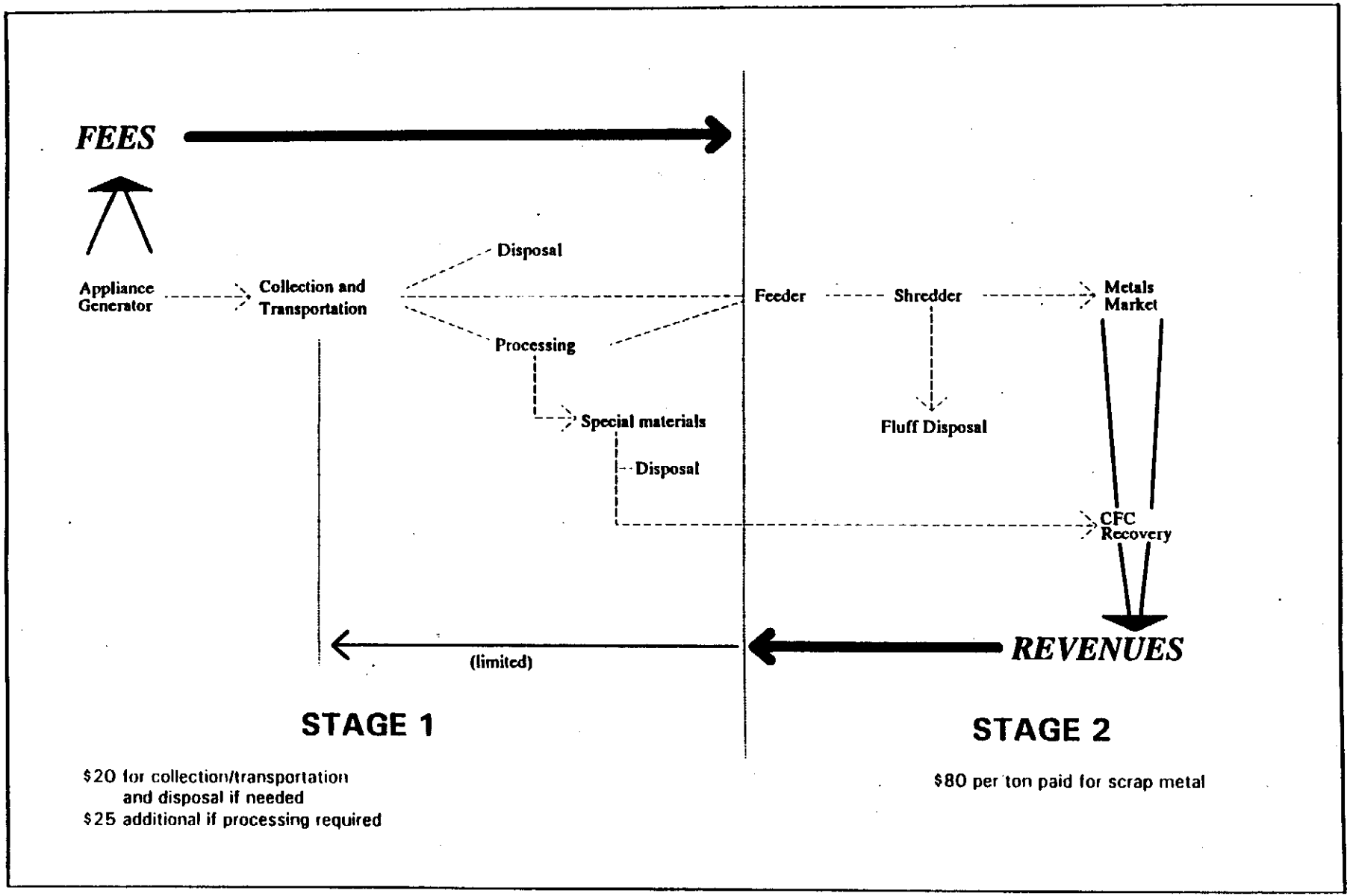
Appliance processors, including retailers, solid waste facilities, special programs, and feeders, incur expenses for recovering CFCs (and other refrigerants) recovery operations, removing and draining compressor motors, managing (disposal) compressor motor oil, and preparing processed appliances for shipment.

4.2.2 System Funding

The existing management system for appliances is funded through a complex and variable combination of fees and revenues. Fees are borne by appliance generators (households and used appliance dealers) and revenues are obtained from the sale of recovered materials, primarily scrap metal. Fees and revenues are each used to finance a relatively distinct portion of the existing management system.

The funding scheme generally operates (see Figure 4.1) in two stages, which are delineated based on the source of funding for the particular stage. Fees paid by appliance generators to appliance collectors are commonly used to cover the expenses collectors and processors incur for appliance collection and transportation (from the

Figure 4.1
Existing Management System Funding



point of collection to delivery to a feeder), appliance processing (if necessary), and whole appliance disposal (if applicable). Expenses that are funded by these fees define the limits of Stage 1.

Stage 2 is defined by revenue-funded expenses. Revenues from the sale of recovered materials are used to cover feeder and metal-shredding facility expenses. Shredders currently receive an average of $80 per ton of scrap metal if it contains a mixture of metals from various sources. $80 per ton is received for appliance metal. Upwards of $120 per ton is received for scrap metal exclusively from vehicles (Ref. 1). Feeders are paid from $32 to $70 per ton by shredders.

With few exceptions, the revenues used to fund Stage 2 expenses are generally not available to fund Stage 1 expenses. Stage 1 expenses are funded almost exclusively by fees charged to appliance generators. Exceptions include situations when the feeder is the collector, when the feeder provides transportation of the appliances from the point of collection (or processing) to its facility, and, most often, when the feeder pays the collector for the appliances (currently averaging $1 per appliance). Feeders will pay a higher price ($2 per pound) for separated and drained compressor motors (Ref. 3). Also, feeders tend to pay a higher price per pound for larger loads. In these situations, feeders use revenues to cover expenses.

Processors also directly receive limited revenue from the sale of recovered CFCs. The market value of recovered CFCs, which depends on quality and quantity, is between $0.65 and $1.00 per pound. However, this price is expected to increase to $4.00-7.00 per pound by 1995 (Ref. 2). The revenue that processors receive from CFCs depends on the recovery rate and market value of recovered CFCs. This report has found that the CFC recovery rate is generally minimal and highly variable. The range of recovery rates should be studied further.

4.2.3 Estimated Cost of System Operation

The estimated cost of system operation addresses only the portion of the management system defined above as Stage 1, since it is this portion of the system that affects appliance generators. Stage 2, which is funded entirely by revenues from scrap metal and is currently self-supporting, does not pose a financial burden to appliance generators. Stage 1 is also the portion of the management system that will be affected by the requirements of AB 1760. AB 1760's effects are discussed following this section.

Stage 1 costs can be estimated either by calculating expenses incurred by appliance collectors and processors or by calculating the costs borne (primarily in the form of fees) by the appliance generators. Since collector and processor expenses are largely inconsistent primarily due to varying collection and transportation expenses, costs of Stage 1 operations are estimated based on fees charged by appliance collectors to appliance generators. Survey results indicate that fees borne by appliance generators are relatively consistent.

These fees are commonly the greatest barrier in the existing management system to the proper handling of appliances for recycling and/or disposal. Such fees encourage illegal venting of CFCs from CFC-containing appliances by generators (and some collectors) who do not possess the necessary equipment for proper CFC recovery, and encourage illegal dumping in order to avoid tipping and pickup fees. However, such fees are currently the only method many appliance recycling programs have of funding Stage 1.

The following cost estimate is based on several assumptions regarding Stage 1 system operation. The estimate for collection and transportation (see Table 4.1) assumes that a fee is paid to an appliance collector by the generator, that the appliance is recycled and not disposed, that the system handles 100 percent of the discarded appliances for a given year, and that the

collector (or processor) handles the transportation of the appliance to a feeder facility. The estimate assumes that the system handles 100 percent of the appliances for a given year because, even if 100 percent of the appliances are not diverted from disposal, a solid waste facility (which is part of the system) is still likely to charge a fee for the disposal of the appliance. Table 4.1 also includes an estimate of the costs (based on fees) to process all of the appliances containing refrigeration units for the proper evacuation of CFCs.

Based on mail and phone survey results, collectors charge generators a fee to cover collection and transportation, storage, and miscellaneous expenses incurred from the point of collection to the point at which the appliance is delivered to a feeder. This fee varies from $15.00 to $20.00 for each appliance.

Survey results indicate that fees in rural areas can be significantly lower or higher than in urban areas. In some cases, no fee is charged for this service. Fees in rural areas are often smaller (or may not be levied) in order to prevent illegal disposal of appliances which, as is also the case in urban areas, is commonly a result of substantial fees. Rural area expenses can be covered by other funding sources including, but not limited to, municipal general funds and solid waste budgets. However, certain rural areas may charge higher fees to cover the costs of collecting appliances from remote areas.

Table 4.1
Estimated Cost of Current System Operation

System Component	Unit Cost (1)	Number Discarded (2)	Number Processed (3)	Total Cost
Collection and Transportation (4)	$20	3,381,520		$67,630,400
Processing CFC Recovery (5)	$25		758,042	$18,951,050
Total				**$86,581,450**

1. Based on an average collector fee of $20 which is commonly borne by appliance generators. Fees can vary substantially, and are often less in rural areas.
2. Total number of appliances estimated to have been discarded in 1991 (see Table 2.4).
3. Assumes 100% of refrigeration units discarded in 1991 are processed, including refrigerators, freezers, and air conditioners, which is a portion of the total number discarded (see Table 2.4).
4. Includes collection, transportation to a processor, and subsequently to a feeder.
5. Includes CFC evacuation, compressor motor removal and draining, and compressor motor oil management (disposal). Processing fee is in addition to collection and transportation fee for appliances with CFCs. Total fee for a CFC-containing appliance is $45.

Appliance retailers normally accept an appliance only when it is the unit that is replaced by the newly delivered appliance. Their collection and transportation costs are typically built into the cost of the new appliance. Special programs are funded by other sources. For example, SMUD's special program is funded with money saved from not having to develop new energy supplies.

Appliance processing increases the cost of system operation. This increased cost, as previously discussed, is generally borne by appliance generators in the form of an additional fee levied by appliance collectors. Based on survey results, the additional fee for appliances which require processing (including refrigerators, freezers, and air conditioners under the current system) averages $25.00 per unit. If the collector is not also a processor and, thus, does not use this additional fee to process the appliance, the collector procures this additional fee to cover expenses (tipping or drop-off fee) at a processing facility. Processing expenses include labor and equipment for properly evacuating CFCs, removing the compressor motor, draining the compressor motor oil, disposing of the drained oil, and preparing the processed appliance for shipment. Some programs also remove capacitors that are suspected of containing PCBs; capacitor removal, however, is not common in the current system.

The estimated total cost for the current system operation (approximately $86.58 million in 1991), as presented in Table 4.1, assumes that those appliances requiring processing were properly processed (not including the removal of PCB-containing capacitors).

4.2.4 AB 1760's Effects on the Existing Management System

AB 1760 mandates that all materials requiring special handling be removed from appliances prior to crushing for transport or transferring to a baler or shredder for recycling. This mandate is expected to alter the economics of the existing management system because certain special materials that currently are not required to be removed will have to be removed beginning January 1, 1994, if the appliance is to be recycled. Appliances which have PCB-containing capacitors are the most likely to be affected because the current system does not provide for the removal of these capacitors. The effects discussed in this section are based on the assumption that discarded appliances will be diverted from disposal and managed in compliance with the requirements of AB 1760.

PCB-containing capacitors and ballasts found in some types of pre-1978 appliances are not currently removed prior to recycling or disposal. AB 1760 requires removal of PCB-containing capacitors and ballasts effective January 1994. Consequently, they will become a hazardous waste and will have to be managed appropriately. Under state regulations, PCBs above 5 parts per million (ppm) must be incinerated. PCB contained in capacitors is assumed to be above this threshold.

Currently, CFC-containing appliances (primarily refrigerators and freezers) comprise the majority of appliances that are processed. The mandate to remove PCB-containing capacitors may require that all pre-1978 appliances be processed, thereby substantially increasing appliance processor expenses. Therefore, for purposes of this study, cost estimates assume that all pre-1978 appliances (which are 25 percent of total appliance discards) contain PCB-containing capacitors. The requirement would apply to all pre-1978 appliances unless specific information was available on the makes and models of appliances that were manufactured with PCB-containing capacitors. This information is not currently available. Air conditioners and microwave ovens manufactured before 1978 are suspected of having most of the PCB-containing capacitors (approximately 90 percent) (Ref. 4) that enter the discarded major appliance waste stream because these appliances

commonly used metal-shelled running capacitors.

Disposal costs for PCB-containing capacitors will be a substantial processor expense.

The need to process appliances to remove PCB-containing capacitors and ballasts is expected to decrease significantly at the end of the decade because the majority of such appliances will have reached the end of the 20-year appliance life span. However, some appliances manufactured in 1978 and for a short time afterward may still have PCB-containing capacitors since appliance manufacturers were permitted to place them in appliances after the ban in order to use their inventories of PCB-containing capacitors.

Processing CFC-containing appliances (refrigerators, freezers, air conditioners) is not expected to be significantly affected by the requirements of AB 1760. Based on site visits and survey results, a large percentage of CFC-containing appliances are currently processed in accordance with the requirements of the Clean Air Act. AB 1760 may not affect those appliances that are currently being improperly managed since there is no requirement in AB 1760 for collectors and recyclers who handle CFC- and PCB-containing appliances to verify that the units were processed. Enforcement of the requirement for CFC evacuation is currently available only through the Clean Air Act.

4.2.5 Estimated Costs of AB 1760

Processing and disposal of PCB-containing capacitors present the major new costs to the existing appliance management system. The estimated cost of system operation, (approximately $11 million in 1994), as presented in Table 4.2, is based on the number of pre-1978 appliances that will be generated during a given year (see Chapter 2). Fees charged to appliance generators for handling PCB-containing capacitors cannot be used as a basis for this cost estimate since, through the survey, no evidence was found of specific fees for appliances holding PCB-containing capacitors. Since the expected life span of appliances averages 20 years, appliances with PCB-containing capacitors are not expected to be generated after 1998. The estimated cost shown in Table 4.2 for processing PCB-containing capacitors is assumed to be borne by appliance generators, given current funding sources, in the form of a processing fee.

It is estimated that 25 percent of the appliances (845,380 units) generated for disposal in California in 1991 were manufactured before 1978 and, therefore, may have PCB-containing capacitors. However, only approximately 25 percent of pre-1978 appliances (211,345) are likely to have PCB-containing capacitors (or ballasts). The majority of the pre-1978 appliances with PCB-containing capacitors are air conditioners, furnaces, and microwave ovens. The 1991 generation rates are used to estimate the number and cost of handling appliances with PCB-containing capacitors in the year 1994, when the processing requirements of AB 1760 become effective, since 1994 generation rates are not known.

Processor expenses to remove and prepare PCB-containing capacitors for disposal can be estimated for appliances that will be recycled based on labor costs and time to remove capacitors from appliances. Assuming that it takes 15 minutes to process an appliance for capacitor removal at $20.00 per hour for labor (including benefits, fringe, equipment, training, supplies), annual costs for appliances holding PCB-containing capacitors is estimated at $4,226,900 ($5.00 per appliance) assuming all pre-1978 appliances that are generated are processed. PCB-containing capacitors and ballasts removed from appliances must be managed as a hazardous waste. PCB wastes are typically incinerated at a Class I hazardous waste facility. The cost to incinerate a 55-gallon barrel of PCB-containing capacitors is approximately $2.00 per pound including transportation to an off-site facility. Because

Table 4.2
Estimated Cost of System Operation
in 1994 (1)

System Component	Unit Cost (2)	Number Discarded (3)	Number Processed (4)	Total Cost
Collection and Transportation (5)	$20	3,381,520		$67,630,400
Processing CFC Recovery (6)	$25		758,042	$18,951,050
PCB Removal (7)	$13		845,380	$10,989,940
Total				**$97,610,280**

1. 1994 is designated since the requirements of AB 1760 become effective January 1, 1994.
2. Based on an average collector fee of $20 which is commonly borne by appliance generators. Fees can vary substantially, and are often less in rural areas.
3. Based on total number of appliances estimated to have been discarded in 1991 since 1994 appliance discard estimate is not available (see Table 2.4).
4. Assumes 100% of refrigeration units discarded in 1991 are processed, including refrigerators, freezers, and air conditioners, which is a portion of the total number discarded (see Table 2.4). Assumes that pre-1978 appliances (which are 25% of total discards) contain PCB-containing capacitors and other materials. Assumes 100% of PCB-containing appliances are processed (see Table 2.4).
5. Includes collection, transportation to a processor, and then to a feeder.
6. Includes CFC evacuation, compressor motor removal and draining, and compressor motor oil management (disposal). Processing fee is in addition to collection and transportation fee for appliances with CFCs. Total fee for a CFC-containing appliance is $45.
7. Includes removal of PCB-containing capacitors (and ballasts) from pre-1978 appliances. Processing fee is in addition to other applicable fees. Total fee for a PCB-containing appliance is $33. If the appliance also contains CFCs, the total fee is $58.

California does not have a commercial incinerator, all PCB-containing capacitors would be sent out of state. A 55-gallon barrel is assumed to weigh 400 pounds and hold 100 capacitors (4 pounds per capacitor). Disposal costs are, therefore, approximately $8.00 per capacitor. (For ease of calculation, disposal for PCB-containing capacitors generated in 1991 are estimated at $6,763,040 annually.

As shown in Table 4.2, processing and capacitor disposal costs are estimated at about $11 million annually. This estimate does not include additional collection and transportation costs that may be incurred in order to separate and transport PCB-containing capacitor appliances to processing facilities. Processing and capacitor disposal costs are expected to decrease annually until 1998 because the number of appliances generated that have PCB-containing capacitors is expected to decrease. After 1998, only very few appliances holding PCB-containing capacitors are anticipated to be generated.

Provided that collectors and processors are able to charge fees (or collect reimbursement) for their services that cover all costs and a healthy market remains for scrap metal, appliance recycling rates are expected to increase because of AB 1760's disposal ban. If collectors and processors are limited in the fee amount that can be charged (in order to prevent increased illegal disposal), some other funding method to cover their expenses would have to be available to maintain an increased appliance recycling rate.

4.3 Vehicles

This section discusses the current vehicle management system expenses and funding, and estimates the cost of system operation. Expenses are incurred at each step in the system.

This section also estimates the cost on the existing system of coming into compliance with the requirements of AB 1760 and discusses potential effects on recycling.

4.3.1 System Expenses

The existing management system for discarded vehicles incurs expenses associated with the collection and transportation, processing, and shredding of vehicles, and disposal of fluff andother residues. Expenses are realized from the point of collection to the point at which the scrap metal is delivered to market. Figure 3.2 summarizes the existing vehicle management system by identifying the point of collection, the scrap metal market, and the stages in between.

Vehicle collectors, primarily vehicle dismantlers, incur expenses for the collection and transportation of vehicles. Collection and transportation expenses for vehicle dismantlers begin at the point of collection and include transportation to their facility, processing (draining of fluids, fluid disposal, CFC recovery, battery, tire and fuel tank removal), and transportation to a feeder. Feeders, in a manner similar to the major appliance management system, incur transportation expenses from delivering appliances to a metal shredding facility and miscellaneous expenses associated with receiving vehicles, storing them, and preparing them for delivery to the metal shredding facility. Metal shredding facilities incur transportation expenses for delivering scrap metal to market and miscellaneous expenses associated with receiving the vehicles, shredding, and separating fluff for disposal. Metal shredding facilities also incur expenses for transporting and disposing of the fluff at a waste management facility.

4.3.2 System Funding

The existing system is funded by revenues from the sale of recyclable materials, primarily scrap metal. Revenues from the sale of recovered materials are used to cover salvage yard and auto dismantler, feeder, and metal shredding facility expenses. Shredders currently receive an average of $80.00 per ton for mixed scrap metal and upwards of $120.00 per ton for metal exclusively from vehicles. Shredders use this revenue to pay for their costs of operation including the purchase of scrap from feeders and the disposal of fluff. Shredders will pay feeders between $32.00 and $70.00 per ton for scrap. Feeders use this revenue for expenses and the purchase of vehicles from salvage yards and auto dismantlers. Feeders will pay up to $30.00 per ton for vehicles that have not been dismantled, and up to $50.00 per ton for vehicles that have been.

Vehicle dismantlers also receive limited revenue from the sale of recovered CFCs. The market value of recovered CFCs, as discussed in Section 4.2 for major appliances, depends on the quality and quantity of recovered CFCs and is between $0.65 and $1.00 per pound. This price is expected to rise to $4.00-7.00 per pound by 1995 (Ref. 2). Many vehicles entering vehicle dismantlers have been in accidents which have resulted in the release of CFCs from air conditioner refrigeration units. Therefore, revenue from recovered CFCs is not a major factor in the vehicle management system.

4.3.3 Estimated Cost of System Operation

The current management system for vehicles, unlike appliances, does not present a cost to vehicle generators. Revenues cover all system expenses. Vehicle generators do not contribute funds to help maintain the system. In fact, vehicle generators are usually paid a minimum of $100.00 for vehicles depending on the type, make and condition. Substantially more is paid for vehicles in good condition or with a significant amount of recoverable parts.

4.3.4 AB 1760's Effects on the Existing Management System

As discussed in Section 4.2, AB 1760 mandates that all materials that require special handling be removed from appliances prior to crushing for transport or transferring to a baler or shredder for recycling. This mandate is expected to affect the economics of the existing management system because intact sodium azide canisters contained in air bags are required to be removed. Generally, vehicle dismantlers currently remove only fluids, CFCs, batteries, tires, and gas tanks before the vehicles are crushed or baled.

Air bag systems with sodium azide canisters, when removed from automobiles, are sometimes sold to vehicle repair businesses for reuse in cars. Survey results indicate that very few discarded automobiles contain air bags and that vehicle dismantlers are not currently removing intact air bag systems from the automobiles that contain them.

4.3.5 Estimated Costs of AB 1760

If required, removal or activation of intact air bag systems from automobiles will be a new expense for vehicle dismantlers. However, this process is not anticipated to impose a cost to the current management system or automobile generator because of the high value of discarded vehicles and reused air bag systems, and the simplicity of either activating the air bag or removing the entire system. Intact air bags containing sodium azide canisters that have been removed from vehicles at a dismantler may bring a price up to $800 (one-half to two-thirds of the cost of a new air bag system) (Ref. 5). For the next several years until the supply of intact air bag systems exceeds demand for reuse, these prices are expected to remain high. Intact air bags are sold to the general public and auto body shops. The revenue from the sale of the air bags will cover the expenses associated with the air bag removal, including labor, training, and equipment.

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CHAPTER FIVE

PUBLIC HEALTH AND ENVIRONMENTAL HAZARDS ASSOCIATED WITH METALLIC DISCARDS

5.1 Overview

Management of certain metallic discards has come under scrutiny with regard to worker and equipment safety and environmental protection. The focus has been twofold: 1) on components of metallic products containing special materials identified as problematic and 2) on new products for which the hazards are comparatively unknown.

Three of these special materials are sodium azide, CFCs, and PCBs. Sodium azide is contained within vehicular air bags, CFCs are present within refrigeration appliances, and PCBs are found within the capacitors of certain major appliances. Other special materials include ammonia and sulfur dioxide refrigerants, used automotive oil, lead frequently found in vehicle gas tanks, and mercury (in switches within certain appliances), cadmium, compressor oil, and other chemicals and wastes contained within discarded appliances.

CFCs and PCBs present well recognized environmental hazards which require special handling and final management. Proper collection and transport are the most important phases of the recycling process since it is during these phases that most of the uncontrolled releases of CFCs and PCBs occur. The recovery of CFCs from the refrigeration coils on an appliance requires proper equipment; however, special attention is also required to minimize cross-contamination between the various types of CFCs present with various refrigeration appliances. PCB liquids are typically located within fully-enclosed metal capacitors within an appliance. An intact capacitor can be removed from the appliance with a hand or power tool without resulting in any exposure to the worker.

Although the hazards associated with sodium azide are defined, the hazards associated with activating sodium azide air bags in auto dismantling and shredding operations are not. At present, the number of air bags within cars that enter the recycling stream is relatively small; however, the number will continue to increase because passive restraint systems are required in all cars since the 1990 model year. Due to the small numbers of automobiles entering shredding operations with intact air bags, little information has been developed on the hazards associated with sodium azide in shredding operations. Information that has been published has been contradictory in nature. Contradictory or insufficient information exists on the explosion potential for sodium azide canisters in shredding equipment, the effects of sodium azide residue in shredder fluff and the hazards associated with the removal and disposal of inactivated air bag systems. Due to these uncertainties, further study should be conducted.

Other special materials as they are found within metallic discards present comparatively lower risks to public health and the environment. These chemicals either have a low potential for release during handling and processing (i.e., mercury-containing switches in some refrigerators and washing machines), are routinely managed properly (i.e., used oil), or are found in very small quantities or very infrequently in metallic discards (i.e., ammonia, sulfur dioxide as refrigerant in appliances, cadmium contained in certain paints used for appliances and cars). Some of these special

materials are not practical or necessary to remove before being hauled or shredded.

This chapter focuses on the general public health and environmental hazards associated with sodium azide, CFCs and PCBs. The discussion includes the handling (i.e., collection, transport, and storage) of the metallic discard in which the chemicals are found, the processing system for the metallic discard, and the recycling and reclaiming procedures used. The methods to alleviate the hazards associated with the chemicals are also discussed for each of these handling procedures. Additionally, other chemicals contained within metallic discards and their associated hazards are discussed briefly.

5.2 Sodium Azide

Automatic restraints, consisting of either manual safety belts combined with an air bag or automatic motorized safety belts, have been required in U.S.-manufactured automobiles since the 1990 model year by the Department of Transportation's (DOT's) National Highway Traffic Safety Administration (NHTSA) (Ref. 1). The MVMA projected that as many as three to four million U.S.-manufactured cars were equipped with air bags in 1990. This is a substantial increase from the approximately 400,000 air bags installed in 1989 model cars. As discussed in Chapter 3, by 1996 the number of cars manufactured with air bags is projected to rise to 30 million; by 1998 all cars manufactured must be equipped with air bags. It is this increase in the use of vehicular air bags containing sodium azide and their subsequent introduction into the scrap metal recycling stream that has prompted environmental and public health concerns during automobile handling, processing, and recycling.

The major components of an air bag, also referred to as an inflatable or passive restraint system, are the inflator unit and the air bag module. The inflator unit refers to the metal housing (aluminum or steel) that encases the gas generant and an oxidizing agent; the air bag module unit refers to the complete assembly, consisting of an inflator unit, a steel and plastic case, and the cushion or folded air bag which is made of nylon or dacron. This assembly is part of a system mounted in the hub of the steering wheel and either underneath or above the glove compartment of an automobile. It is activated when the front of the automobile is subjected to a predetermined level of impact. The front bumper houses one or more sensors which detect an impact (Refs. 2, 3, 4, and 1).

Approximately 140 grams of sodium azide blended with an oxidizer, such as cupric oxide or ferric oxide, is the gas generant used in the inflator unit (Refs. 5 and 6). It is present as a pressed solid disc or in pelletized form inside a hermetically sealed steel or aluminum housing. When an air bag is activated in a vehicular impact, the sodium azide is ignited by an electrical impulse and converted to a specific amount of nontoxic nitrogen gas which inflates the air bag (Refs. 4 and 1). As opposed to exploding, the generant undergoes a very rapid, controlled burning or combustion process, referred to as deflagration, which generates the nitrogen gas (Refs. 6, 7, and 4).

5.2.1 Overview of Public Health and Environmental Hazards

Sodium azide, NaN_3, is a poisonous white crystalline material. Neither sodium azide by itself nor the gas generants containing it are explosive; it can only form an explosive under special conditions where it reacts with lead or copper salts (Ref. 7). A predominant characteristic of sodium azide is that it is not a persistent environmental threat; it decomposes rapidly in the soil. This process is accelerated by moisture, soil acidity, and sunlight (Ref. 7).

Acute toxicity effects are those which occur within 24 hours from inhalation or ingestion of a toxic compound. The warning symptoms of exposure to low concentrations of azides are easily recognized, and, therefore, corrective action can be taken by the individual exposed

before dangerous concentrations build up in the environment. Some of the side effects observed in humans after inhalation of hydrogen azide (hydrazoic acid) and sodium azide include flushing of the facial skin exposed to vapors, drop in blood pressure, dizziness, fatigue, nausea, unconsciousness, and swelling of the mucous membranes in the nostrils. Most of the accounts of acute exposure to hydrazoic acid and sodium azide indicate that these symptoms disappear within a few hours (Ref. 7).

Chronic toxicity effects are those which may be the result of prolonged exposure to a toxic compound at subacute levels and may take several years to become apparent. It is unknown if repeated exposure of workers to low levels of azide produces chronic effects, but it is conceivable that repeated stimulation of the heart accompanied by weakening and dilation of major blood vessels could lead to circulation problems in later life. In one study, some of the workers at a factory had been exposed to hydrogen azide vapor concentrations ranging from 0.3 to 3.9 parts per million (ppm) by volume for up to 16 years. Apart from the acute symptoms, the workers had not noted any adverse effects upon their health as a result of their occupation. Detailed physical examinations revealed no evidence of any pathological condition which could be correlated in any way with employment in the lead azide plant (Ref. 7).

In addition, azides have not shown indications of being mutagenic, teratogenic, or carcinogenic in animals or humans (Refs. 7 and 8).

The American Conference of Governmental Industrial Hygienists (ACGIH) has established a threshold limit value (TLV) for sodium azide of 0.29 milligrams per cubic meter (mg/m^3). The TLV for a normal 8-hour workday or 40-hour work week is the concentration to which nearly all workers may be repeatedly exposed, day after day, without adverse effect. This level is also considered a ceiling limit; therefore, the TLV should not be exceeded at any time and short-time exposures to higher concentrations may not be compensated by longer exposure to levels below the TLV (Refs. 7 and 9).

Azide does not persist in the soil. The literature reviewed notes that azide would be more effective in many of its herbicidal and bacteriocidal applications if it could be made to last longer in the soil (Ref. 7). The SAE states, in a report published in 1979, that sodium azide (disperses rapidly and) is relatively short-lived when exposed to the environment (Ref. 10). In addition, any residual sodium azide will begin to decompose with a half-life of approximately 3.5 days (Ref. 7).

The material safety data sheets (MSDSs) accompanying various air bag inflator/module products indicate that no manufacturer is aware of any particular health or environmental risks when the inflator/module units are subjected to normal conditions. One MSDS explicitly states that "no special precautions are necessary for handling a sealed inflator" (Ref. 4). While there may be no hazard with handling a sealed inflator, automobile dismantlers are removing intact inflators for resale values. According to the TRW MSDS, undeployed units should not be reclaimed. During the use or processing of sodium azide, chemical protective goggles are recommended where there is a possibility of eye contact with the propellant, protective gloves should be worn to prevent skin irritation and or absorption, and if vapors, fumes, or dusts are generated during the processing or use, local exhaust ventilation should be provided to maintain exposures below the established ACGIH TLVs (Ref. 11). Therefore, these precautions should be provided to all individuals with the potential for sodium azide exposure.

5.2.2 Handling

In general, cars can be driven or towed to the scrap yard with the air bag unit either activated or intact. Under any of these scenarios, the collection, transport, and storage of the automobiles prior to shredding poses minimal public health and environmental hazards. If the

air bag unit is intact, the public health and environmental hazards are the same as for any other operating car which is equipped with an air bag unit. If the air bag unit has been activated, the sodium azide is destroyed.

5.2.3 Processing and Recycling

The primary pieces of equipment involved in processing and recycling auto bodies are the shredder, baler, and shear. The shredder reduces a vehicle hulk through a series of hammers into fist-size pieces so that nonferrous metals can be recovered and the purity of the recovered ferrous metal can be maximized. The baler, or baling press, compresses vehicles and other recyclables into a compact bundle. The shear reduces large pieces of scrap into a designated size for better manageability. Although the baler and the shear are used to process cars, the majority of vehicles are recycled by shredders (Ref. 2).

SAE has published a recommended practice for deploying air bags prior to automobile reclamation or processing. Deployment of the air bags prior to reclamation is also recommended by ISRI (Ref. 2). The procedure was developed to provide a uniform method which does not require significant technical expertise, is easy to operate, and is readily available to be used by vehicle dismantlers or shredders to deploy air bags prior to automobile recycling (Ref. 17).

In 1979, the U.S. Department of Commerce summarized the chemistry and hazard aspects of sodium azide. At that time, they anticipated that it was unlikely that someone would remove the cartridge containing the sodium azide, primarily because they are not readily accessible and are permanently sealed in the inflator housing (Ref. 7). However, according to one (1,500 cars per month) scrap metal shredder operator located in the Minneapolis/St. Paul metropolitan area, most intact air bag systems are removed prior to crushing because of their reuse value in automobile repair.

In 1979, it was also believed that, based on the information on sodium azide toxicity, the vehicle shredding and metal recycling operations at that time would be incapable of coping with the hazard posed by intact inflators if all cars were equipped with air bags. It was recommended that a method be sought whereby it is easy for a dismantler employee to deploy air bag inflators in cars prior to shredding and yet maintain a high level of difficulty for unwanted access to the inflator ignition circuit (Ref. 7).

According to one fate study tracing sodium azide through the shredding process performed in the late 1970s, 60 percent of the sodium azide is deployed, 30 percent remains in the ferrous product, 3 percent remains in the nonferrous product, and 7 percent remains in the fluff and scrubber/sump (Ref. 7).

Although the activation of the sodium azide in the shredding process may not be considered a significant problem, the random initiation of a fire or explosion in combination with other combustibles in the system (lead or copper salts) might be a concern depending on the size of the shredder system. ISRI expresses concern for intact air bags at shredders, since there is a risk of ignition (Ref. 2). However, as noted previously, because of the unique circumstances and chemical reactions necessary to cause an explosion, the probability of such accidents is low. Nevertheless, according to a scrap metal shredder operator, explosion of sodium azide canisters during shredding of the cars, rather than prior to shredding, does not cause any problem for equipment handling although this may be a function of the size of the equipment used. Large shredding units may be more capable of controlling any air bag explosions that may occur because of the size of the shredder.

Solid sodium azide may be contained within sections of fragmented inflators comprised of both ferrous and nonferrous products. The exposure to personnel from the ferrous portions is minimal; the ferrous product is ultimately

introduced into a melt furnace where residual sodium azide will be consumed (Ref. 7). The exposure to personnel from the nonferrous portions is more uncertain. In small scrap metal operations, if personnel are required to hand sort nonferrous metals they may be exposed to sodium azide (Ref. 7). When an air blower or cyclone is used to remove the nonferrous metals, ISRI expresses concern for air borne contaminants (Ref. 2). Sodium azide dust from damaged units which are cut open but do not ignite may also be a hazard in the control room of the shredder (Ref. 7).

NHTSA has stated that environmental risks from sodium azide releases during automobile recycling and shredding operations would be either minimal or precluded by proper management safeguards:

"High concentrations of sodium azide are not likely to accumulate in the air or in landfills because the chemical will decompose completely within several weeks when exposed to the natural environment. In addition, in acid solution, sodium azide will hydrolyze to form hydrazoic acid, which will then either vaporize, auto-oxidize, or be broken down organically into harmless substances such as water vapor or nitrogen. Thus, any sodium azide released by improper handling during scrap yard operations is not likely to contaminate the local drinking water because sodium azide in water naturally decomposes by organic processes. In summary, although some concerns may be associated with the disposal of sodium azide, these concerns are being solved by proper management. Safeguards already in place as a result of existing Occupational Safety and Health Administration (OSHA) and U.S. EPA regulations are expected to control the exposure of scrap yard workers to sodium azide." (Ref. 4)

In a study commissioned by MVMA, it was noted that small manually charged cupola-type furnaces used by scrap customers in iron and steel-making would be particularly susceptible to adverse effects when charge materials contain intact air bags (Ref. 10). Researchers at A.D. Little, Inc., referencing the MVMA study, could not identify events in the life cycle of air bags that could be classified as imminently dangerous to humans or the environment. But they noted that care would be needed in processing scrapped vehicles. They mentioned the possibility of an intact inflator being fed into a metal melting furnace, which could, in certain circumstances, result in serious injury to the furnace operator, particularly in small, hand-fed systems (Ref. 13). Neither of these studies indicate that there had been documented occurrences of injuries or equipment damage.

According to SAE and ISRI, the preferred approach for managing intact air bags is deployment or activation. Using their recommended procedure, first, all cars entering the dismantling/recycling process should be inspected to see if the bags are deployed. Deployed air bags would hang conspicuously from the steering wheel hub and the dashboard. Even if someone had torn the bag off to use the fabric for other purposes, the hole left in the steering wheel and the dash would be apparent. Second, if the bag had not been deployed, a designated circuit on the car could be energized with a pulse of electricity from a portable lightweight dry-cell battery to inflate the air bag (Ref. 7). For this preferred method to work, the following conditions must be met:

1) The energizing circuit must be easily accessible;
2) The energizing terminals must be accessible to the dismantling yard employee; and
3) The firing circuit must be undamaged (Ref. 7).

Another option is removing the sodium azide canister; although this is not the preferred approach. Under California hazardous waste regulations, intact discarded sodium azide canisters may be considered to be a hazardous waste if they exhibit hazardous characteristics (e.g., reactivity) and should not be disposed of in a solid waste landfill. The propellant should

be disposed of by incineration under carefully controlled conditions and some incineration facilities may not accept azide-containing materials (Ref. 11).

5.2.4 Reclaiming

While the car manufacturing industry does not recommend reuse of intact air bag canisters, reuse is practiced by repair shops.

5.3 Chlorofluorocarbons in Appliances and Vehicles

Effective July 1, 1992, Section 608 of the Clean Air Act prohibits individuals from knowingly venting ozone-depleting compounds used as refrigerants into the atmosphere while maintaining, servicing, repairing, or disposing air-conditioning or refrigeration equipment (Ref. 14). Ozone-depleting compounds include CFCs and HCFCs.

There are approximately 153 million home refrigerators and freezers in use nationally with approximately 9 million units produced each year. Each has a useful lifetime of about 20 years, at which time it is discarded (Ref. 15). The refrigerant in the refrigeration cycle of most home refrigerators and freezers is hermetically sealed within a system of coils. Consequently, aside from servicing emissions, most releases occur when appliances are discarded. These releases amount to approximately one percent of all effective CFC emissions nationally (Ref. 15). There are an estimated 6,000 metric tons or 13 million pounds of refrigerant available for recycling from refrigerators and freezers upon discard (Ref. 15).

Motor vehicles are defined as light trucks, vans and automobiles and there are an estimated 119 million motor vehicle air conditioners on the road nationally. Most of them use CFC-12; some now use HFC-134a. Motor vehicle air conditioners have the highest leakage rate of refrigerant charge of any equipment type and only 40 percent contain a refrigerant charge upon discard. With an original charge of two to four pounds of refrigerant per motor vehicle, this represents an estimated 9,000 metric tons or 20 million pounds available for recycling upon discard.

There are approximately 133 million residential air-conditioning units in use. The refrigerant charge in each unit is four to seven pounds. There are an estimated 1,600 metric tons or 3.5 million pounds available for recycling from air conditioners at disposal (Ref. 15).

There are many different CFCs and HCFCs that act in specific ways for various applications; each is identified by the number following the letters: CFC, HCFC, or R (for refrigerant). The CFCs typically found in appliances include CFC-12 in freezers, dehumidifiers, refrigerators and motor vehicle air conditioners; CFC-22 in air conditioners; and CFC-11 as the blowing agent in insulation. Some older refrigerators contain C-114 and some dehumidifiers contain CFC-500 (Ref. 16). CFC compounds consist of chlorine, fluorine, and carbon, and do not exist naturally in the environment (Ref. 15).

5.3.1 Overview of Public Health and Environmental Hazards

The public health and environmental hazards associated with release of CFCs remain the same throughout the various steps in appliance and vehicle recycling: handling (i.e., collection, storage, and transport); processing; and recycling and reclaiming. Therefore, these hazards will be presented only in this section. Additionally, CFCs do not pose public health concerns, other than those which develop as a result of its environmental impacts. Consequently, only the environmental impacts are discussed.

The release of CFCs to the atmosphere results in the depletion of stratospheric ozone. Ozone is a naturally occurring gas that is distributed throughout the atmosphere, but is especially concentrated in the stratosphere, 9 to 30 miles

above the earth's surface. Its most important function is as an absorber of ultraviolet (UV) radiation. When exposed to UV light, CFCs are broken up in the stratosphere which frees the chlorine. Free chlorine atoms act to catalyze a set of reactions resulting in the depletion of ozone. Subsequently, the depletion of stratospheric ozone allows increased amounts of UV radiation to penetrate to the surface of the earth (Ref. 15).

Certain types of UV radiation can damage human DNA. Increased penetration of UV radiation to the surface of the earth is expected to result in increased incidence of skin cancer; each one percent reduction in the total amount of ozone from the top of the stratosphere to the surface of the earth is thought to result in about a two to six percent increase in the incidence of skin cancer (Ref. 15). Other important health effects of ozone depletion include an increase in human skin cancer and cataract cases, suppression of the human immune system, a decrease in crop yields and damage to marine phytoplankton, and an increase in the global greenhouse effect (Ref. 16).

In 1989, only one chemical substitute having similar physical properties had been identified for CFC-12. This substitute is a blend of HCFC-22 and HCFC-142b; however, since HCFC-142b is flammable, safety concerns may preclude its use in home refrigeration (Ref. 15). HFC-134a is also available to replace CFC-12; it does not contain chlorine, is nonflammable, essentially nontoxic, and readily available (Ref. 17).

5.3.2 Handling

The collection, transport, and storage of appliances present the greatest potential for the release of CFCs to the environment. Minimal hazards are associated with handling vehicles.

The greatest potential for release of CFCs to the environment during collection and transport of appliances is from the rupturing of the coils during loading, unloading, and transport. The coils are often exposed at the back of the appliance and may be punctured by equipment or crushed or cracked through rough handling, dropping of the appliance, shifting during transport, or damage from loading equipment. In general, the collection systems designed for worker safety are less likely to result in routine releases due to improper handling or transport. Since the method of loading and unloading appliances from vehicles also affects the chances of a release, loading and unloading using dollies, power-lift gates, or conveyors are preferable handling methods. In addition, these methods are labor-saving devices. Dumping appliances onto a concrete surface or lifting with a clam, a forklift, or a front-end loader can puncture the coils and, as a result, cause a release.

The type of transport vehicle can also be a factor in minimizing releases. Appliances should be blocked or tied down to prevent shifting and damage. In general, closed-body vehicles are safer than open-body trucks. Roll-off boxes should only be used if they are loaded like a semitrailer. Training collection workers may also reduce the potential for release by identifying appliances that contain CFCs and taking extra precautions with those units.

The collection and transport of automobiles are done using tow trucks or wreckers and car carriers. With careful use of this equipment, the damage to the motor vehicle air conditioner should be kept to a minimum.

Between the collection or drop-off of appliances and vehicles and transfer to a processing facility or metal recycler, they may be stored until cost-effective transportation can be achieved. Storage most often takes place at the point of collection or drop-off such as at a solid waste facility, feeder, and vehicle dismantler (Ref. 16). There appears to be no indication of ongoing problems with storage of the discarded appliances or vehicles unless there is damage to the unit which could lead to the release of CFCs.

5.3.3 Processing

Under EPA's planned proposal (see Chapter 6), equipment that typically enters the waste stream with the CFC charge intact (which includes household refrigerators and freezers, air conditioners and vehicles) would be subject to special safe disposal requirements. Under these requirements, the final person in the disposal chain, such as a metal shredder, would be responsible for ensuring that refrigerant had been recovered from equipment before the final disposal of the equipment. Persons "upstream" could also remove the refrigerant as long as they provided documentation of its removal to the final person (Ref. 14 and 15).

Processing discarded appliances and vehicles refers to recovering CFCs prior to delivery to recyclers such as metal shredders. The ARI Standard 740-91 defines recovery as removing refrigerant in any condition from a system and storing it in an external container without necessarily testing or processing it in any way. Recovery is more complicated for appliances than for automotive air conditioning systems since several refrigerants are used in the various appliances and these refrigerants should not be mixed together (Ref. 18). Most appliances containing CFCs have a label which identifies the type of refrigerant used within its system. Most vehicle air conditioners contain CFC-12.

As discussed in Chapter 3, refrigerants can be readily evacuated and recovered from appliances by repair services and processors. In general, the equipment used for household appliances was initially developed to service mobile air conditioners and has been used for many years. Recovery typically takes place by tapping into the refrigeration coils either with a valve or other device which, in turn, is hooked up to the recycling equipment. A manifold system can be used to recover gas from several appliances at a single time (Ref. 16). Recovered CFCs are filtered to remove contaminants such as particulates and oils but are not capable of reclaiming CFCs to ARI 700-88 standards (the purity levels equivalent to new CFCs). Nevertheless, most can recycle to a purity level that may not be harmful to an appliance. The same system can also be used for different types of CFCs as long as the system is adequately purged prior to introduction of the different CFCs and different storage containers are used so that cross-contamination does not occur. Some appliance manufacturers contend that using recycled CFCs that do not meet ARI 700-88 standards may be harmful to an appliance and the warranty may be voided.

Most vehicles are brought to a vehicle dismantler where parts are removed. Most CFC recovery could be done at this point. Recovery is done by connecting the recovery unit hoses to the air-conditioning system's service ports. The refrigerant is passed through filters to remove acid, oil and particulates. The refrigerant can be removed from and returned to mobile air conditioning systems if it meets SAE's J-1991 standard of purity which includes limits for moisture, oil and air.

Removal of the CFCs is usually conducted in a building or a mobile processing facility (Ref. 10). The CFCs are collected in US DOT-approved cylinders. Users of this type of equipment are required to send the recovered refrigerant from appliances to a reclaimer to have the CFCs processed back to ARI 700-88 standards.

5.3.4 Recycling and Reclaiming

ARI Standard 740-91 defines recycling and reclaiming as follows:

- Recycle: To clean refrigerant for reuse by oil separation and single or multiple passes through moisture absorption devices, such as replaceable core filter-driers.

- Reclaim: To process refrigerant to new specifications, by means which may include distillation. This will require a chemical analysis of the refrigerant to determine

whether the appropriate process specifications have been met to allow the refrigerants to be resold for new or existing applications (Ref. 3).

Equipment is available to recycle the refrigerant CFCs although this practice is limited. Reclamation of recovered CFCs to ARI 700 is hindered by a lack of markets for recovered CFCs. This is partially due to the current price and availability of new CFCs; however, as the production of new CFCs decreases and taxes increase, the markets for recovered CFCs should also increase.

Purity standards were established to define the limits of contaminants that would be allowed in reclaimed CFCs. Due to the various refrigerants used within appliances, contamination as a result of mixing various CFCs is a problem. In most cases, different types of refrigerants cannot be mixed, and if they are, processes are not available to separate them. Recovered CFCs that are too contaminated to be reclaimed to purity standards are generally incinerated.

5.4 Polychlorinated Biphenyls

PCBs are produced by attaching one or more chlorine atoms to a biphenyl molecule. They are one of the most stable organic compounds known. As such, their properties made them useful as dielectric (nonconducting) fluid in various types of electrical equipment and heat transfer systems. But this same stability has also caused the disposal problems associated with PCBs.

Prior to the 1970s, PCBs were widely used in commercial and industrial applications. Some of these applications included use in capacitors and transformers, hydraulic systems, plasticizers, carbonless copy paper, wrapping paper, printing inks, paints, resins, tires, pesticides, dust control agents, and flame retardants. The chemical and physical properties that made PCBs desirable industrial chemicals are their excellent thermal stability, their strong resistance to corrosive chemicals, their general inertness, and their fire-retardant properties. Other properties of PCBs include low solubility in water, low finite vapor pressure, and strong sorption onto soils and sediments. These same properties that make PCBs physically and chemically stable, also make them highly persistent in the environment.

The Monsanto Corporation, the sole U.S. producer of PCBs, voluntarily restricted sales to closed system applications, such as capacitors and transformers, in 1971. In 1976, Congress banned the manufacture, processing, and use of PCBs except in totally enclosed systems and Monsanto discontinued production entirely in 1978. Other European countries and Japan have initiated similar actions. The manufacture of PCBs is now prohibited in the U.S., and the EPA issued a final order requiring the removal of PCB liquids, or the transformers that contain them, from all commercial buildings.

PCBs are commonly found in transformers and small capacitors serving as a dielectric and heat transfer fluid. These transformers and capacitors may be present in household appliances, such as air conditioners and microwave ovens and furnaces; industrial equipment, such as welding units; and fluorescent light ballasts. A capacitor, consisting of two conductors separated by a dielectric, is a device for accumulating and holding a charge of electricity. Small capacitors commonly contain between 0.1 and 0.6 pounds of PCBs in the form of a dielectric fluid. A fluorescent light ballast is a device that electrically controls fluorescent light fixtures, and it may include a capacitor containing PCB.

In general, PCB-containing capacitors are in appliances that draw an electrical load. Capacitors serve two functions in appliances. There are starting capacitors and running capacitors; in general, most running capacitors placed in appliances manufactured prior to 1978 contain PCBs (Ref. 19). Typically, the running capacitors have a metal shell while the starting capacitors use an aluminum or hard plastic

Bakelite construction because of their short operating time. There can be two or three capacitors in some appliances, with weights ranging from less than 0.25 to almost 5.0 pounds per capacitor. Pre-1978 air conditioners, microwave ovens, and furnaces have been found to be the most likely appliances to hold PCB-containing capacitors (Ref. 20). As stated in an October 20, 1988 EPA letter to interested state government, "we can identify room and central air conditioners, heat pumps, furnace blowers, fluorescent lighting ballasts, and microwave ovens as the only household white appliances with a significant likelihood of containing a PCB-type small capacitor. We understand that these appliances have historically represented a relatively small percentage of recycled white goods (approximately 5 percent)."

The letter continued, "we have not uncovered any evidence that PCB small capacitors were used in household clothes washers, clothes dryers, dishwashers, hot water heaters, garbage disposers, trash compactors, conventional ovens, ranges, or stoves. Although there have been suggestions that some refrigerators contain PCB small capacitors, we believe that the use of these capacitors in household refrigerators was limited. There is also evidence that some household freezers may contain PCB small capacitors."

5.4.1 Overview of Public Health and Environmental Hazards

PCBs in wildlife samples were first reported in Sweden in 1966 and later in several European countries, North America, and Japan. PCBs have been reported in water, sediments, fish, birds, and throughout the food chain including human tissue and milk. In fact, PCBs have been steadily released into the environment in many countries and are now found to be a pervasive, worldwide contaminant.

Public Health Effects

PCBs have entered the environment particularly in bodies of water where they can be consumed by lower organisms and fish and thus enter the food chain. The strong affinity for lipids or fatty tissue of PCBs contributes to their tendency to accumulate in fatty deposits and results in a magnification in the food chain.

Current information on the human health hazards associated with PCBs is varied. The EPA has determined that PCBs are toxic and persistent. PCBs, despite their low acute toxicity, have been shown to be carcinogenic in humans. Recent studies on the toxicity and carcinogenic characteristics of PCBs have minimized the long-term chronic health effects previously associated with PCBs.

PCBs may cause fetal resorption, birth defects, high offspring mortality, reproductive failure, reduced weight gain, and enlargement of the liver, kidney, and heart in test animals. Available laboratory animal studies indicate that depending on the degree of exposure, PCBs have a potential to produce tumors. Currently, epidemiological data are inadequate to confirm or negate this potential in humans. Further epidemiological research is needed to correlate human and animal data. Nevertheless, EPA finds no evidence to suggest that the animal data would not predict an oncogenic potential in humans.

PCBs can enter the body through the lungs, gastrointestinal tract, and skin. They circulate throughout the body and are stored in the body's fatty tissue. EPA finds that PCB exposure may cause negative reproductive effects and developmental toxicity in humans. Available data show that some PCBs have the ability to alter reproductive processes in mammals, sometimes even at doses that do not cause other signs of toxicity. Animal data and limited available data on humans suggest that prenatal exposure to PCBs can result in various degrees of developmental effects. Postnatal effects have

been demonstrated on immature mammals following exposure to PCBs prenatally and through lactation.

In some cases, chloracne may occur in humans exposed to PCBs. Severe cases of chloracne are painful and disfiguring, and may be persistent. Although the effects of chloracne are reversible, EPA considers these effects to be significant.

Environmental Effects

Although the use of PCBs has now been greatly curtailed in most parts of the world, considerable quantities still remain in the environment. It has been estimated that the worldwide production of PCBs since 1929 has been close to 2 million tons, of which 600,000 to 1,000,000 tons were produced in the U.S. It is also estimated that from 150,000 to 300,000 tons of PCBs were disposed in U.S. landfills, and 88,000 tons were released to the soil, sediments, water, and air. From 1,000 to 2,000 tons per year of PCBs (estimated), escaped into the atmosphere in past years from plasticized materials containing PCBs, and about 4,000 tons per year entered waterways from dumping and leakage of lubricants, hydraulic fluids, and heat transfer fluids.

Certain PCB species are among the most stable chemicals known and decompose very slowly once they are released into the environment. They remain in the environment and are taken up and stored in the fatty tissue of organisms. EPA has concluded that PCBs can be concentrated in freshwater and marine organisms. The toxic effects of PCBs on estuarine and marine phytoplankton, bacteria, and other microbes are well documented. Besides being directly toxic to aquatic species, it has been shown that natural species relationships may be disrupted due to the varying degrees of sensitivity or resistance shown among species. This could be deleterious to the ecosystem if a persistent species becomes more dominant as a result, and yet were an inferior food source for higher species.

PCBs are toxic to fish at very low exposure levels and can adversely affect their survival rate and reproductive success. The literature shows that various sublethal physiological effects on bone development and reproductive organs are attributed to exposure to PCBs. The transfer of PCBs up the food chain from phytoplankton to invertebrates, fish, and mammals can result in human exposure through consumption of PCB-containing food sources.

5.4.2 Handling

As with CFCs, the collection, transport and storage of appliances present the greatest potential for the release of PCBs to the environment and subsequent contamination. The collection, transport, and storage of appliances containing PCBs are primarily the same as for those containing CFCs; therefore, refer to Chapter 3 for a discussion of these methods.

Release of PCBs to the environment is most likely to occur during collection and transport of the appliance. Releases may happen if capacitors are ruptured during loading, unloading, and transport of the appliance. Capacitors may be punctured by equipment or crushed or cracked through rough handling, dropping of the appliance, shifting during transport, or damage from loading equipment. However, compared with CFC releases during handling, the probability of release of PCBs is low because most PCB-containing capacitors are encased in a metal shell and are located within the internal portions of the appliance.

Because the volumes of PCB are small and the acute toxicity is low, the immediate public health and environmental hazards from a release during handling are low. PCBs are relatively immobile in soils and sediments and small spills can be remediated easily. Long-term health and environmental problems may be encountered at transfer or processing points where releases are more frequent and workers are exposed over longer periods of time.

The methods to minimize the risk of release and long-term exposure of PCBs associated with handling are the same as those for CFCs. In general, the collection systems designed for worker safety are less likely to experience routine releases due to improper handling or transport. Since the method of loading and unloading appliances from vehicles also affects the chance of a release, loading and unloading using dollies, power lift gates, or conveyors are preferable handling methods. In addition, these methods are also labor-saving devices. Dumping appliances onto a concrete surface or lifting with a clam, forklift, or front-end loader can damage the capacitor and as a result cause a release.

The transport vehicle type can also be a factor in minimizing releases. Appliances should be blocked or tied down to prevent shifting and damage and closed body vehicles are generally safer than open body trucks. Training collection workers may also reduce the potential for release by identifying appliances that potentially contain PCBs and taking extra precautions with those units.

5.4.3 Processing Systems

As discussed earlier in this chapter, a capacitor is a device for accumulating and holding a charge of electricity. The primary problem with PCB-containing capacitors that have not been removed before shredding is that PCB contamination of shredder fluff is possible. As discussed in Chapter 3, residue or fluff containing 5 milligrams or more per liter (mg/L) PCBs must be disposed in a hazardous waste landfill at a much greater cost than disposal in a solid waste landfill.

Removal of PCB-containing capacitors is usually conducted in a building or a mobile processing facility. The processing area should be designed according to California Title 22 requirements with a concrete pad and spill containment curbing. Typically, appliances are disassembled using hand and power tools. The capacitor or ballast is identified, removed, and stored in a 55-gallon drum prior to transport to a hazardous waste facility. Experienced handlers of appliances are familiar with the location and characteristics of capacitors in appliances.

Proper removal and handling of small capacitors, with or without PCBs, pose very minimal environmental hazards. This is due to low acute toxicity of the PCB compounds. As long as capacitors are not leaking fluid, handling should not entail risk. Workers removing and handling capacitors should wear disposable work gloves, coveralls, disposable shoe protection, and safety glasses. Respirator protection is not necessary. California Title 22 requirements for hazardous waste handling apply. This means that removal must take place in an area designed to contain any spills (e.g., six-inch curb, impervious surface).

5.4.4 PCB Disposal

PCBs from capacitors and fluorescent light ballasts cannot be recycled or reclaimed; generally they must be incinerated at a hazardous waste facility.

5.5 Other Special Materials

Other special materials as they are found in metallic discards present relatively lower risks to public health and the environment. These special materials include lead contained within vehicle gas tanks, cadmium that may be found in some paints of older appliances and vehicles, mercury in certain switches used in refrigerators and washing machines, and ammonia and sulfur dioxide refrigerants used primarily in a few older model refrigerators and freezers. Contaminated used oil may also be found in vehicles and in appliance compressors. These chemicals either have a low potential for release during handling and processing (i.e., mercury-containing switches), are routinely managed properly (i.e., used oil), or are found in very small quantities or very infrequently in metallic discards (i.e., ammonia, sulfur dioxide as

refrigerant in appliances, cadmium contained in certain paints used for appliances and automobiles). Some of these special materials are not practical or necessary to remove before the appliances and vehicles are crushed for transport or transferred to a baler or shredder for recycling.

5.5.1 Lead

Lead, a bluish-white or gray metal typically insoluble in water, poses serious acute and chronic health effects to humans and bioaccumulates in a variety of organisms. Lead particles may be inhaled or ingested by consuming fish or other organisms. Lead is classified as a B2 carcinogen by EPA (Ref. 21).

Lead contained in some vehicle gas tanks does not present a significant human health hazard during vehicle handling, processing, or recycling. Vehicle gas tanks are removed intact by dismantlers and sold for reuse or transported to a feeder. Feeders bale gas tanks and sell them directly as scrap to steel mills or mini mills. Because gas tanks are not shredded, release of lead particles that could be inhaled by workers is unlikely.

5.5.2 Cadmium

Cadmium, a metal insoluble in water, also presents significant acute and chronic human health effects. Humans may be exposed to cadmium primarily via inhalation. EPA rates cadmium as a human carcinogen (EPA Class B1) via inhalation (Ref. 22).

As discussed, cadmium may be found in the paint (generally in some oranges and reds) of older appliances and vehicles (Ref. 23). The low concentrations of cadmium found in the paint of those discards does not present a human health or environmental hazard during handling, processing, recycling or disposal. Although cadmium may be released from paint during crushing and shredding of vehicles and appliances, the quantities and concentrations released (given that very few appliances and vehicles have cadmium-containing paint) that workers could be exposed to are very low. EPA indicated that cadmium found in shredder fluff is often above the characteristic level for hazardous wastes. However, the EPA indicated that these data are insufficient to identify appliances or vehicles as the primary source of cadmium in fluff (Ref. 24).

5.5.3 Mercury

Mercury, a silver-white metal insoluble in water, has well known acute and chronic human health effects. This chemical readily bioaccumulates in fish and other organisms (Ref. 25). Human exposure to mercury occurs via the inhalation and dermal routes. Data on human carcinogenicity are not available.

Mercury may be contained within switches in some refrigerators and washing machines. The switches, which are about one-half inch in length, serve to turn on or off lights in refrigerators and to stop washing machines when the lid is opened during operation. Very small amounts of mercury are found in these switches. A large processing facility would only generate about one-half of a 55-gallon drum in a year (Ref. 24). Because mercury switches are contained in the interior of refrigerators and washing machines, release during handling is not likely. Processing these appliances also presents only a minor hazard to workers since mercury is sealed within the switches and their proper removal (i.e., using a screwdriver to disconnect wires and remove the switch manually) would not cause a release. Intact mercury switches are often reused in appliances.

Data are not available, but shredding refrigerators and washing machines with mercury switches probably results in very low levels of mercury in shredder fluff.

5.5.4 Other Chemicals and Materials

Other chemicals or materials contained in vehicles include lead-acid batteries, tires, and used oil. These materials are currently removed by vehicle dismantlers from vehicles prior to crushing for transport or transferring to a baler or shredder for recycling. These materials are managed properly and reused and recycled at high rates.

Ammonia and sulfur dioxide have been found occasionally in discarded refrigerators and freezers (Ref. 26). These chemicals were used as refrigerants in a few refrigerators and freezers, most of which have been discarded.

Ammonia and sulfur dioxide are hazardous and, if released, may affect the health of workers handling or processing these appliances. However, if appliances with these chemicals are handled and processed properly, hazards are minimal.

There are extremely minor human health and environmental hazards associated with shredding the relatively few appliances that contain ammonia and sulfur dioxide refrigerants.

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CHAPTER SIX

FEDERAL AND STATE LEGISLATION AND REGULATION

6.1 Overview

An increasing number of metallic discard related laws and regulations have been enacted at the federal and state levels in recent years in response to environmental protection and worker safety concerns. Many of these new laws and regulations focus on the removal and disposal of special materials which had previously been generally unregulated.

This chapter provides an overview of major federal and California legislative and regulatory programs pertaining to metallic discards (primarily for major appliances and vehicles). Examples of local and regional initiatives which are part of California's program, are discussed. This chapter also presents a brief overview of several other state programs.

Although federal law does not regulate the management of metallic discards directly, several environmental statutes govern the management of the chemicals and hazardous wastes contained in vehicles and major appliances. Most notably, the Clean Air Act of 1990 prohibits venting or release of CFCs from discarded major appliances and vehicles. The appliance management standards and procedures developed to implement AB 1760 must be consistent and compatible with the federal Clean Air Act's CFC removal requirements. In addition, under the federal Toxic Substances Control Act (TSCA), PCBs removed from appliances or released during the shredding process must be managed as a hazardous waste if they are above concentration levels. EPA has determined that discarded intact or deployed sodium azide canisters are not federal hazardous wastes.

The disposal of major appliances has been regulated by many states. Some states have banned landfilling of appliances to conserve currently permitted landfill space. The assumption in these states is that if the appliances cannot be landfilled, they will be recycled and the metal reused. Some states have banned the landfilling of major appliances as part of a group of "problem materials." This list of materials usually includes used oil, lead-acid batteries, tires, household batteries, paint and household hazardous waste. These materials either contain a hazardous material or have characteristics that make them difficult to manage in a landfill, such as tires.

No state-level solid waste legislation or regulation specific to vehicles was identified after contacting several trade associations, including the MVMA, and approximately 14 states that have appliance discard programs. The Department of Toxics Substances Control has not made a specific determination as to whether discarded intact or deployed sodium azide canisters are considered a hazardous waste under California Title 22 regulations.

6.2 Federal

6.2.1 Vehicles

There are currently no federal regulations governing the management of sodium azide in vehicular air bags. In reviewing the issue of managing the air bags as hazardous waste under Subtitle C of RCRA, "prior EPA regulatory determinations indicate that intact [air bag] units, both deployed and undeployed, do not exhibit hazardous waste characteristics that would subject them to RCRA Subtitle C controls" (Ref. 1).

Based on a 1985 letter from EPA to the Institute of Scrap Iron and Steel (ISSI), discarded sodium azide canisters are not considered a hazardous waste under 40 Code of Federal Regulations, Part 261.33. Under these regulations, in order for a waste to be hazardous, the sodium azide must have been: 1) never used as intended, 2) discarded, and 3) the sole active chemical ingredient. Because sodium azide is not the only active ingredient in the canister (there is an oxidizer) it is, therefore, determined by EPA to not be a hazardous waste.

CFC recovery from air-conditioning units contained in discarded vehicles is regulated under the Clean Air Act amendments. Basically, the federal Clean Air Act prohibits individuals from knowingly venting CFCs into the atmosphere while maintaining, servicing, repairing or disposing (or recycling) of air-conditioning and refrigeration equipment.

CFC legislation and regulation pertaining to vehicle air conditioning units is similar to major appliances and is discussed below.

6.2.2 Major Appliances

Polychlorinated Biphenyls (PCBs)

In 1978, the federal government banned the manufacturing, processing and distribution of PCBs. However, some manufacturers of appliances were given an extension to use stockpiled (existing) PCB-containing capacitors.

Generators of PCB wastes are required to obtain a U.S. EPA identification number to be used to manifest all shipments of PCBs for management. In addition, all generators are required to comply with EPA regulations for storage, transport and disposal of PCBs. The containers used for the storage of PCBs must be approved by the DOT for PCB shipment and storage and marked appropriately. PCBs must be stored in a roofed, curbed area with an impervious surface, transported by EPA-licensed hazardous waste transporters, and managed at an EPA-permitted hazardous waste disposal facility. In general, PCBs must be incinerated.

TSCA regulations are administered by each state through its regulatory agency. Generators of PCBs must be licensed or permitted in accordance with the requirements of the state in which they operate. There may also be additional licensing or permitting requirements at the local level for generating hazardous waste.

Chlorofluorocarbons (CFCs)

Effective July 1, 1992, Section 608 of the Clean Air Act prohibits individuals from knowingly venting ozone-depleting compounds, used as refrigerants, into the atmosphere while maintaining, servicing, repairing or disposing of air-conditioning or refrigeration equipment contained in appliances and vehicles. In order to establish the prohibition on venting, the federal Clean Air Act requires EPA to develop regulations that limit emissions of ozone-depleting compounds during their use and disposal to the "lowest achievable level" and that "maximize recycling." Therefore, the federal Clean Air Act requires the development of minimum standards for removal of CFCs from appliances in California including a reporting system.

EPA issued proposed regulations to implement Section 608 on December 10, 1992 and (Ref. 2) published the final rule in the May 14, 1993, Federal Register (Federal Register, May 14, 1993, pages 28660-28734).

The rule establishes a recycling program for ozone-depleting refrigerants recovered during servicing and disposal of air conditioners and refrigeration equipment. The rule requires technicians to reduce refrigerant emissions, establishes technician, equipment and reclaimer certification programs, and requires the removal of ozone-depleting refrigerants prior to disposal. The certification requirements will be phased in over a period of one to 18 months and

"grandfathers in" existing equipment and technicians which meet minimum requirements.

EPA's certification program for refrigerant reclaimers requires reclaimers to submit a signed statement to EPA stating that 1) CFCs are returned to the ARI Standard 700's standard of purity, 2) the CFC purity level is verified using ARI Standard 700 methods, and 3) wastes from the reclamation process are disposed of properly. Reclaimers are also required to submit a list of equipment used and maintain records of customers. EPA will also perform site inspections and/or the sampling of reclaimed refrigerants by EPA-approved parties.

While the EPA rule to service and repair appliances is very stringent, the rules under EPA's Safe Disposal Program are more flexible. The Safe Disposal Program addresses refrigerant recovery from appliances at disposal or recycling. EPA indicates this is because the disposal system may be varied in different situations, and involve solid waste transporters, appliance dealers, landfill operators, and local governments.

The regulations require the removal of refrigerants from household refrigerators, freezers, room air conditioners, dehumidifiers and water coolers prior to disposal. There is no requirement for the removal of CFCs from the foam insulation in appliances due to the significant technical and practical problems as well as the high cost of removal equipment.

The rule offers a general requirement that "refrigerant be recovered before disposal of equipment" and makes the final processor of the appliance (e.g., the metal shredding facility) responsible for the removal of the refrigerant. If the final processor chooses not to recover the refrigerant themselves, they must require certification or verification from the supplier of the appliances which must include a signed statement containing the name and address of the person who recovered the refrigerant and the date the refrigerant was recovered. These requirements became effective on July 13, 1993. State and local governments may establish more stringent requirements in this area.

On the issue of technician training for recovery of refrigerant from appliances at disposal, EPA will use guidance documents rather than requiring formal training.

Under the rule, equipment used in the recovery of refrigerant at disposal must meet the same standards as set for servicing equipment. Because the equipment must frequently evacuate refrigerant from several appliances at a time, many companies build their own equipment. EPA allows that if this equipment meets the required evacuation levels of servicing equipment and recovers 90 percent of the refrigerant charge, the equipment need not be certified.

EPA has clarified the applicability of the RCRA Subtitle C regulations to CFC refrigerants and related wastes: namely, used CFC refrigerants are not hazardous wastes provided the refrigerant is recycled or reclaimed for further use. Two by-products of refrigerant recovery and recycling, used oil and used replaceable core filter dryers, are subject to the RCRA hazardous waste requirements (Ref. 3).

6.3 California

California's existing laws and regulations for metallic discards management, particularly removal of special materials, mirror federal requirements.

6.3.1 CFC Recovery and Reclamation

CFCs recovered from appliances are not considered hazardous wastes if they are reused or recycled (§ 25143.2(d)(7) Health and Safety Code).

Several California localities have issued policy statements, promulgated regulations, or enacted ordinances to reduce ozone-depleting chemicals

during servicing or disposal. In April of 1990, the South Coast Air Quality Management District (SCAQMD) adopted a "Policy on Global Warming and Stratospheric Ozone Depletion." To implement these provisions, the SCAQMD has adopted the following rules which apply to CFC use, recovery, and reclamation from metallic discards:

Rule 1411: Recovery or Recycling of Refrigerants from Motor Vehicle Air-Conditioners - requires the use of recovery or recycling equipment for installation, service, or repair of motor vehicle air conditioners; or any other related repairs including vehicle dismantling that could cause the release of refrigerant. Revisions are underway to include HCFCs, HFCs and other refrigerants and to limit the sale of currently regulated CFCs.

Rule 1415: Reduction of CFC Emissions from Stationary Refrigeration and Air Conditioning Systems - requires recovery or recycling equipment during industrial or commercial refrigerator or air conditioner servicing or dismantling to reduce CFC emissions. All systems must be inspected each year by a certified auditor. Revisions are underway to include HCFCs, HFCs and other refrigerants and to limit the sale of currently regulated CFCs.

Rule 1418: Recovery or Recycling of Halons from Fire Extinguishing Systems - requires recovery or recycling of halons from fire extinguishing systems, limits the use of halons to specific applications, prohibits the sale of small amounts of halons.

The Bay Area Air Quality Management District (BAAQMD) has also adopted a "Stratospheric Ozone Policy" the goal of which is "to eliminate the use of stratospheric ozone depleting substances within the District at the earliest practicable date." The BAAQMD has adopted a rule (Regulation 12, Rule 7) which applies to refrigerant recovery and recycling during the servicing or salvaging of motor vehicle air conditioners and incorporates the provisions of the federal regulations (40 CFR 82 Subpart B) into the district's rules and regulations; furthermore, this rule builds on the federal standard as follows:

- Prohibits the addition of refrigerant to motor vehicle air-conditioning systems unless there are no detectable leaks (as determined by the specific procedure established by this rule);
- Prohibits the operation of recovery, recycling, or charging equipment unless there are no detectable leaks (as determined by the specific procedure established by this rule);
- The provisions of the federal regulation (40 CFR 82 Subpart B, section 82.34) are enhanced in the BAAQMD's rule to include sales or distribution of refrigerant in containers of any size; and

The BAAQMD is very close to adopting another rule (Regulation 12, Rule 8), expected to be adopted in 1993, to recover and recycle refrigerant during the servicing and salvaging of stationary refrigeration equipment (Ref. 4).

6.3.2 PCB Management

PCB-containing electrical equipment that is not regulated under TSCA, such as small capacitors and ballasts, are regulated by the Department of Toxic Substances Control (DTSC) under Title 22 CCR. Unlike the weight exemptions for small capacitors as specified under TSCA, DTSC regulates all PCB-containing capacitors unless it is shown that the capacitor does not contain PCBs at or above the 5 milligrams per liter (mg/L) threshold. The effect of this demonstration requirement is that most facilities that properly manage removed capacitors choose to manage them as hazardous waste rather than paying for the costs of laboratory testing.

Several differences exist between the federal and California PCB regulations; the most significant

is that the state of California regulates PCB waste with a concentration of 5 milligrams per liter or more as hazardous while TSCA only regulates PCB wastes with concentrations greater than 50 ppm.

6.3.3 Sodium Azide

The Department of Toxics Substances Control has not specifically determined whether discarded intact or deployed sodium azide canisters are considered a hazardous waste under California Title 22 regulations. However, discarded sodium azide canisters may be subject to California hazardous waste regulations if it is determined that the waste is hazardous pursuant to the criteria set forth in Title 22 of the California Code of Regulations (i.e., waste is a listed waste or is hazardous because of its characteristics, (e.g., reactivity)).

6.3.4 Other Hazardous Wastes Potentially Subject to Regulation

Other materials considered to be hazardous wastes by the state of California may be present in major appliances and vehicles. These wastes include lubricating oil in vehicles and appliance compressors that contain hazardous constituents, mercury switches which may be found in appliances, metals (e.g., lead, and cadmium), and ammonia and sulfur dioxide (each of which has been found in a few appliances typically more than 30 years old). These wastes must be managed as hazardous according to Title 22 regulations. Specific regulations pertaining to these materials as they relate to their presence in metallic discards do not exist for the state of California.

6.3.5 Vehicle Dismantlers, Feeder Yards and Shredders

Vehicle dismantlers, feeder yards and shredders that accept metallic discards containing special materials must comply with the CFC, PCB, and other regulations discussed in this section. In addition to these requirements, feeder yards and shredders that generate oil from motor blocks and other discards are subject to local limits for discharges of oil and other wastes to the sanitary sewer system or may be required to manage oil sludge generated in on-site treatment/separation tanks as a hazardous waste.

Feeder yards, shredders, and certain vehicle dismantlers are also required to meet California's stormwater management regulations.

Fluff generated by the shredding process must be stabilized and disposed of in a hazardous waste landfill if it contains hazardous constituents, such as PCBs, above levels established by DTSC in Title 22, CCR. The PCB threshold level for fluff in California is 5 milligrams per liter or more. Vehicle dismantlers and other facilities that accept discarded vehicles must comply with state recycling and disposal requirements for lead-acid batteries and scrap tires.

6.4 Other State Programs

This section discusses metallic discard programs in other states. Based on research conducted for this report, no state has legislation or regulations that address discarded vehicles directly. The Appliance Recycling Centers of America (ARCA) indicated that eighteen states have management programs or solid waste management measures that apply to the major appliance (or white goods) waste stream. Table 6.1 lists the information ARCA supplied on state programs and Table 6.2 summarizes program components for selected states. This section summarizes programs in seven of these states with a particular focus on Minnesota and Wisconsin because of their comparatively well-established programs. These states were selected because they represent a range of management approaches that could be considered in California.

Table 6.1
State Major Appliance Programs

Program Characteristic	State(s)	Effective Date
Landfill Disposal Ban	California	1/94
	Florida	1/90
	Illinois	7/94
	Louisiana	7/90
	Massachusetts	12/91
	Minnesota	7/90
	Missouri	1/91
	Nebraska	9/95
	North Carolina	1/91
	Oregon	7/91
	Rhode Island	5/89
	South Carolina	5/94
	South Dakota	7/92
	Vermont	1/91
	Wisconsin	1/91
Processing Requirement (1)	California	N/A
	Illinois	N/A
	Minnesota	N/A
	South Carolina	N/A
Source Separation Requirement (Applicable to Recyclable Metals)	Connecticut	2/89
	New York	9/92
	Rhode Island	5/89
Purchase Deposit	Maine	7/89
	South Carolina	11/91

Notes:
1. In addition to federal Clean Air Act provisions and requiring the removal of hazardous materials.

Source: ARCA

Table 6.2
Selected State Major Appliance Programs

State	Landfill Ban	Incinerator Ban	Resource Recovery (1)	Purchase Deposit (2)	Hazardous Materials (3)
Connecticut	No	No	Yes	No	Yes
Florida	Yes	No	No	No	No
Illinois	Yes	No	No	No	Yes
Maine	Yes	N/A	No	Yes	N/A
Massachusetts	Yes	Yes	No	No	Yes
Minnesota	Yes	N/A	Yes	No	Yes
Wisconsin	Yes	Yes	Yes	No	Yes

Notes:
1. This column refers to a state program of specific materials recovery or recycling requirements.
2. This column refers to a deposit or fee on the purchase of appliances. This is being considered in Minnesota
3. This column refers to requirements for the removal or processing of hazardous materials from major appliances in addition to the federal standards (i.e., the Clean Air Act requirements).

Source:
State contacts and review of available legislation and regulation.

6.4.1 Minnesota

The state of Minnesota currently has a very well-developed major appliance processing system due to a history of private sector activity and very aggressive appliance-related legislation.

Statutes and Regulations

In 1989, Minnesota banned the landfilling of appliances effective July 1, 1990. The legislation was amended in 1990 to state that "major appliances must be recycled or reused." Recycling was defined in the legislation as 1) the removal of capacitors that may contain PCBs;2) the removal of ballasts that may contain PCBs; 3) the removal of CFC refrigerant gases; and 4) the recycling or reuse of the metals, including mercury. Minnesota was the first state to direct how discarded appliances should be managed and recycled (Ref. 5).

During the 1990 Minnesota legislative session, a CFC management bill (Minnesota Statutes §116.70 to 116.74) was passed. It addresses CFC management during the servicing of vehicle air conditioners, appliances and industrial refrigeration units, aerosol products, CFC substitutes and warning labels, and requires the removal and recycling of CFCs from refrigerators, central air conditioning units and freezers before disposal. This law's effective date was July 1992 (Ref. 6).

Program Summary

The implementation of the appliance-related laws in Minnesota has been carried out by two state agencies: the Minnesota Pollution Control

Agency (MPCA) and the Minnesota Office of Waste Management (OWM).

The 1989 legislation which banned the landfilling of major appliances also required the OWM to prepare a report for the legislature on "how major appliances are being disposed of and should be disposed of." When this report was completed, it was shared with the major appliance recyclers in the state for their review. The report recommended the development of a Major Appliance Task Force to assist the OWM and MPCA with major appliance-related issues. The Major Appliance Management Group (as it was later called) has been meeting on a regular basis two to four times a year since 1990. The meetings are attended by 20 to 40 people involved in appliance management, including state and local government staff, waste collectors and landfill operators, scrap yard and metal shredder operators, appliance processors and recyclers, and other interested parties.

One of the major projects undertaken by the OWM and MPCA in 1992, with assistance from the Major Appliance Management Group, was the development of guidelines or minimum standards to be used by major appliance recyclers in Minnesota. The guidelines include 1) minimum processing requirements, such as PCB, CFC and mercury removal; 2) minimum legal requirements, such as licensure as a hazardous waste generator, recycling or waste processing facility; 3) end market identification requirements for hazardous waste management, CFC reclaiming and metal recycling; 4) annual reporting requirements; and 5) review criteria for inclusion on the State List of Major Appliance Processors, including proper training and annual reporting.

The guidelines and an application form for inclusion on the state list was sent to all persons involved in major appliance management in Minnesota in March 1992. The application forms were due on May 1, 1992 and approximately 30 were received from appliance processors around the state. Staff from OWM and MPCA and affected counties were involved in reviewing these applications. A final State List of Major Appliance Processors was published by OWM and MPCA in November 1992.

One of the recommendations in the 1990 OWM Major Appliance Management Report was to investigate the possibility of developing a training program addressing the technical aspects of major appliance recycling. At the November 1992 meeting of the Major Appliance Management Group, it was announced that this training was about to begin. The Minnesota Technical College System has developed a curriculum to standardize training for major appliance recycling and CFC management. In January 1993, a "training the trainers" session was held with support from the Minnesota Board of Education. The 33 vocational technical schools in Minnesota began offering 8-hour sessions in February and March 1993.

The 1990 CFC-related legislation did not appropriate funds for staff people to develop regulations or guidelines to implement the law. Instead, the staff of the MPCA Air Quality Division elected to develop some fact sheets about CFC usage and disposal and CFC laws and wait until the U.S. EPA issued regulations for the federal Clean Air Act and then adapt them for use in Minnesota.

In the Twin Cities area, enforcement is delegated to local government. It is estimated that a one-half full-time equivalent (FTE) person is dedicated to this program. In other areas of Minnesota, the MPCA implements this law (Ref. 7).

6.4.2 Wisconsin

The state of Wisconsin is rapidly developing a major appliance processing system as a result of state legislation. The aggressive implementation of this legislation is being carried out by the Wisconsin Departments of Natural Resources (DNR); Industry, Labor and Human Relations

(DILHR); and Agriculture, Trade and Consumer Protection (DATCP).

Statutes and Regulations

During the 1989 session of the Wisconsin Legislature, two bills passed that directed how discarded appliances were to be handled in the state. Act 294 prohibits the venting of CFCs from appliances when they are recycled effective July 1, 1992 (Ref. 8).

Act 335 prohibits the land disposal or incineration of major appliances beginning January 1, 1991. (Major appliances were defined as residential or commercial air conditioners, clothes dryers, clothes washing machines, dishwashing machines, freezers, microwave ovens, ovens, stoves, and refrigerators.) This legislation neither directs that the appliance should be recycled nor indicates how the appliance should be handled. Most believe the intent of the legislation is to encourage appliance recycling (Ref. 9).

Program Summary

Act 284 requires the DNR to promulgate rules for the administration of Section 144.422, Recovery of Ozone-depleting Refrigerants. The draft rules, Chapter NR488, were issued in spring 1992. They required that 1) appliance salvagers/dismantlers register annually with the state and certify that CFCs will be recovered from discarded appliances using state-approved equipment operated by individuals who have attended state-approved training; 2) any person who transports discarded appliances that may contain CFCs must register with the DNR annually and provide information on transport equipment and loading procedures used; and 3) only certified appliance salvagers/dismantlers may sell or give CFC-containing appliances to a scrap metal processor with written certification that the CFCs have been recovered. The proposed fees for annual certification are $250 for appliance salvagers/dismantlers and $75 plus $25 per vehicle for appliance transporters. These fees will be used to fund CFC enforcement staff at DNR. The proposed penalties are not less than $100 nor more than $1,000 for each violation.

The DILHR developed guidelines for DILHR-approved refrigerant handler training in late 1991. Organizations wishing to provide DILHR-approved training submitted a course description and instructor qualifications for department approval. There are currently 13 approved training courses offered through technical colleges, unions and private companies around the state. DILHR officials estimate over 3,000 people in the state had been trained to handle refrigerants from appliances and vehicles by mid-1992.

The DATCP developed rules governing the sale of mobile air-conditioners containing ozone-depleting refrigerant and the sale of recycled refrigerant from mobile air-conditioners in vehicles. The rules also govern the servicing of mobile air conditioners.

The state of Wisconsin has assigned staff people in all three agencies, DNR, DATCP and DILHR, to work on the appliance and CFC issues. It is estimated that each agency has devoted one-third to one-half of an FTE to the appliance issue and DNR has committed one-third of an FTE for appliance-related CFC issues. Enforcement is the responsibility of DNR's district offices. It is estimated that less than one FTE is allocated to the appliance program in each of the DNR's six district offices (Ref. 7).

6.4.3 Connecticut

A representative of the Connecticut Department of Environmental Protection (DEP) indicated that, despite the absence of a formal disposal or landfill ban, the vast majority of discarded appliances (white goods) are currently recycled in the state (Ref. 10). The state does have a resource recovery program requiring the recycling of all scrap metal (including that.

contained in major appliances). This program has imposed significant fiscal impacts on municipalities (as most landfills in the state are municipally owned and operated). The state also regulates shredder fluff by requiring that landfills that accept fluff be licensed. As a result of this regulation, fewer landfills accept fluff, and, consequently, many shredders/recyclers will only accept metallic discards from municipalities whose landfills accept shredder fluff (Ref. 11).

Connecticut has a fairly extensive application program for recycling facilities which requires that anyone who collects or discards major appliances remove capacitors and dispose of PCB-containing capacitors as PCB waste. Compliance with these provisions is reported by DEP to be fairly good as a result of extensive outreach, field inspections, and fines of up to $25,000 per violation per day (Ref. 10). CFCs contained in major appliances are managed under the federal Clean Air Act regulations only.

6.4.4 Florida

Section 403.704, Florida Statutes (F.S.), provides the Florida Department of Environmental Regulation (DER) with authority to promulgate regulations pertaining to major appliances. The primary component of the Florida major appliances program is a landfill ban established by both the F.S. §403.708 and Florida Administrative Code (F.A.C.) §17-701.040 and effective January 1, 1990; the F.A.C. states that ". . . no person who knows or should know of the nature of such solid waste shall dispose of the following wastes in any landfill: (d) White goods, after January 1, 1990." This ban, as established by the F.A.C. and F.S., does not apply to incineration or waste-to-energy disposal of major appliances. DER, by statute, was charged with identifying and assisting in the development of alternative management options for major appliances by the effective date of the landfill ban.

The Florida program provides a framework for the management of solid waste (in particular, major appliances) but management approach and program specifics are left for counties to determine and develop with assistance and guidance from DER (Ref. 12). As a result, there is a high degree of diversity among county programs in the state. The review of the statute and rule provided by the Florida DER did not reveal specific requirements for the removal of hazardous materials (i.e., CFCs, PCBs) from major appliances. This was confirmed by further contact with DER staff (Ref. 13). Given the county's burden of management discussed above and the fact that the state does not have particular rules requiring hazardous materials removal and management (with respect to major appliances), it is assumed that these materials are managed at the county level at least in accordance with federal standards. DER staff indicated that this is a "fairly safe" assumption (Ref. 14). County or local ordinances may exist and some counties may have extensive management strategies for metallic discards; state staff indicated that most counties and municipalities regulate or remove hazardous materials in order to move appliances on the scrap market. Specific information on county or municipal programs was not readily available.

The Solid Waste Management Act (SWMA) establishes an overall 30 percent recycling goal for municipal solid waste to be achieved by the end of 1994. By statute, no more than half of the 30 percent recycling goal may be met through the recycling of special waste (including white goods). Generation is approximately 3,000,000 major appliances per year. It is estimated that, between July 1, 1990 and June 30, 1991, 66 percent of white goods (approximately 103,000 tons) and 65 percent of all ferrous metals (approximately 755,000 tons) were recycled in the state (Ref. 14).

6.4.5 Illinois

The state of Illinois enacted a ban on the landfill disposal of major appliances effective July 1,

1994; Illinois Revised Statutes (I.R.S.) Ch. 111 1/2, par. 1022.28 ("the statute") states, in part, that ". . . no person shall knowingly offer for collection or collect white goods for the purpose of disposal by landfilling unless the white good components have been removed." This statute also prohibits, as of July 1, 1994, the acceptance of major appliances for final disposal by landfill owners or operators unless the following criteria are met:

- The landfill participates in the Industrial Materials Exchange Service by communicating the availability of white goods;
- Prior to landfill disposal, handlers remove white good components (i.e., special materials); and
- If white good components are removed at the landfill, a site operating plan satisfying the Illinois Environmental Protection Act has been approved under the facility's site operating permit and the conditions of the operating plan are met.

White goods components, as defined by the statute, include any CFC refrigerant gas, any electrical switch containing mercury, and any device that contains or may contain PCBs in a closed system (such as dielectric fluid for a capacitor or ballast).

In addition to the provisions for the landfill ban, the statute authorizes the Illinois EPA to provide financial assistance to units of local government from the state's Solid Waste Management Fund to plan for and implement programs to collect, transport, and manage major appliances and to promulgate rules to implement the provisions of the statute. In response to this authorization, the Illinois EPA issued proposed rules (35 Illinois Administrative Code (I.A.C.) 875) which include the requirements for obtaining grants, criteria for fund disbursement, actions that can be taken for noncompliance with grant conditions, and auditing and records requirements. The statute further states that all materials (i.e., major appliances) collected or received with financial assistance under this program shall be recycled whenever possible.

The statute also establishes a White Goods Task Force to develop and propose desired statutory, regulatory, and programmatic changes necessary to effectively implement the provisions of the statute. A representative of the Illinois EPA indicated that, although there are no rules specifically addressing major appliance components (containing hazardous materials) at this time, this task force may develop state rules in this area (Ref. 15). Currently, the primary rules that apply to major appliances in Illinois are federal (i.e., under the Clean Air Act) and implemented through Illinois EPA (Ref. 15).

6.4.6 Maine

A representative of the Maine Waste Management Agency (WMA) indicated that, by law, it is the responsibility of municipalities in Maine to provide for municipal solid waste management. According to the WMA, most municipalities in Maine are currently using incinerators — or will be in the near future — for the management of municipal solid waste. (Ref. 16). Major appliances are largely managed by municipalities in accordance with federal regulations. The WMA representative indicated that adequate, low cost or no cost major appliance "disposal" has historically been available to municipalities through the private sector.

The state has imposed a $5.00 Recycling Assistance Fee on, among other items, new major appliances. This fee applies to all items characterized as major appliances whether used for residential, commercial, or industrial purposes unless specifically exempt. The fee also applies to new major appliances sold out of state for use within the state. The effective date, for taxable purchases made within the state and for taxable items brought into the state by the user, was July 1, 1990. The Tax Assessor Rules regarding collection and administration of this fee were not readily available for this

10. Investigating the generation and management of discarded motorcycles, scooters, and bicycles.

11. Exploring steps that can be taken to enhance hot water heater, microwave oven, and dishwasher recycling.

12. Developing suggested methods or criteria to determine economic feasibility for salvaging metallic discards.

10. Telephone conversation between John Werner, SAIC, and Laurie Saliby, Connecticut Department of Environmental Protection, PCB Section, November 18, 1992.

11. Telephone conversation between John Werner, SAIC, and Barry Leopold, SAIC, November 1992.

12. "Solid Waste Management in Florida, 1991 Annual Report", Florida DER, September 1992.

13. Telephone conversation between John Werner, SAIC, and Ron Hendricks, Florida Department of Environmental Regulation, Bureau of Solid and Hazardous Waste, January 6, 1993.

14. Telephone conversation between John Werner, SAIC, and Matt Tala, Florida Department of Environmental Regulation, Bureau of Solid and Hazardous Waste, November 13, 1992.

15. Telephone conversation between John Werner, SAIC, and Mike Nechvatal, Illinois Environmental Protection Agency, Solid Waste Management Section, November 17, 1992.

16. Telephone conversation between John Werner, SAIC, and Hartley Palleschi, Maine Waste Management Agency, November 16, 1992, and letter, November 17, 1992.

17. Telephone conversation between John Werner, SAIC, and John R. Pepi, Massachusetts Department of Environmental Protection, November 17, 1992.

18. "White Goods Management in Massachusetts: Questions and Answers for Municipal Waste Management Officials," Massachusetts DEP, page 4-5.

Other State References Reviewed

State of Connecticut, Environmental Protection, Water Pollution Control, Title 22a, Ch. 446k, Sec. 22a-467, "Disposition of PCB regulated" (statute).

State of Connecticut, Department of Environmental Protection, "Common Questions/Answers on PCBs and White Goods Capacitors".

State of Connecticut, Department of Environmental Protection, "Fact Sheet on Chlorofluorocarbons (CFCs)".

State of Connecticut, Department of Environmental Protection, "Guide for Removal, Storage, and Disposal of PCB Small Capacitors", February 1989.

Florida Statutes, Chapter 403, ss. 403.702 et seq.

Florida Administrative Code, Chapter 17-701.

Illinois Revised Statutes 1991, Chapter 111 1/2, Paragraph 1022.28 (Environmental Protection Act, Section 22.28).

Illinois Administrative Code, Title 35, Subtitle G, Chapter II, Part 875 (proposed).

36 Maine Revised Statutes Annotated §§4831 - 4834.

Massachusetts General Law (M.G.L.) c. 21A, ss. 2 & 8 and c. 111, s. 150A (Statutes 1987, c. 584).

310 Code of Massachusetts Regulations 19.017.

Massachusetts Department of Environmental Protection, Guidance Document SWM-6-7/91, July 1991.

Massachusetts Department of Environmental Protection, "White Goods Management in Massachusetts: Questions and Answers for Municipal Waste Management Officials."

CHAPTER SEVEN

FINDINGS, MANAGEMENT PLAN OPTIONS, AND RECOMMENDATIONS

7.1 Overview

This chapter presents the major findings of the report, management plan options, and recommendations. Perhaps the most significant finding is that controls or measures beyond those authorized by existing legislation on the handling and processing of appliances that contain PCB-containing capacitors and CFCs are necessary to protect human health and the environment. Most businesses and organizations that manage refrigerators, air conditioners, and freezers that contain CFCs comply with the federal Clean Air Act by properly recovering and reclaiming CFCs and not venting CFCs to the atmosphere. However, a significant number of small generators (e.g., primarily households and businesses) and smaller appliance handling operations violate these requirements. In addition, CFC regulation, whether at the federal, state, regional, or local level, does not control or prevent the release of CFCs during appliance collection and transportation; the stage of the discarded appliance management system where releases are most likely.

The removal of PCB-containing capacitors and ballasts from major appliances before appliances are crushed for transport or transferred to a baler or shredder does not commonly occur. PCB-containing capacitors are typically found in pre-1978 microwave ovens, air conditioners and residential furnaces. These appliances make up about 6.25 percent of the major appliance waste stream. This percentage will decline significantly by 1998 when most pre-1978 appliances are expected to be discarded.

Additional controls that are needed based on these findings include safeguards on the handling of appliances and steps to ensure that PCB-containing capacitors are removed from major appliances. The CIWMB, other appropriate agencies, and industry associations may be able to encourage these additional controls voluntarily with existing funding without legislative or regulatory changes. Alternatively, these controls could be imposed under a new permitting program for handling and processing appliances which would require new legislation to implement. Many respondents to the mail survey suggested both non-regulatory (e.g., education) and regulatory controls on appliance handling and processing, similar to those discussed in this chapter.

Some form of financing and/or responsible entity program (i.e., manufacturer responsibility) may be necessary to subsidize appliance handling and processing costs. Financing or manufacturer-supported handling and processing is especially needed in rural areas of the state where illegal dumping of appliances can be significant if fees charged to generators are too high. Several survey respondents, including the County of San Bernardino, expect illegal dumping to be a problem, especially in rural areas, if compliance costs are too high.

For vehicles, hazards associated with management of sodium azide canisters in discarded automobile air bags are not prevalent at this time due to the limited number of automobiles with air bags entering metal recycling facilities. However, with the current and future legal requirements to install air bags as safety devices in automobiles, automobile dismantlers and recyclers will come in contact with increasing numbers of undeployed sodium azide canisters. Although studies have been conducted on the potential hazards of sodium azide, contradictory information exists. Due to

these uncertainties, further study should be conducted before removal of sodium azide canisters is regulated.

Other hazardous materials or wastes may be found in certain appliances. These materials include ammonia and sulfur dioxide refrigerants, mercury-containing switches, and cadmium, which is occasionally found in vehicle and appliance paint. These hazardous materials or wastes as they exist in metallic discards do not pose human health or environmental hazards that make additional regulations necessary at present levels of contamination or detection. However, if processing requirements are established for CFCs and PCBs, the state may also wish to require proper removal of ammonia and sulfur dioxide refrigerants and removal and proper handling of compressor oil from refrigerators and freezers after CFCs have been evacuated from refrigeration units. Removing mercury-containing switches within washing machines and refrigerators (and possibly several other appliances which may not otherwise be subject to processing requirements) may not be justified.

Findings specific to each of this report's study objectives are provided below. Management options, all of which satisfy AB 1760's basic mandate with regard to special materials removal, are addressed in detail in Section 7.3. Management approaches build on, and are consistent with, existing programs under the current system such as the Clean Air Act. Because the Clean Air Act and corresponding state, regional and local air quality regulation require removal of CFCs from discarded appliances and vehicles, all requirements, standards, and reports developed to implement AB 1760 must be compatible with these preexisting controls. Accordingly, all of the options incorporate Clean Air Act CFC removal and reporting requirements.

Most management options include new requirements for handling which are not regulated by the Clean Air Act or California air quality programs. Some options include provisions for new funding, such as advance disposal fees (ADFs), and for manufacturer responsibility for appliance handling and processing. As discussed in Chapter 6, several states, including Minnesota, Wisconsin and Illinois, have appliance management programs that require licensing and certification of appliance handlers and processors. Wisconsin's legislation has powerful enforcement and penalty authorities. A number of states have or are investigating ADFs; many have grant and loan programs to support local appliance management programs.

Implementing the permitting and enforcement program associated with options 2, 3, 4, and 5 that is discussed in Section 7.3 would require at least five or six full-time equivalent (FTE) staff positions at the state level and an average of about one-third FTE for each county. FTE estimates are based on Minnesota and Wisconsin's program staffing.

Based on program administration costs and the incremental costs of new requirements imposed on appliance management (primarily $3 million for removal of PCB-containing capacitors), approximately $3 to $6 million of new funding would be necessary to cover costs. Only $3 million for administrative costs would be necessary if it is assumed that appliance handlers and processors could recover their costs with fees charged to generators. Also, at least $5 million in additional funding should be made available for grants and loans and other financial assistance, especially in rural areas where illegal release of PCBs and CFCs, and illegal dumping of appliances may be more prevalent than in urban areas. Given that about 3.5 million new appliances are sold each year in California, a $3.00 to $5.00 ADF would probably be adequate to finance programs. This level of fee would cover costs associated with collecting and administering the ADF. It should be noted that these funding estimates are very preliminary and not based on a formal fiscal analysis.

7.2 Findings

Findings and conclusions are summarized below for each major study objective. Findings are summarized from information contained in Chapters 2, 3, 4, 5, and 6. These chapters should be referred to for more specific information and references.

What are the current generation and recycling rates of metallic discards in California?

Appliances and Other Metallic Discards

- In 1991, approximately 3.38 million major household appliances (268,000 tons) and 301,500 tons of other metallic discards (e.g., wood-burning stoves, metal furniture) were discarded. Appliance and other metallic discards generation (not including vehicles) is approximately 1 percent of the solid waste generated each year in California.

- Published recycling rate estimates for household appliances range from 25 percent to 40 percent. Findings of this report indicate higher recycling rates for large appliances especially refrigerators, freezers, washing machines, and clothes dryers. Most microwave ovens, hot water heaters, dishwashers, and dehumidifiers, however, are likely landfilled.

Vehicles

- In 1991, approximately 1.63 million vehicles (2.76 million tons) were discarded.

- Vehicles are estimated to be recycled at rates exceeding 90 percent. This estimate does not include bicycles, motorcycles, and scooters that are believed to be recycled at much lower levels. The recycling rate for vehicles is higher than for appliances because of the amount of scrap metal in a vehicle and the relatively well-established system for recycling vehicles.

What are the existing management systems and associated problems for discarded major appliances and vehicles?

Appliances

- The handling stage of the appliance management system statewide involves many players including solid waste facilities, franchised and contract solid waste collectors, appliance retailers, small (and independent) collectors, special appliance management programs, and scrap yards (feeders).

- The proper handling and processing of appliances, particularly those containing refrigeration units with CFCs, are variable and inconsistent. Improper handling (i.e., collection and transportation) is a widespread problem that causes releases of CFCs. Although most solid waste facilities, special programs, appliance retailers, and feeders are properly recovering CFCs, small collectors are generally not.

- The removal of PCB-containing capacitors and ballasts from appliances before the appliance is crushed for transportation or shredded, does not commonly occur. Compliance with AB 1760's requirements will necessitate the removal of PCB-containing capacitors and ballasts.

- Neither small nor large operators are removing foam containing CFC-11 which is present in refrigerators and many freezers. This is primarily due to the lack of clear guidance from regulatory agencies on the issue of how to manage removed foam and the technical and economic barriers to CFC-11 recovery.

- Although CFCs that are the most damaging to the environment are being banned, substitutes that are currently available also cause environmental problems and must be managed properly. Therefore, the

management system established for CFCs will probably be necessary for decades. This applies to both appliances and vehicles.

Vehicles

- Vehicle dismantlers handle and process almost all discarded vehicles in California.
- Materials requiring special handling are removed from vehicles before they are shredded in order to meet industry (and shredder) specifications and requirements.
- Intact air bags are contained in very few cars that are discarded. However, this will dramatically change as more cars are equipped with air bags and as these cars reach the end of their useful lives.
- An increasing number of intact air bag systems are being removed from discarded cars and sold to automobile and individual repair shops for reuse.
- Most vehicle dismantlers that were surveyed for this report were not aware of the proper procedures for activating or removing sodium azide air bags.
- Whereas the handling and processing stages of the appliance management system and the vehicle management system differ, the recycling stages are the same. All appliances and vehicles are shredded at a metal shredding facility where the metal is separated from the nonmetal portions. Scrap metal from a shredding facility is delivered to market.

What are the costs and revenues of the existing management system and what are the probable economic impacts associated with AB 1760's implementation? What does "economically infeasible to salvage" mean as stated in AB 1760?

Appliances

- The current management system for appliances (and vehicles) is driven by the worldwide market for scrap metal. The market will continue to be the driving factor even with the requirements of AB 1760.
- AB 1760 is anticipated to particularly impact the economics of recycling appliances that contain special materials, especially those with PCB-containing capacitors.
- The appliance management system is funded by fees and revenues.
- Fees for the appliance management system are borne by appliance generators. These fees range $15.00 to $20.00 for handling only. An additional fee of $25.00 is typically charged for processing. Fees paid by generators are equated with the cost of operating the appliance management system.
- Collection and processing fees are the greatest barrier to the proper management of appliances. Fees encourage illegal venting of CFCs from appliances in all areas of the state. Fees encourage illegal dumping of appliances, especially in rural areas. Several respondents to the mail survey, including San Bernardino County, are concerned about illegal dumping if compliance costs associated with special material removal programs are too high. Government or private financing is necessary to subsidize the appliance management system in order to increase recycling and decrease illegal venting or release of special materials.

- The estimated annual cost of managing the number of appliances discarded in 1991, including proper processing of appliances with CFC-containing refrigeration units, is $86.58 million. This cost, under the current system, is borne by appliance generators in the form of a processing fee. This cost assumes 100 percent compliance with AB 1760.

- The annual cost of the appliance management system, when in compliance with the requirements of AB 1760, is estimated at $97.61 million; about a $11 million increase over existing costs assuming a 100 percent compliance rate. This additional cost is due primarily to removal of PCB-capacitors from all pre-1978 appliances. If it could be determined, as it is widely believed, that only certain pre-1978 appliances contain PCB-capacitors, annual compliance costs could be reduced to approximately $3 million.

- The costs associated with compliance with AB 1760 are not anticipated to reduce recycling of appliances (or vehicles). In fact, compliance with AB 1760 is expected to increase recycling because of the landfill ban on metallic discards.

- Prices paid for appliance scrap metal are currently about $80 per ton.

- Diversion of appliances with significant metals content is economically feasible provided collectors and processors are able to charge a fee or collect reimbursement for their services to cover their costs. Also, a healthy market (such as is the case at present) must exist for scrap metal.

Vehicles

- The economics of the vehicle management system are not anticipated to be affected significantly.

- The vehicle management system is funded by revenues from the sale of scrap metal. Revenue received for vehicle scrap metal averages $80 per ton if it is mixed. Prices paid for scrap metal exclusively from vehicles are upwards of $120 per ton.

- No fees are borne by vehicle generators.

- There is a high reuse value ($100.00 - $800.00) for removed air bag systems.

What are the environmental and public health hazards associated with special materials that are contained in major appliances and vehicles?

Appliances

- Hazards associated with CFCs and PCBs are recognized as serious problems to human health and the environment.

- Improper handling (i.e., collection and transportation) of CFC-containing appliances causes frequent releases. Similarly, PCBs contained in capacitors are released primarily during handling. However, because PCBs are encased in metal capacitors contained within the interior of an appliance, release during handling is not as likely as that of CFCs since the refrigeration unit coils on the exterior of the appliance can be easily and accidently punctured.

- Proper processing of appliances does not generally cause a release of PCBs and CFCs.

- Releases of CFCs from discarded appliances (and vehicles) amount to approximately one percent of total annual CFC releases in the U.S. Most CFC releases from appliances occur at the time of discard.

Vehicles

- For vehicles, hazards associated with management of sodium azide canisters in discarded automobile air bags are not prevalent at this time due to the limited number of automobiles with air bags entering metal recycling facilities. However, with the current and future legal requirements to install air bags as safety devices in automobiles, automobile dismantlers and recyclers will come in contact with increasing numbers of undeployed sodium azide canisters. Although studies have been conducted on the potential hazards of sodium azide that show human health risks, contradictory information still exists on the explosion potential for sodium azide canisters in shredding equipment, the effects of sodium azide residue in shredder fluff and the hazards associated with the removal of unactivated air bag systems for automobiles. Due to these uncertainties, further study should be conducted before sodium azide canisters are regulated.

- Only about 40 percent of vehicles contain a CFC charge at discard.

- The potential for release during vehicle handling or processing (i.e., removal of CFCs) is very low.

7.3 Management Plan Options

AB 1760 requires that the CIWMB develop a management plan for the removal of special materials from metallic discards. The Legislature directed the CIWMB to specify programs for administering and financing removal programs.

The management plan options presented in this section are intended to give the CIWMB an opportunity for review and to make decisions on program goals, components and options. Management options only address discarded appliances. Vehicles are not addressed because this report has found that special materials removal from vehicles does not warrant additional regulation at this time. Due to the uncertainty regarding the hazards associated with discarded sodium azide canisters, regulatory options are not presented to address air bags. AB 1760 should be amended to give the CIWMB discretion to regulate sodium azide canisters as a special material if studies show that existing hazards make regulation necessary to protect the public and environment.

CFCs are the other special materials associated with vehicles. Because CFC removal and disposal from discarded vehicles are currently regulated adequately under other laws (e.g., federal Clean Air Act), an additional regulatory program under AB 1760 is not necessary. Recommendations are made in Section 7.4 on other aspects of discarded vehicle management.

Each discarded appliance management option, to some degree, satisfies the two goals stated in AB 1760 that relate to special materials removal:

1) Protect the public health and environment from threats posed by the release of special materials contained in metallic discards; and

2) Enhance recycling of metallic discards which are currently landfilled.

Certain requirements of the options could be implemented under existing laws and incorporated into established recycling and waste disposal programs. However, other requirements may necessitate new legislation and regulations.

The management options consist of various program components. Program components include: the types of discards and special materials covered by the program; permitting of persons who handle (i.e., collect, transport and store) and/or process (i.e., remove) metallic discards that contain special materials, including certification of employees; economic incentives;

funding; market development (e.g., guaranteed acceptance of discards); enforcement; and reporting. The options do not contain provisions, such as product design requirements (e.g., prohibiting CFCs in appliances) that would directly affect the content of discards and associated recyclability requirements. Although such provisions may be an effective way to control environmental hazards associated with metallic discards and to enhance recycling, they are assumed to be beyond the scope of AB 1760.

An assessment of the secondary effects of the options (systemic feedback mechanisms not directly linked to recycling and protection of human health and the environment from toxics contained in discards), such as implications for product design and energy efficiency, have not been focused on. For example, an important criterion not evaluated in this study is the ability of ADFs and other economic incentives to affect product design (i.e., because ADFs based on special materials content could encourage substitution of non-hazardous for hazardous materials and possibly also reduce/increase energy efficiency and affect product reliability). The state should consider these factors for any program adopted.

For consistency, a common set of screening or evaluation criteria is applied to each management option to identify advantages and disadvantages. This method of option evaluation promotes an analysis of the trade-offs among the management options.

The criteria used to evaluate the management options are:

- Protect the public health and environment from threats posed by release of special materials contained in metallic discards;
- Enhance recycling of metallic discards which are currently landfilled;
- Minimize cost to the existing management system so as to not adversely affect recycling economics;
- Minimize cost to government to administer the program and to consumers;
- Ensure program enforceability;
- Limit problems in program administration and reporting;
- Maximize consistency with existing solid and hazardous waste management programs and systems (if possible); and
- Minimize illegal dumping.

OPTION 1: Current Management System

The current management system includes a landfill ban (effective January 1, 1994) and removal of special materials from appliances and vehicles as required by AB 1760 and other regulations, including the Clean Air Act and California air pollution control law. The main purpose of this alternative would be to ensure proper handling of metallic discards that contain special materials. Primarily because of the landfill ban, implementation of this option would also lead to increased recycling.

Under AB 1760, the burden of proof that special materials were removed from appliances before they were crushed for transport, or baled and transported to a metal shredding facility lies with the facilities that conduct crushing and/or baling activities. The Federal Clean Air Act requires the proper removal of CFCs; however, no permits or licenses would be required for appliance handling or processing. Also, there is no enforcement or penalty authority under AB 1760, and no new state funding is provided for existing programs. The CIWMB, U.S. EPA, California Air Resources Board (CARB), the Department of Toxics Substances Control (DTSC), and regional and local air pollution control districts are responsible for implementing

the various requirements of AB 1760 and the Federal Clean Air Act.

Advantages

- Minimizes new costs to business or the public.
- Consistent with existing state and local programs.

Disadvantages

- Environmental and public health hazards associated with handling (i.e., collection and transportation) appliances that contain CFCs and with handling and recycling (e.g., shredding) appliances that contain PCBs. The illegal release of CFCs, and possibly PCBs, from appliances due to the practices of small appliance handlers and appliance generators would remain a problem.
- Passive noncompliance with the requirement to remove PCB-containing capacitors would continue because of the lack of permitting, compliance, and enforcement requirements. Accordingly, fluff would probably continue to be contaminated by PCBs thereby generating hazardous wastes or making it problematic for recyclers to dispose of fluff at landfills.
- Recycling of certain appliances not maximized because of marginal economics.
- Makes enforcement more difficult because of numerous small operations that are unknown to agencies.
- Illegal dumping likely to be a problem, especially in rural areas. Generators may not be able or willing to pay the fee required by a handler and/or processor.

OPTION 2: Permitting Program

In addition to the requirements under the current management system, this alternative would require that any person who handles or removes CFCs, PCBs, or other special materials from major appliances obtain a permit from a state agency. Similar to under option 1, this option is designed to primarily ensure proper handling of metallic discards that contain special materials.

Household generators would be exempt from having to obtain a permit if their handling of a discarded appliance containing special materials is limited to delivering it to a permitted processor. Annual state inspections of facilities would be required. The responsible state agency may delegate permitting and inspection requirements to local health or fire departments, air pollution control districts or solid waste agencies. Permitting requirements would include certification and training of personnel who handle and/or remove special materials. Equipment standards would be specified for handling.

A permit fee would be collected. Appliance processors may only accept appliances from permitted transporters (i.e., handlers) and household generators. Feeder yards and shredders may accept appliances only from permitted operators that certify that special materials are removed in compliance with the requirements of AB 1760 and other applicable laws and regulations. Transporters of appliances to feeder yards and shredders would be required to document that appliances were processed properly by a permitted operator. Documentation may include some kind of manifesting. Processors would have to maintain records of numbers and types of appliances managed. Penalties would be assessed for violations. Civil and criminal enforcement authorities would be available. The permitting requirement in the law could "sunset" when appliances no longer contain special materials.

Advantages

- Minimizes illegal release of CFCs and PCBs because of permitting and manifest program.
- Minimal fees to fund program.
- Consistent with existing state and local programs.
- Enhances environmentally sound recycling of appliances.
- Makes enforcement easier because of the limited number of operators to inspect.

Disadvantages

- Does not maximize recycling of appliances because of marginal economics. For example, establishing processing facilities may be slow because of high capital and operating costs.
- Illegal dumping likely to be a problem, especially in rural areas. Generators may not be able or willing to pay the fee required by a handler and/or processor.

OPTION 3: Permitting and Financial Assistance Program

In addition to requirements under the current management system, this alternative would require that any person who handles or removes CFCs, PCBs, or other regulated special materials from major appliances obtain a permit from a state agency. Also, under this option, an advance disposal fee (ADF) would be charged on the sale of new appliances in California. The funds generated by the ADF would support permitting and recycling programs. Similar to Options 1 and 2, this alternative is designed to ensure compliance with metallic discards handling requirements but this program would stimulate recycling more than alternatives without financial assistance.

Annual state inspections would be required. The responsible state agency may delegate permitting and inspection requirements to local health or fire departments, air pollution control districts or solid waste agencies. Permitting requirements would include certification and training of personnel who handle and/or remove special materials. Equipment standards would be specified for handling.

A permit fee would be collected. Appliance processors may only accept appliances from permitted transporters (i.e., handlers). Feeder yards and shredders may accept appliances only from permitted operators that certify that special materials are removed in compliance with the requirements of AB 1760 and other applicable laws and regulations. Transporters to feeder yards and shredders would be required to document that appliances were processed properly by a permitted operator. Documentation may include some kind of manifesting. Processors would have to maintain records of numbers and types of appliances managed. Penalties would be assessed for violations. Civil and criminal enforcement authorities would be available. The law's permitting requirement could "sunset" when appliances no longer contain special materials.

Funds generated by the ADF would be used for grants and loans to municipalities and private parties for establishing appliance collection and processing programs (especially in rural areas to minimize illegal dumping), state-sponsored research and development, and for administering the program. In addition, the CIWMB would actively work with municipalities and private parties to establish processing facilities. For example, the CIWMB could encourage solid waste facilities (and provide incentives) to process appliances. This may include providing tax credits and permit streamlining assistance for processing facilities.

Advantages

- Minimizes illegal release of CFCs and PCBs because of permitting and manifest program.
- Limits illegal dumping because of financial assistance program.
- Consistent with existing state and local programs.
- Enhances environmentally sound recycling of appliances.
- Makes enforcement easier because of a limited number of operators to inspect.
- Provides financial assistance to regions that are unable to establish appliance processing facilities and programs, as necessary.

Disadvantages

- Fees increase costs of new appliances. May decrease the number of households that can purchase new appliances which may be more energy efficient or have fewer special materials.
- Imposes administrative costs of operating a grants and loans program.
- ADF would increase administrative requirements.

OPTION 4: Permitting and Guaranteed Acceptance Program

In addition to requirements under the current management system, this option would require that any person who handles or removes CFCs, PCBs, or other regulated special materials from major appliances obtain a permit from a state agency. Similar to option 3, this alternative is designed to ensure the proper handling of metallic discards that contain special materials and to enhance recycling. This alternative would also include a guaranteed acceptance program for appliances.

Annual state inspections would be required. The responsible state agency may delegate permitting and inspection requirements to local health or fire departments, air pollution control districts or solid waste agencies. Permitting requirements would include certification and training of personnel who handle or remove special materials. Equipment standards would be specified for handling.

A permitting fee would be collected. Appliance processors may only accept appliances from permitted transporters (i.e., handlers). Feeder yards and shredders may accept appliances only from permitted operators that certify that special materials are removed in compliance with AB 1760 and other applicable laws and regulations. Transporters to feeder yards and shredders would be required to document that appliances were processed properly by a permitted operator. Documentation may include some kind of manifesting. Processors would have to maintain records of numbers and types of appliances managed. Penalties would be assessed for violations. Civil and criminal enforcement authorities would be available. The law's permitting requirement could "sunset" when appliances no longer contain special materials.

This program would require appliance retailers, landfills and transfer stations to accept, at no charge, discarded appliances. Appliance handling and processing would be funded with an ADF on the sale of new appliances. The fee would apply to most appliances. The ADF would be specific to each appliance type depending on factors that may include special materials content and weight. Consumers could receive a rebate if an old appliance was returned at the time of purchase of a new appliance, or shortly thereafter. A fiscal impact analysis would have to be developed to evaluate the feasibility of this program option.

Advantages

- Minimizes illegal release of CFCs and PCBs because of acceptance, permitting and manifest programs.
- Minimizes illegal dumping because of acceptance program.
- Consistent with existing state and local programs.
- Enhances environmentally sound recycling of appliances.
- Encourages substitution of CFCs and recyclability of appliances because of ADF (fees could vary based on recyclability and special materials content).
- Makes enforcement easier because of the limited number of operators to inspect.
- Imposes no additional cost to the public other than the cost of new appliances.
- Consistent with existing state and local programs.

Disadvantages

- Fees increase the cost of new appliances. May decrease the number of households that can purchase new appliances which may be more energy efficient or have less special materials.
- ADF would increase administrative requirements.
- Establishing ADFs specific to appliance type would be difficult.

OPTION 5: Responsible Entity Approach

Under this option, the state would assign each manufacturer financial responsibility for discarded appliances based on an amount comparable to the impact of their appliances requiring handling, processing, recycling and disposal. This mechanism is based on the assumption that broadly-funded waste management (e.g., funded by nonvariable refuse fees, general fund) is inequitable and that only the manufacturer and the consumer of a specific product should pay for that item's disposal. Legislation that makes manufacturers of appliances responsible for municipal solid waste management would be required. Implementing this option would serve the dual purpose of ensuring proper metallic discards handling and processing and enhancing environmentally sound recycling.

The assumption behind this option is that manufacturers would form a consortium to carry out their obligations by

- Creating a discarded appliance management system,
- Contracting out the management of the system, or
- Funding municipal programs.

Manufacturers would select one of the above options based on cost. Manufacturers presumably would internalize these costs into the price of a new appliance. Manufacturers, who choose the materials used in the appliances they design and market, would be responsible for finding secondary materials markets for the discarded materials and ensuring proper disposal of those materials that cannot be recycled or recovered. Incentives for source reduction and design for recyclability are thus internalized. Manufacturers would also be responsible for meeting the requirements discussed in Option 2 (i.e., permitting and manifesting). Some form of "backdrop" regulations would be required to ensure that manufacturers' meet their responsibilities for appliance diversion.

A possible variation of this approach would be to involve not only manufacturers but suppliers

of appliance parts and appliance retailers in this responsible entity program. However, although this increased involvement may spread the burden of responsibility for discarded appliances more equitably, implementing and enforcing this approach would be significantly more complicated than under a manufacturers responsibility scheme.

Advantages

- Minimizes financial burden on state and local government for program administration.
- Limits the number of "players" involved since there are relatively few appliance manufacturers.
- Minimizes illegal release of CFCs and PCBs because of permitting and manifest program.
- Minimizes illegal dumping.
- Initiates a new approach to waste management that is compatible with existing state and local waste programs.
- Enhances environmentally sound recycling of appliances.
- Encourages designing and manufacturing appliances that are more recyclable and contain less special materials.
- Makes enforcement easier because of the limited number of appliance handlers and operators to inspect.
- Imposes no additional cost to public other than the cost of new appliances.

Disadvantages

- Imposes new costs on appliance manufactures.
- Imposes increased cost on new appliances sold in California.
- Decreases the ability of households to purchase new appliances (due to cost) which may be more energy efficient and/or contain less special materials.
- Causes difficulties in implementing this approach if a manufacturer is no longer in business when appliance is discarded (20 years after sale) unless the program that is developed accounts for this possibility (e.g., the industry, not a particular manufacturer, in the responsible entity).

7.4 Recommendations

This section presents recommendations for metallic discards management. Recommendations are not made on a specific management option in order to give the state an opportunity to collect more information on the merits of each option and to seek advice through the Task Force Program.

7.4.1 Recommendation to Form a Metallic Discards Task Force

Developing and implementing a metallic discards management program will be a challenging and complex endeavor. Many state and local regulatory agencies are involved including the CIWMB, DTSC, CARB and local solid waste enforcement agencies and air pollution control districts. Appliance and vehicle manufacturers will play an important role in program development and implementation. Solid waste operators, the metallic discards handling, processing and recycling industry, and environmental groups will also be involved.

Communication among these parties will be critical to effective development and implementation of a metallic discards management system.

It is recommended that the CIWMB establish a Metallic Discards Management Task Force. The Task Force should include representatives of the CIWMB, DTSC, CARB, other appropriate agencies within Cal EPA, local enforcement agencies and air pollution control districts, U.S. EPA, appliance and solid waste collectors and processors, vehicle dismantlers, the scrap metal industry, CFC industry, appliance/vehicle manufacturers, new and used appliance dealers, citizens, environmental groups and legislators. The Task Force would have appliance and vehicle subcommittees.

The Task Force should be formed as soon as possible to discuss and provide advice and recommendations to legislators, CIWMB staff and other state agency staff on the options and recommendations for metallic discards management as provided in this report. In addition to considering the management options, specific issues to be considered by the Task Force should include the following legislative and administrative recommendations.

7.4.2 Legislative Recommendations

AB 1760 and other legislation passed by state and federal government that regulates metallic discards management is a driving force behind any regulatory program. Because of AB 1760's requirement for this report on metallic discards management, it is clear that the Legislature is seeking advice and recommendations on specific regulatory and financing programs that fit within the overall framework for metallic discards management established by AB 1760. The following recommendations are suggestions for legislative changes to improve the metallic discards management system.

Amendments to AB 1760

Modifications to AB 1760 are needed to further define the scope and coverage of the legislation.

1. Designate responsible state agencies for program implementation.

2. Give implementing agencies the discretion in administrative regulations to define major appliances.

3. Give implementing agencies the discretion in administrative regulations to define the major appliances that contain PCBs and would, therefore, be subject to regulation.

4. Delete sodium azide canisters in unspent air bags from the definition of special materials and require the appropriate agency to study hazards associated with sodium azide canisters in unspent air bags. The legislature should give the implementing agencies discretion to define sodium azide canisters as a special material based on this study.

5. Change the definition of "materials that require special handling" in AB 1760 to clarify the meaning of special materials with respect to hazardous waste definitions.

7.4.3 Administrative Recommendations

A. Monitor the effectiveness of selected management options and determine if further action is needed. Examine the need and potential mechanisms for funding the removal of special materials on a state-wide basis.

B. Implementation of an effective metallic discards management system requires outreach and education, training, and research on additional topics and issues. The DTSC, CIWMB, other agencies of the California Environmental Protection Agency and possibly educational institutions (e.g., University of California Extension), will have roles in the system administration. In addition, federal and other state agencies

engaged in metallic discards management will play vital roles especially in education and outreach, training and additional research. Some of the problems associated with the existing vehicle and appliance management systems may be addressed by education, training and outreach programs. Specific recommendations are:

1. Train DTSC, CIWMB and other state and local staff to better enable them to implement the program and provide information on metallic discards management issues. Providing better information to citizens and businesses involved in metallic discards management will increase compliance rates. Training should include information on establishing appliance processing facilities and capabilities, CFC evacuation equipment information, proper PCB capacitor, electrical ballast, and sodium azide canister removal techniques, and general regulatory background on metallic discards management issues. The DTSC/CIWMB should develop fact sheets to distribute to participants in the metallic discards management system on these and other issues. Additionally, the DTSC/CIWMB should disseminate information on proper metallic discards management through information hotlines.

C. Study of Issues

The management of metallic discards will continue to increase in prominence as an important issue. Proper management presents many technical and regulatory challenges. In order to make informed decisions, legislators and government officials in the state of California, already on the forefront of waste management and metallic discards management, will need to further define issues and clarify technical uncertainties. Activities to further study outstanding issues include:

1. Improving knowledge of which appliances are not likely to contain PCBs. These appliances would then not be subject to regulation provided they do not contain other special materials.

2. Investigating proper handling and disposal of mercury switches found in certain appliances.

3. Investigating proper handling and disposal of sulfur dioxide and ammonia from certain types of refrigeration equipment.

4. Investigating proper handling and disposal of cadmium in certain paints occasionally found in appliances and vehicles.

5. Evaluating appliance processing capacity statewide in order to identify shortages.

6. Coordinating with other state and federal agencies, and industry on the issues of regulation of CFC foam and alternative refrigerants.

7. Entering into a dialog with appliance manufacturers on making appliances that can be disassembled more easily.

8. Entering into a dialog with vehicle manufacturers to encourage the reuse and recyclability of metal, plastic, air bags and other components of vehicles.

9. Conducting fiscal/economic impact analyses of ADF, guaranteed acceptance, and responsible entities management options, if these options are pursued further.

10. Investigating the generation and management of discarded motorcycles, scooters, and bicycles.

11. Exploring steps that can be taken to enhance hot water heater, microwave oven, and dishwasher recycling.

12. Developing suggested methods or criteria to determine economic feasibility for salvaging metallic discards.

APPENDIX A-1

Material Processing Questionnaire,
California Integrated Waste Management Board
November 6, 1992 and Summary of Responses to Questionnaire

STATE OF CALIFORNIA

Pete Wilson, Governor

CALIFORNIA INTEGRATED WASTE MANAGEMENT BOARD
8800 Cal Center Drive
Sacramento, California 95826

November 6, 1992

Dear Owner/Operator:

The California Integrated Waste Management Board (CIWMB) is distributing the enclosed survey to metallic processing facilities, scrap dealers, and appliance repair facilities within California in an attempt to expand our knowledge and database on processes to recover and recycle metallic discards and the special materials contained in metallic discards in this state. This information will be used to assist staff in meeting the requirements of Assembly Bill 1760 (AB 1760, Eastin, Chapter 849, Statues of 1991), codified in Public Resources Code Sections 41270-41276).

AB 1760 (copy enclosed) requires the CIWMB to examine the issues concerning the disposal and recycling of metallic discards (such as major appliances and vehicles) and the special wastes within them (i.e. CFCs, PCBs, sodium azide canisters, etc.). The CIWMB is required to develop a "metallic discards" management plan to encourage decreasing the disposal of recyclable metallic discards at solid waste landfills and to increase recycling in the most cost effective and environmentally safe manner. It is essential that we receive input from the industry itself in order for us to complete a comprehensive report that may assist industry in meeting the requirements of AB 1760. Included in the management plan may be recommendations for new legislation, regulations, or implementation policies.

The surveys are to be sent to Science Applications International Corporation (SAIC), a contractor commissioned by the CIWMB to assist with the management plan. Due to the time frame required of us by the Legislature, we are requesting that you return the survey in the self-addressed stamped envelope **by November 23,1992.**

All information that is collected from this survey will be used for data analysis **only**, by SAIC , and not for enforcement purposes. The Board's contractor intends to keep all answers confidential and not release them to others, within the limits of applicable laws. No specific facility/company will be named within the management plan itself.

We would be very appreciative if you would supply us with any information on your program or information on other programs that are not covered in the attached survey. The comment section at the end of the survey can be used for additional information or for any recommendations that you may have to improve the current management of metallic discards.

If you have any questions concerning this survey, please do not hesitate to call me at (916) 255-2343 or Trevor O'Shaughnessy at (916) 255-2344.

Thank you in advance for your cooperation,

Stephen Austrheim-Smith
Senior Waste Management Engineer
Special Wastes Section
Research and Technology Development Division

Enclosures

cc: Tom Jensen, SAIC

Materials Processing Questionnaire

Contact Person: _____ Phone: (____)_____

Site Information:

Facility name: _____

Address: _____

Facility type: Landfill, Appliance Dealer, Reclaimer, Other_____

Please mark a (✓) for each of the following questions.

		Yes	No	Estimated No. /Year	Estimated Tons/Year
1.	Types of Materials Handled:				
a.	CFC containing Metallics	___	___	_____	_____
b.	PCB containing Metallics	___	___	_____	_____
c.	Air Conditioners	___	___	_____	_____
d.	Auto Bodies and Parts	___	___	_____	_____
e.	Dehumidifiers	___	___	_____	_____
f.	Freezers	___	___	_____	_____
g.	Refrigerators	___	___	_____	_____
h.	Dishwashers	___	___	_____	_____
i.	Dryers	___	___	_____	_____
j.	Machinery	___	___	_____	_____
k.	Microwaves	___	___	_____	_____
m.	Residential Furnaces	___	___	_____	_____
n.	Washers	___	___	_____	_____
f.	Electronic Products	___	___	_____	_____
i.	Metal Furniture	___	___	_____	_____
k.	Ranges/Ovens	___	___	_____	_____
o.	Water Heaters	___	___	_____	_____
p.	Wood Burning Stoves	___	___	_____	_____
q.	Other (name)				

2. Do You have Collection Services?

Yes, (if yes, please answer 2a-2f) No, (if no, please move on to question 3)

		Yes	No	Estimated No./Year
a.	Do you collect appliances curbside?	___	___	_____
b.	Are individuals or clients allowed to drop-off appliances?	___	___	_____
c.	Do you provide satellite trailers for citizen drop-off?	___	___	_____

d. Do you provide CFC evacuation for homeowners? Yes or no

e. If drop-off or trailers are provided, where are the sites? (e.g. landfills, City/County Yards, Warehouses, other)

_____

f. What is your service area, in general: (neighborhood, city, county region, other ____

_____

g. What rates do you charge per unit? _____

3. Do you Store Appliances after collection?

Yes, (if yes, please answer 3a-3b) No, (if no, please move on to question 4)

a. Describe where they are stored and for how long (warehouse, scrap pile, etc.):
_____ and for how long
___ up to 1 month ___ 1-3 months ___ 3-6 months ___ 7 months to 1 year
___ more than a year

b. How are the appliances transported (i.e. whole, flattened, etc.) _____

_____

_____

and what are the transportation costs per unit or per pound? _____

4. Do You Process Appliances?

Yes, (if yes, please answer 4a-4i) No, (if no, please move on to question 5)

a. A brief description of steps taken to process reclaimed metallic discards and the special materials (ie: freon, oil, other) contiained within them. Please discuss the final use or disposal method of each material. _____

_____

_____

_____

_____

_____

b. Do you charge a processing fee? if yes how much? _____

c. Processing capacity (units or tons/yr.) _____

d. Special materials processed: (note by processing rate, lbs/yr if avaliable, otherwise just check.)

___ CFC-11 ___ CFC-12 ___ PCB ___ Oil ___ Ammonia ___ HCFC-22
___ others _____

e. What laws and regulations currently govern your processing of these materials (Federal, State, Local)? _____

_____

f. Processing equipment: (note by quantity)

__ Loader __ Compactor __ Shredder __ CFC Equip.
__ Fork Lift __ Baler __ Classifier
__ Others _____

_____

g. Do you shred or bale appliances? ___ shred ___ bale
___ neither

h. What are your specifications or requirements for accepting appliances (e.g. free of special materials [CFC's, PCB], size limitations, minimum quantity)? _____

_____

_____

i. Where are processed appliances taken? (e.g. out-of-County, state)_____

_____

_____

5. Please list any standards you know of imposed by industry for reclaiming materials? _____

6. Please provide estimate costs to implement Clean Air Act requirements that require evacuation of CFCs from appliances prior to disposal. Specify types of costs incurred (i.e., new recovery equipment, reclaiming equipment, training, phasing out operations, etc.). _____

7. Do you have any recommendations to improve the regulation, handling, processing and profitability of metallic discards, keeping in mind that the goal is to recover and recycle valuable materials in an environmentally sound and economical manner. (e.g. education, training, State role, licensing, costs): (use additional paper if needed)_____

recycling of those products.

SEC. 2. Chapter 3.5 (commencing with Section 42160) is added to Part 3 of Division 30 of the Public Resources Code, to read:

CHAPTER 3.5. METALLIC DISCARDS

Article 1. Definitions

42160. The definitions in this article govern the construction of this chapter.

42161. "Metallic discard" means any large metal article or product, or any part thereof, including, but not limited to, metal furniture, machinery, major appliances, electronic products, and wood-burning stoves.

42162. "Salvage" means the controlled removal of metallic discards from the solid waste stream at a permitted solid waste facility for the express purpose of recycling or reuse.

42163. "Recycling residue" means nonhazardous residue or residue treated to be nonhazardous that is a direct result of metals recovery operations for the express purposes of recycling.

42164. "Solid waste landfill" means a solid waste landfill, as defined in Section 46027.

42165. "Vehicle" means any device used for transportation. "Vehicle" includes bicycles, airplanes, and other transportation devices not used on highways, and automobiles and other vehicles, as defined in Section 670 of the Vehicle Code.

42166. "Major appliance" means any domestic or commercial device, including, but not limited to, a washing machine, clothes dryer, hot water heater, dehumidifier, conventional oven, microwave oven, stove, refrigerator, freezer, air-conditioner, trash compactor, and residential furnace.

42167. "Materials which require special handling" means sodium azide canisters in unspent air bags which are determined to be hazardous by federal and state law or regulation, encapsulated polychlorinated biphenyls (PCBs) in major appliances, and chlorofluorocarbons (CFCs) injected in air-conditioning/refrigeration units or any other hazardous waste or hazardous material regulated by the Department of Toxic Substances Control.

42168. "Solid waste facility" means a solid waste facility as defined in Section 40194.

Article 2. Disposal of Metallic Discard

42170. (a) After January 1, 1994, no solid waste facility shall accept for disposal any major appliance, vehicle, or other metallic discard which contains enough metal to be economically feasible to salvage as determined by the solid waste facility operator.

(b) After January 1, 1994, no person shall place a major appliance or other metallic discard in mixed municipal solid waste or dispose of a major appliance or other metallic discard in or on land, except for a solid waste landfill operator who complies with subdivision (a). This material shall be delivered to a facility to process for reuse or recycling, placed in a solid waste facility for salvage, or disposed of at a solid waste landfill if economically infeasible to salvage.

(c) Notwithstanding any other provision of law, any solid waste facility operator who salvages major appliances, vehicles, other metallic discards or other recyclables shall not be required to revise the solid waste facilities permit to implement these activities.

(d) This section shall be subject to enforcement pursuant to Chapter 1 (commencing with Section 45000) of Part 5.

42171. The board shall evaluate the use of recycling residue for use as solid waste landfill cover materials or for use as extenders for currently used cover material. If used as daily cover or as extenders to daily cover, recycling residues shall have all of the physical characteristics required by regulations for cover materials adopted pursuant to Section 43020. The results of this evaluation shall be reported pursuant to Section 42950.

42172. The board shall conduct its evaluation of recycling residue in consultation with the Department of Toxic Substances Control, the State Air Resources Board, the State Water Resources Control Board, and any other agency having pertinent jurisdiction. Recycling residue used as daily cover or as extenders in daily cover shall meet performance standards and requirements for cover material as specified in Sections 17682, 17683, and 18211 of Title 14 of the California Code of Regulations.

Article 3. Processing Metallic Discards

42175. On or after January 1, 1994, materials which require special handling shall be removed from major appliances and vehicles in which they are contained prior to crushing for transport or transferring to a baler or shredder for recycling.

42176. On or before January 1, 1993, and with existing funds, the board shall develop and submit a management plan to the Legislature for the removal of materials which require special handling from major appliances and vehicles. The plan shall specify how the removal of materials which require special handling should be financed and administered. The plan shall also specify what, if any, state agency approvals are to be required of those persons removing these materials.

Article 4. Fees and Surcharges for Recycling Residue

42185. No city or county shall impose any fees, except facility operating fees, state-mandated fees, or fees pursuant to Sections

41901, 41902, 41903, and 43213, or surcharges on the disposal of recycling residue generated from the metals recovery and reuse of major appliances, vehicles, and other metallic discards, provided the residue is not delivered to the solid waste facility mixed with other solid waste.

O

CHAPTER 849

An act to add Chapter 3.5 (commencing with Section 42160) to Part 3 of Division 30 of the Public Resources Code, relating to solid waste.

[Approved by Governor October 11, 1991. Filed with Secretary of State October 11, 1991.]

LEGISLATIVE COUNSEL'S DIGEST

AB 1760, Eastin. Solid waste: metallic waste.

Existing law regulates the disposal of solid waste, and requires any hazardous waste, as defined, that is disposed of in a solid waste landfill, to be disposed of in a hazardous waste facility, as defined.

This bill would, after January 1, 1994, prohibit a solid waste facility from accepting for disposal any major appliance, vehicle, or other metallic discard, as defined, which contains enough metal to be economically feasible to salvage as determined by the solid waste facility operator.

The bill would require the California Integrated Waste Management Board to evaluate, as prescribed, the use of recycling residue, as defined, for use as solid waste landfill cover materials, as specified, or extenders for currently used cover material.

The bill would, after January 1, 1994, prohibit any person, except as specified, from placing a major appliance or other metallic discard in mixed municipal solid waste or disposing of a major appliance or other metallic discard in or on land. The bill would require after January 1, 1994, that materials which require special handling, as defined, be removed from major appliances and vehicles in which they are contained prior to crushing for transport or transferring to a baler or shredder for recycling. The bill would require the board by January 1, 1993, to develop and submit to the Legislature a management plan for the removal of materials which require special handling from major appliances and vehicles. The bill would prescribe related matters.

The people of the State of California do enact as follows:

SECTION 1. The Legislature finds and declares that the disposal of major appliances and other large metallic discards in solid waste landfills needlessly uses scarce landfill capacity. The Legislature further finds and declares that major appliances, automobile bodies and parts, and other large metallic items can be effectively separated from the waste stream and recycled. Therefore, the Legislature finds and declares that the purpose of this act is to decrease the disposal of recyclable metallic discards at solid waste landfills and to increase

Definition of Terms

·Appliance
Appliances are defined as residential or commercial air conditioners, clothes dryers, clothes washers, dishwashers, freezers, microwave ovens, ovens, refrigerators, or stoves. In addition, for the purpose of this study, appliances include trash compactors, garbage disposals, water heaters, residential furnaces, humidifiers, and dehumidifiers.

·Appliance Recycling
Reuse of the metals (primarily steel), chlorofluorocarbon refrigerant gases and other materials from discarded appliances.

·Appliance "Scrapper"
An appliance scrapper is an individual or service that collects appliances from household and businesses, often for little or no fee, and delivers the appliances to a scrap yard or metal shredder, usually without processing.

·Capacitor
A device for accumulating and holding a charge of electricity. This device may contain PCBs.

·Chlorofluorocarbons (CFCs)
A group of synthetic compounds that contain chlorine, fluorine and carbon. They are used in appliances as a refrigerant gas and a blowing agent for foam insulation. CFCs most commonly used in appliances are CFC-11, CFC-12, CFC-114, CFC-500, CFC-502, and the hydrochlorofluorocarbon HCFC-22. CFCs can be recovered, recycled, or reclaimed.

·Discarded Appliances
Appliances removed permanently from service.

·Discarded Appliance Management System
The combination of elements and services used to collect, transport, process, and recycle appliances including removal and handling of PCBs, CFCs, and other contaminants, and the baling or compaction of appliances for transport, and the shredding prior to reuse of the metals.

·Discarded Appliance Processing
A service which includes; 1) the removal and the proper disposal of capacitors and electrical ballasts which may contain PCBs; 2) the recovery of CFCs and HCFCs from refrigerators, freezers, air conditioners, and dehumidifiers; 3) the removal of other contaminating materials which may include mercury switches, ammonia, and others; 4) the recovery of other materials (e.g. plastics, aluminum); and 5) the delivery of the metal appliance shell to a metal recycler.

Polychlorinated Biphenyls (PCBs)
A group of synthetic compounds found in some capacitors and electrical ballasts in appliances. PCBs were used where thermal stability, resistance to corrosive, inertness, and fire retardant properties were required. The stability of these compounds has made PCBs highly persistent in the environment which led to accumulating levels of PCBs in the food chain. Among the detrimental effects on humans, is the a potential to cause cancer.

Used Appliance Business (Rebuild for Resale)
Used appliances, typically refrigerators, washers, dryers, stoves, freezers, air conditioners, and microwave ovens, are often returned to working condition, sometimes painted, and sold as a rebuilt unit. Businesses conducted this activity are known as used appliance dealers.

SUMMARY OF SURVEY RESULTS

In November 1992, the CIWMB survey was sent to 243 businesses and government agencies engaged in metallic discards management. A total of 56 responses were received (23 percent return rate). Responses by category of business or agency surveyed were as follows:

Auto Dismantling/Wrecking/Recycling	22
Appliance Dealers/Service and Repair Shops	9
Landfills	6
Electric utility	1
Recyclers/Reclaimers	5
Local Enforcement Agencies	4
Other (N/A, no data, etc.)	9

Below is a summary of the survey results by category.

Auto Dismantling/Wrecking/Recycling Facilities

Twenty-two facilities in this category responded to the survey. Because most of the questionnaire was focused on appliance handlers and processors, limited useful information regarding the processing of automobile bodies and parts is available from the survey. Thirteen facilities classified themselves as auto dismantlers, five as automobile wreckers, two as auto parts dealers, one as an auto recycler, and one as an auto salvager. The facilities responding to the survey ranged from small (between one and 40 automobiles processed/year) to very large (6,000 automobiles processed/year) in size. Eight facilities handled between 175 and 700 autos/year.

The survey respondents' knowledge of industry standards was incomplete. Eight facilities responding to the survey question on industry standards alluded to freon (CFC) recovery requirements. One facility reported that "Crushers require us to remove fluids, tires and fuel tank from vehicles before delivery." Another facility cited "EPA standards for auto dismantlers."

Five facilities responded as having incurred costs ranging from $1,000 to $5,000 with an average of about $1,800 as a result of the new Clean Air Act Amendments (CAA). These costs are presumed to include CFC recovery equipment and training.

Recommendations from auto dismantling/recycling facilities on a management program are as follows:

- Promote maximum recycling of automobiles.
- Provide complete auto recycling centers for 1) batteries, 2) waste oil, 3) anti-freeze, 4) tires, and 5) used fuel tanks.
- Impose advance disposal fees to reduce the added burden on dismantlers and reduce incentives for illegal dumping.
- Give recyclers incentives instead of additional costly compliance requirements.
- Streamline duplicate environmental requirements by coordinating government efforts.
- Charge a minimum fee to encourage more recycling.

- License and inspect so-called recyclers to confirm that they are legitimate.
- Make sure that a system is in place prior to implementing new rules and regulations (i.e., before stating that all air conditioning units must be recycled, government should set up a recycling mechanism and recycling locations.)
- Educate not only industry (i.e., where to recycle, with whom and what materials), but also local and county government as to the type of information that is required to comply and what type of recycling companies can service this industry.

Appliance Dealers/Service and Repair Shops

Nine facilities in this category responded to the survey. Six of the nine reported that they evacuate CFCs from appliances. These facilities were aware of the requirement to remove CFCs from appliances. Equipment costs for meeting the new CAA requirements ranged from approximately $500 to over $2,000. One facility stated that it does not handle appliances containing CFCs (i.e., refrigerators, freezers, air conditioners.) Two of the facilities collect appliances and charge $15 and $45, respectively, for removing CFCs. Nearly all dealers store appliances, usually in a warehouse or on-site in the shop. Length of storage ranges from one to seven months. All facilities reported that they transport their appliances whole for disposal or recycling. Two of the facilities allow consumers to drop off used appliances.

Recommendations from appliance dealers/service shops on a management program are as follows:

- Establish recovery system guidelines. Provide information on where recovered freon can be disposed. Issue regulations prior to requiring that equipment be purchased so that facilities know if they have purchased equipment that meets EPA standards.
- Provide a place to dispose of used appliances because landfills are too costly.

Landfills

Six landfills and one recycling facility at a landfill responded to the survey. These facilities collect large metallic discards and store them in a scrap pile until a large enough quantity of material is generated for transport to a processor. Only two of the facilities listed requirements for accepting large metallic discards (i.e., all doors removed from appliances, autos quartered with no sears, no PCBs, no commercial refrigeration equipment.) Three facilities either removed the freon themselves or contracted out for its removal. CFC evacuation fees were reported as $2.50 or $5 per refrigerated appliance. One landfill reported that it did not charge a fee for CFC evacuation, but it charged a $7.10 tipping fee. One of the facilities reported that it is charged $8 per unit for CFC evacuation, another $10 per unit, and a third $15 to $25 per unit. One facility reported that it only accepts appliances that are certified to be free of CFCs. Another facility reported, as the cost of handling/processing refrigeration units goes up as result of CAA, it is likely that unaware persons will remove the refrigeration unit from appliances to avoid incurring a disposal fee.

Metallic discards are usually either baled or flattened and delivered to a metals processor. Two of the facilities periodically bring in portable balers. One facility reports that it will install a baler permanently in 1993. One other facility mentioned that its processed appliances are sent to a steel mill and that the discards are marketed by its baling contractor. One rural facility listed its transport costs as $400 per

10,000 pounds. Only one facility listed industry standards for metallic discards (i.e., no motors [copper contamination], no wood [as in freezer frames], and minimal aluminum and plastic.)

Recommendations from landfill operators on a management program are as follows:

- Finalize regulations for CFC removal and for PCB handling and disposal.
- Create advance disposal fees on appliances requiring special handling. Charging a processing fee at the time of dumping is an incentive to illegal dumping.
- Design appliances to ease dismantling.
- Provide better public education of the hazards of CFC to the environment.

Electric Utility

One electric utility responded to the survey. It processes 18,000 refrigerators per year. The appliances are transported whole and stored in a storage yard. These appliances are accepted as part of a rebate trade-in program. The facility removes freon with a Pinnacle machine. The freon is transferred to cylinders to be sold. Oil from the refrigerator compressors is removed, processed as a hazardous waste and sold to recyclers. Processed appliances are shipped to a metals processor. This facility spent $20,100 on CFC evacuation equipment and $400 on certification training.

Recyclers/Reclaimers

Five facilities in this category responded to the survey. None of these facilities listed themselves as handling metallic discards that contain PCB (one handles CFCs). One facility provides drop-off collection services. Respondents process between 10,000 and 1,000,000 tons of metallic discards per year.

All facilities reported that material coming to them must be free of PCBs (one processes CFCs). Additional requirements listed by one or more facilities included: free of all oils, electric components, excess insulation, tires, rubber, wood, and foam. Processed metals are shipped to steel mills. Fluff or residue is usually landfilled.

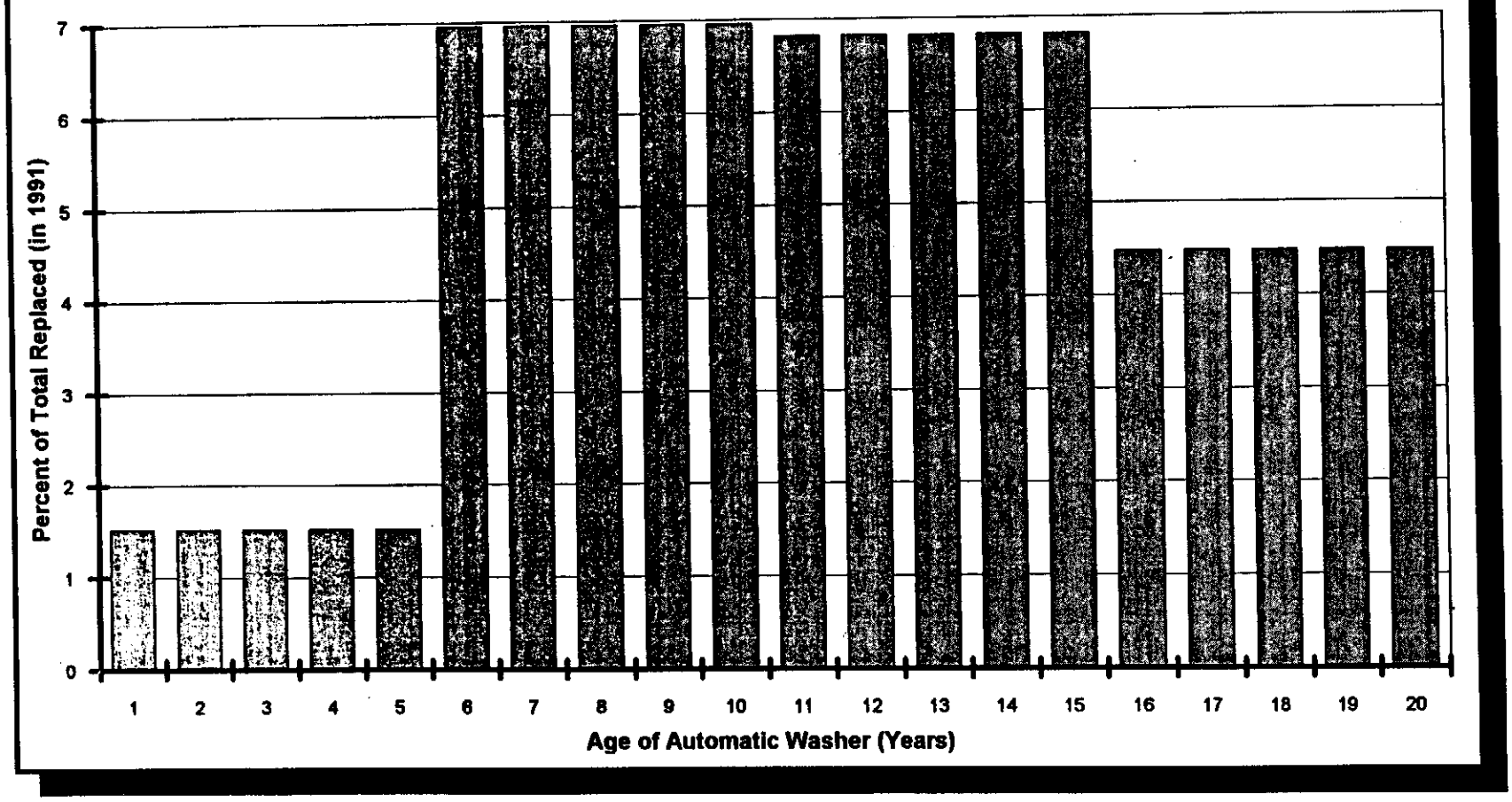
Recommendations from recyclers/reclaimers on a management program are as follows:

- Educate state, county, city and federal employees because they need to understand the recycling business before they impose laws.
- All metallic discards going to landfills should be recycled; they should be pulled out as they come off trucks and taken to recycling plants; all other waste should be gasified and used as electricity.

APPENDIX A-2

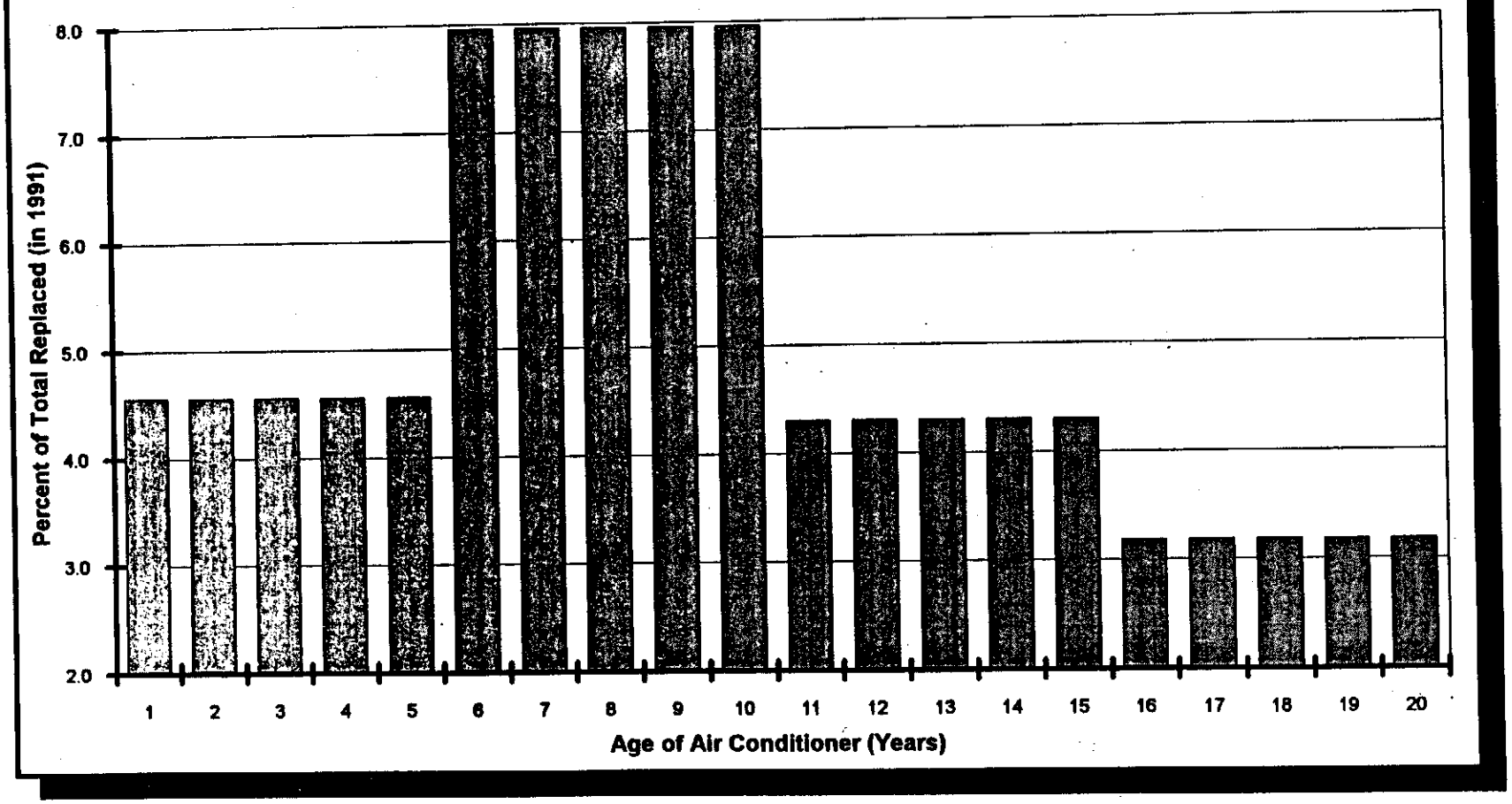
Appliance Replacement Data

Exhibit A-1: Automatic Washers



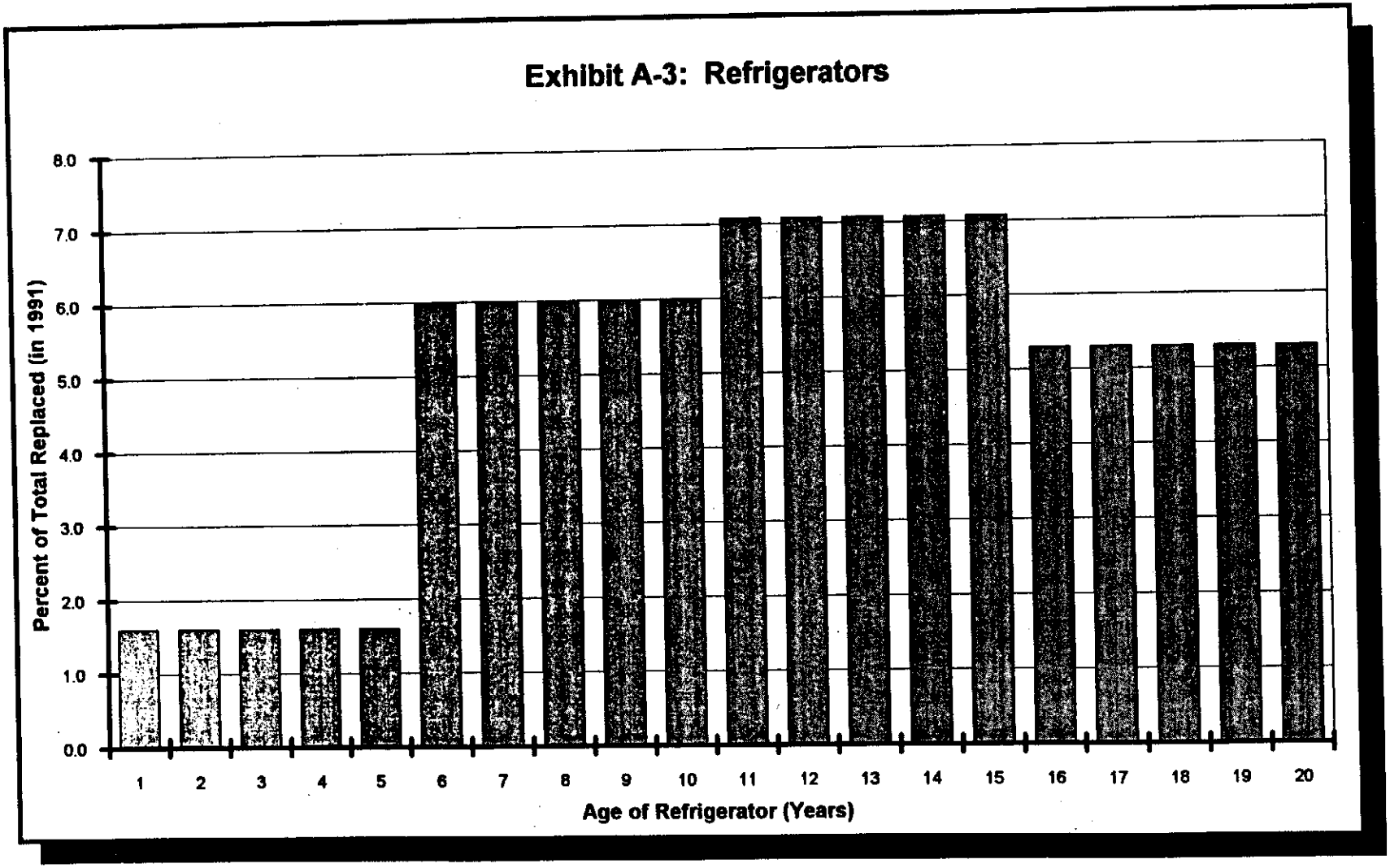
Source: Quantification of Metallic Discards in California, Cal Recovery, Inc., 1992

Exhibit A-2: Air Conditoners (Room type)



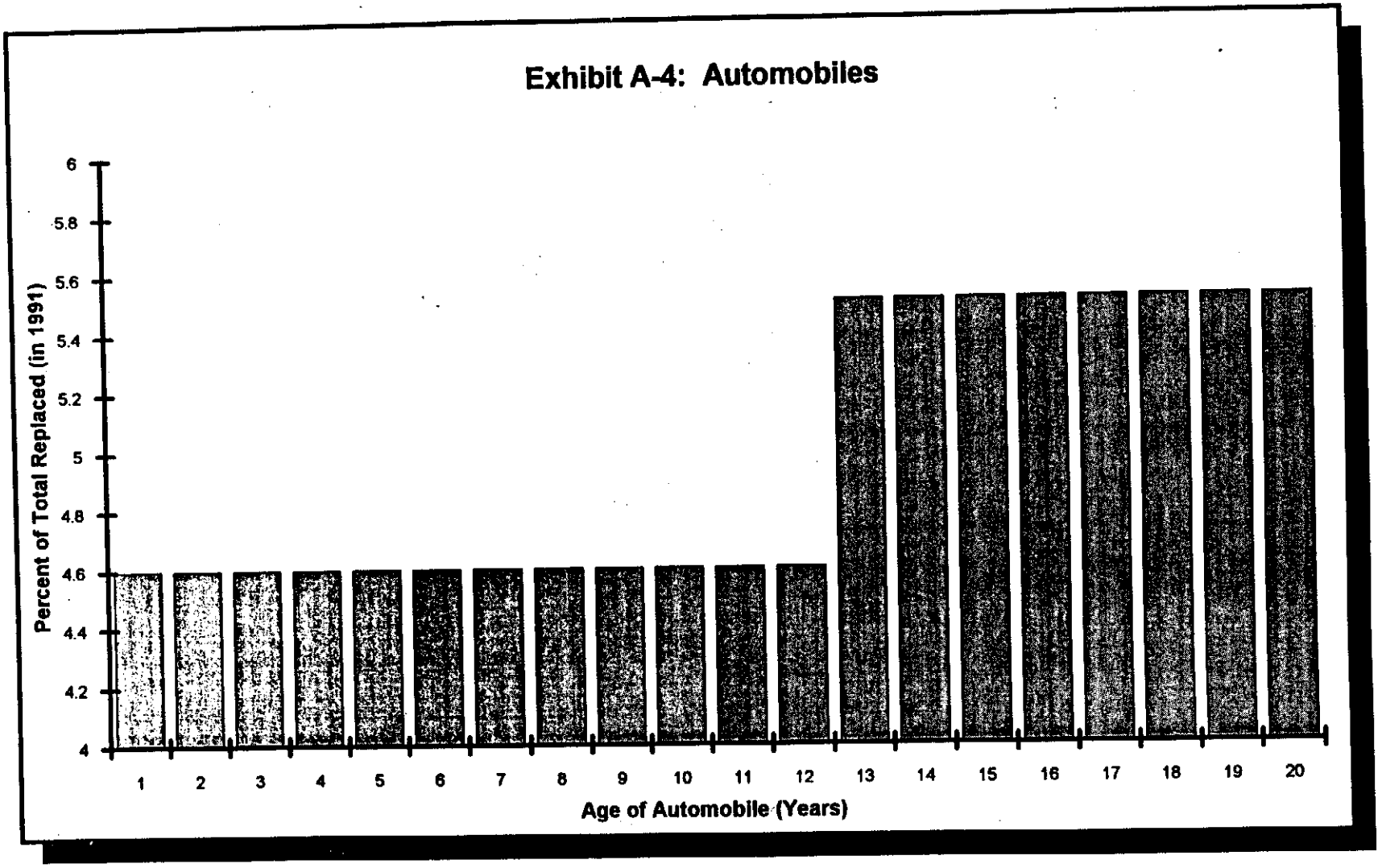
Source: Quantification of Metallic Discards in California, Cal Recovery, Inc., 1992

Exhibit A-3: Refrigerators



Source: Quantification of Metallic Discards in California, Cal Recovery, Inc., 1992

Exhibit A-4: Automobiles



Source: Quantitification of Metallic Discards in California, Cal Recovery, Inc., 1992

Table A-1: Automatic Washers

AUTOMATIC WASHERS

Year	Units Sold c)	Percent-> a) / Years -> b)	Product Life Distribution 1.5 / 1	1.5 / 2	1.5 / 3	1.5 / 4	1.5 / 5	7.0 / 6	7.0 / 7	7.0 / 8	7.0 / 9	7.0 / 10	6.0 / 11	6.0 / 12	6.0 / 13	6.0 / 14	6.0 / 15	4.5 / 16	4.5 / 17	4.5 / 18	4.5 / 19	4.5 / 20
1970	341,654																					17,564
1971	359,520																				16,877	16,877
1972	392,505																			18,554	18,554	18,554
1973	421,372																		16,589	16,589	16,589	16,589
1974	414,151																	17,525	17,525	17,525	17,525	17,525
1975	370,286																26,238	18,549	18,549	18,549	18,549	18,549
1976	391,187															29,039	29,039	19,075	19,075	19,075	19,075	19,075
1977	414,047														29,308	29,308	29,308	19,251	19,251	19,251	19,251	19,251
1978	425,790													26,530	26,530	26,530	26,530	17,427	17,427	17,427	17,427	17,427
1979	429,710												25,554	25,554	25,554	25,554	25,554	16,786	16,786	16,786	16,786	16,786
1980	389,000											23,420	22,949	22,949	22,949	22,949	22,949	15,075	15,075	15,075	15,075	15,075
1981	374,690										26,600	26,600	26,065	26,065	26,065	26,065	26,065	17,122	17,122	17,122	17,122	17,122
1982	336,492									34,055	34,055	34,055	33,370	33,370	33,370	33,370	33,370	21,921	21,921	21,921	21,921	21,921
1983	392,196								36,672	36,672	36,672	36,672	35,935	35,935	35,935	35,935	35,935	23,605	23,605	23,605	23,605	23,605
1984	489,300							40,827	40,827	40,827	40,827	40,827	40,006	40,006	40,006	40,006	40,006	26,280	26,280	26,280	26,280	26,280
1985	526,900						9,915	45,400	45,400	45,400	45,400	45,400	44,487	44,487	44,487	44,487	44,487	29,223	29,223	29,223	29,223	29,223
1986	586,600					10,432	10,432	47,766	47,766	47,766	47,766	47,766	46,806	46,806	46,806	46,806	46,806	30,746	30,746	30,746	30,746	30,746
1987	652,300				10,030	10,030	10,030	45,929	45,929	45,929	45,929	45,929	45,005	45,005	45,005	45,005	45,005	29,564	29,564	29,564	29,564	29,564
1988	666,300			9,109	9,109	9,109	9,109	41,711	41,711	41,711	41,711	41,711	40,872	40,872	40,872	40,872	40,872	26,849	26,849	26,849	26,849	26,849
1989	659,900			8,936	8,936	8,936	8,936	40,925	40,925	40,925	40,925	40,925	40,102	40,102	40,102	40,102	40,102	26,342	26,342	26,342	26,342	26,342
1990	599,300																					
1991	588,000																					

NUMBER OF UNITS REPLACED BY YEAR

No. of Units to be Replaced For ——>		1991	1990	1989	1988	1987	1986	1985	1984	1983	1982	1981	1980	1979	1978	1977	1976	1975	1974	1973	1972	1991 Total Units Gen. for Discard
		8,936	9,109	10,030	10,432	9,915	40,827	36,672	34,055	26,600	23,420	25,554	26,530	29,308	29,039	26,238	17,525	16,589	18,554	16,877	17,564	437,796
Ave. Unit Wt = (lb)	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	

TONS TO BE REPLACED BY YEAR

Tons to be Replaced For Yr.——>	1991	1990	1989	1988	1987	1986	1985	1984	1983	1982	1981	1980	1979	1978	1977	1976	1975	1974	1973	1972	1991 Total Weight Gen. (tons)
	787	808	893	934	892	3695	3337	3118	2447	2166	2377	2481	2755	2744	2683	1674	1593	1790	1631	1714	40,714

a) Percentage replaced in specific year.

b) Number of years after initial purchase.

c) AHAM

Source: Quantification of Metallic Discards in California, Cal Recovery, Inc., 1992

Table A-2: Room Air Conditioners

AIR CONDITIONERS (Room)

Product Life Distribution

Year	Units Sold	Percent--> Years-->	4.0 1	4.0 2	4.0 3	4.0 4	4.0 5	8.0 6	8.0 7	8.0 8	8.0 9	8.0 10	4.3 11	4.3 12	4.3 13	4.3 14	4.3 15	3.2 16	3.2 17	3.2 18	3.2 19	3.2 20	
1970	161,610		7,369	7,369	7,369	7,369	7,369	12,864	12,864	12,864	12,864	12,864	6,949	6,949	6,949	6,949	6,949	5,139	5,139	5,139	5,139	5,139	
1971	181,466		8,276	8,276	8,276	8,276	8,276	14,446	14,446	14,446	14,446	14,446	7,804	7,804	7,804	7,804	7,804	5,771	5,771	5,771	5,771	5,771	
1972	233,979		10,669	10,669	10,669	10,669	10,669	18,625	18,625	18,625	18,625	18,625	10,061	10,061	10,061	10,061	10,061	7,441	7,441	7,441	7,441	7,441	
1973	219,818		10,024	10,024	10,024	10,024	10,024	17,498	17,498	17,498	17,498	17,498	9,452	9,452	9,452	9,452	9,452	6,990	6,990	6,990	6,990	6,990	
1974	133,719		6,097	6,097	6,097	6,097	6,097	10,644	10,644	10,644	10,644	10,644	5,750	5,750	5,750	5,750	5,750	4,252	4,252	4,252	4,252	4,252	
1975	84,508		3,854	3,854	3,854	3,854	3,854	6,727	6,727	6,727	6,727	6,727	3,634	3,634	3,634	3,634	3,634	2,687	2,687	2,687	2,687	2,687	
1976	96,516		4,492	4,492	4,492	4,492	4,492	7,842	7,842	7,842	7,842	7,842	4,236	4,236	4,236	4,236	4,236	3,133	3,133	3,133	3,133	3,133	
1977	110,269		5,028	5,028	5,028	5,028	5,028	8,777	8,777	8,777	8,777	8,777	4,742	4,742	4,742	4,742	4,742	3,507	3,507	3,507	3,507	3,507	
1978	121,320		5,532	5,532	5,532	5,532	5,532	9,657	9,657	9,657	9,657	9,657	5,217	5,217	5,217	5,217	5,217	3,858	3,858	3,858	3,858	3,858	
1979	134,860		6,140	6,140	6,140	6,140	6,140	10,719	10,719	10,719	10,719	10,719	5,790	5,790	5,790	5,790	5,790	4,282	4,282	4,282	4,282	4,282	
1980	85,370		3,893	3,893	3,893	3,893	3,893	6,795	6,795	6,795	6,795	6,795	3,671	3,671	3,671	3,671	3,671	2,715	2,715	2,715	2,715	2,715	
1981	94,470		4,306	4,306	4,306	4,306	4,306	7,520	7,520	7,520	7,520	7,520	4,062	4,062	4,062	4,062	4,062	3,004	3,004	3,004	3,004	3,004	
1982	62,177		2,835	2,835	2,835	2,835	2,835	4,949	4,949	4,949	4,949	4,949	2,674	2,674	2,674	2,674	2,674	1,977	1,977	1,977	1,977	1,977	
1983	58,695		2,676	2,676	2,676	2,676	2,676	4,672	4,672	4,672	4,672	4,672	2,524	2,524	2,524	2,524	2,524	1,867	1,867	1,867	1,867	1,867	
1984	142,600		6,503	6,503	6,503	6,503	6,503	11,351	11,351	11,351	11,351	11,351	6,132	6,132	6,132	6,132	6,132	4,535	4,535	4,535	4,535	4,535	
1985	204,200		9,312	9,312	9,312	9,312	9,312	16,254	16,254	16,254	16,254	16,254	8,781	8,781	8,781	8,781	8,781	6,494	6,494	6,494	6,494	6,494	
1986	133,700		6,097	6,097	6,097	6,097	6,097	10,643	10,643	10,643	10,643	10,643	5,749	5,749	5,749	5,749	5,749	4,252	4,252	4,252	4,252	4,252	
1987	109,700		5,002	5,002	5,002	5,002	5,002	8,732	8,732	8,732	8,732	8,732	4,717	4,717	4,717	4,717	4,717	3,486	3,486	3,486	3,486	3,486	
1988	177,400		8,089	8,089	8,089	8,089	8,089	14,121	14,121	14,121	14,121	14,121	7,626	7,626	7,626	7,626	7,626	5,641	5,641	5,641	5,641	5,641	
1989	193,400		8,819	8,819	8,819	8,819	8,819	15,395	15,395	15,395	15,395	15,395	8,316	8,316	8,316	8,316	8,316	6,150	6,150	6,150	6,150	6,150	
1990	176,100		8,030	8,030	8,030	8,030	8,030	14,018	14,018	14,018	14,018	14,018	7,572	7,572	7,572	7,572	7,572	5,600	5,600	5,600	5,600	5,600	
1991	90,000		4,104	4,104	4,104	4,104	4,104	7,164	7,164	7,164	7,164	7,164	3,870	3,870	3,870	3,870	3,870	2,862	2,862	2,862	2,862	2,862	
No. of Units for Replacement From ——>			1991	1990	1989	1988	1987	1986	1985	1984	1983	1982	1981	1980	1979	1978	1977	1976	1975	1974	1973	1972	
			4,104	8,030	8,819	8,089	5,002	10,643	16,254	11,351	4,672	4,949	4,062	3,871	5,790	5,217	4,742	3,133	2,687	4,252	6,990	7,441	129,899
Avg. Unit Wt = (lbs)		132	132	132	132	132	132	131	131	131	131	130	125	125	125	120	120	120	115	115	110	105	
Tons to be Replaced From Yr.——>			TONS TO BE REPLACED BY YEAR																				
			1991	1990	1989	1988	1987	1986	1985	1984	1983	1982	1981	1980	1979	1978	1977	1976	1975	1974	1973	1972	
			271	530	582	534	330	697	1065	743	308	322	254	229	382	313	284	186	155	244	384	391	8,185

Source: Quantification of Metallic Discards in California, Cal Recovery, Inc., 1992

Table A-3: Refrigerators

REFRIGERATORS

Product Life Distribution

Year	Units Sold	Percent--> Years-->	1.0 1	1.0 2	1.0 3	1.0 4	1.0 5	6.0 6	6.0 7	6.0 8	6.0 9	6.0 10	7.1 11	7.1 12	7.1 13	7.1 14	7.1 15	5.3 16	5.3 17	5.3 18	5.3 19	5.3 20	
1970	464,520		7,432	7,432	7,432	7,432	7,432	27,872	27,872	27,872	27,872	27,872	32,999	32,999	32,999	32,999	32,999	24,620	24,620	24,620	24,620	24,620	
1971	503,760		8,060	8,060	8,060	8,060	8,060	30,227	30,227	30,227	30,227	30,227	35,666	35,666	35,666	35,666	35,666	26,700	26,700	26,700	26,700	26,700	
1972	539,753		8,636	8,636	8,636	8,636	8,636	32,385	32,385	32,385	32,385	32,385	38,215	38,215	38,215	38,215	38,215	28,607	28,607	28,607	28,607	28,607	
1973	558,681		8,938	8,938	8,938	8,938	8,938	33,521	33,521	33,521	33,521	33,521	39,555	39,555	39,555	39,555	39,555	29,610	29,610	29,610	29,610	29,610	
1974	493,099		7,890	7,890	7,890	7,890	7,890	29,586	29,586	29,586	29,586	29,586	34,911	34,911	34,911	34,911	34,911	26,134	26,134	26,134	26,134	26,134	
1975	412,815		6,605	6,605	6,605	6,605	6,605	24,769	24,769	24,769	24,769	24,769	29,227	29,227	29,227	29,227	29,227	21,879	21,879	21,879	21,879	21,879	
1976	457,455		7,319	7,319	7,319	7,319	7,319	27,447	27,447	27,447	27,447	27,447	32,386	32,386	32,386	32,386	32,386	24,245	24,245	24,245	24,245	24,245	
1977	525,535		8,409	8,409	8,409	8,409	8,409	31,532	31,532	31,532	31,532	31,532	37,206	37,206	37,206	37,206	37,206	27,853	27,853	27,853	27,853	27,853	
1978	528,960		8,462	8,462	8,462	8,462	8,462	31,732	31,732	31,732	31,732	31,732	37,443	37,443	37,443	37,443	37,443	28,030	28,030	28,030	28,030	28,030	
1979	537,710		8,603	8,603	8,603	8,603	8,603	32,263	32,263	32,263	32,263	32,263	38,070	38,070	38,070	38,070	38,070	28,499	28,499	28,499	28,499	28,499	
1980	481,280		7,220	7,220	7,220	7,220	7,220	27,077	27,077	27,077	27,077	27,077	31,951	31,951	31,951	31,951	31,951	23,918	23,918	23,918	23,918	23,918	
1981	440,880		7,081	7,081	7,081	7,081	7,081	26,441	26,441	26,441	26,441	26,441	31,200	31,200	31,200	31,200	31,200	23,356	23,356	23,356	23,356	23,356	
1982	397,437		6,199	6,199	6,199	6,199	6,199	23,248	23,248	23,248	23,248	23,248	27,431	27,431	27,431	27,431	27,431	20,534	20,534	20,534	20,534	20,534	
1983	474,218		7,567	7,567	7,567	7,567	7,567	28,453	28,453	28,453	28,453	28,453	33,575	33,575	33,575	33,575	33,575	25,134	25,134	25,134	25,134	25,134	
1984	660,500		10,568	10,568	10,568	10,568	10,568	39,630	39,630	39,630	39,630	39,630	46,763	46,763	46,763	46,763	46,763	35,007	35,007	35,007	35,007	35,007	
1985	715,600		11,460	11,460	11,460	11,460	11,460	42,936	42,936	42,936	42,936	42,936	50,664	50,664	50,664	50,664	50,664	37,927	37,927	37,927	37,927	37,927	
1986	770,300		12,421	12,421	12,421	12,421	12,421	46,578	46,578	46,578	46,578	46,578	54,962	54,962	54,962	54,962	54,962	41,144	41,144	41,144	41,144	41,144	
1987	861,100		13,779	13,779	13,779	13,779	13,779	51,666	51,666	51,666	51,666	51,666	60,966	60,966	60,966	60,966	60,966	45,638	45,638	45,638	45,638	45,638	
1988	942,800		15,085	15,085	15,085	15,085	15,085	56,566	56,566	56,566	56,566	56,566	66,750	66,750	66,750	66,750	66,750	49,966	49,966	49,966	49,966	49,966	
1989	851,900		13,630	13,630	13,630	13,630	13,630	51,114	51,114	51,114	51,114	51,114	60,315	60,315	60,315	60,315	60,315	45,151	45,151	45,151	45,151	45,151	
1990	878,400		14,054	14,054	14,054	14,054	14,054	52,704	52,704	52,704	52,704	52,704	62,191	62,191	62,191	62,191	62,191	46,555	46,555	46,555	46,555	46,555	
1991	837,400		13,398	13,398	13,398	13,398	13,398	50,244	50,244	50,244	50,244	50,244	59,268	59,268	59,268	59,268	59,268	44,382	44,382	44,382	44,382	44,382	

Number of Units for Replacement

From ---->			1991	1990	1989	1988	1987	1986	1985	1984	1983	1982	1981	1980	1979	1978	1977	1976	1975	1974	1973	1972	
1992	840,000		13,398	14,054	13,630	15,085	13,779	46,578	42,936	39,630	28,453	23,248	31,200	31,951	38,070	37,443	37,206	24,245	21,879	26,134	29,610	29,607	557,136
Ave. Unit Wt = (lbs)		236	237	238	241	243	247	249	251	253	255	258	266	274	282	300	310	318	325	333	340	345	

Tons to be Replaced — TONS TO BE REPLACED BY YEAR

From Yr.---->			1991	1990	1989	1988	1987	1986	1985	1984	1983	1982	1981	1980	1979	1978	1977	1976	1975	1974	1973	1972	
			1588	1660	1642	1833	1702	5799	5386	5013	3628	2999	4150	4377	5368	5616	5767	3855	3555	4351	5034	4935	78,290

Source: Quantification of Metallic Discards in California, Cal Recovery, Inc., 1992

Table A-4: Automobiles

AUTOMOBILES

Product Life Distribution

Year	New Reg	Percent-->	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	
		Years -->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
1970	1,350,000		61,875	61,875	61,875	61,875	61,875	61,875	61,875	61,875	61,875	61,875	61,875	61,875	74,250	74,250	74,250	74,250	74,250	74,250	74,250	74,250	
1971	1,370,990		62,837	62,837	62,837	62,837	62,837	62,837	62,837	62,837	62,837	62,837	62,837	62,837	75,404	75,404	75,404	75,404	75,404	75,404	75,404	75,404	
1972	1,392,081		63,804	63,804	63,804	63,804	63,804	63,804	63,804	63,804	63,804	63,804	63,804	63,804	76,564	76,564	76,564	76,564	76,564	76,564	76,564	76,564	
1973	1,413,172		64,770	64,770	64,770	64,770	64,770	64,770	64,770	64,770	64,770	64,770	64,770	64,770	77,724	77,724	77,724	77,724	77,724	77,724	77,724	77,724	
1974	1,434,262		65,737	65,737	65,737	65,737	65,737	65,737	65,737	65,737	65,737	65,737	65,737	65,737	78,884	78,884	78,884	78,884	78,884	78,884	78,884	78,884	
1975	1,455,353		66,704	66,704	66,704	66,704	66,704	66,704	66,704	66,704	66,704	66,704	66,704	66,704	80,044	80,044	80,044	80,044	80,044	80,044	80,044	80,044	
1976	1,476,444		67,670	67,670	67,670	67,670	67,670	67,670	67,670	67,670	67,670	67,670	67,670	67,670	81,204	81,204	81,204	81,204	81,204	81,204	81,204	81,204	
1977	1,507,564		68,097	68,097	68,097	68,097	68,097	68,097	68,097	68,097	68,097	68,097	68,097	68,097	82,916	82,916	82,916	82,916	82,916	82,916	82,916	82,916	
1978	1,538,685		70,523	70,523	70,523	70,523	70,523	70,523	70,523	70,523	70,523	70,523	70,523	70,523	84,628	84,628	84,628	84,628	84,628	84,628	84,628	84,628	
1979	1,569,805		71,949	71,949	71,949	71,949	71,949	71,949	71,949	71,949	71,949	71,949	71,949	71,949	86,338	86,338	86,338	86,338	86,338	86,338	86,338	86,338	
1980	1,600,926		73,376	73,376	73,376	73,376	73,376	73,376	73,376	73,376	73,376	73,376	73,376	73,376	88,051	88,051	88,051	88,051	88,051	88,051	88,051	88,051	
1981	1,632,046		74,802	74,802	74,802	74,802	74,802	74,802	74,802	74,802	74,802	74,802	74,802	74,802	89,763	89,763	89,763	89,763	89,763	89,763	89,763	89,763	
1982	1,666,922		76,488	76,488	76,488	76,488	76,488	76,488	76,488	76,488	76,488	76,488	76,488	76,488	91,785	91,785	91,785	91,785	91,785	91,785	91,785	91,785	
1983	1,705,567		78,173	78,173	78,173	78,173	78,173	78,173	78,173	78,173	78,173	78,173	78,173	78,173	93,808	93,808	93,808	93,808	93,808	93,808	93,808	93,808	
1984	1,742,373		79,859	79,859	79,859	79,859	79,859	79,859	79,859	79,859	79,859	79,859	79,859	79,859	95,831	95,831	95,831	95,831	95,831	95,831	95,831	95,831	
1985	1,779,146		81,544	81,544	81,544	81,544	81,544	81,544	81,544	81,544	81,544	81,544	81,544	81,544	97,853	97,853	97,853	97,853	97,853	97,853	97,853	97,853	
1986	1,815,924		83,230	83,230	83,230	83,230	83,230	83,230	83,230	83,230	83,230	83,230	83,230	83,230	99,876	99,876	99,876	99,876	99,876	99,876	99,876	99,876	
1987	1,850,449		85,548	85,548	85,548	85,548	85,548	85,548	85,548	85,548	85,548	85,548	85,548	85,548	102,655	102,655	102,655	102,655	102,655	102,655	102,655	102,655	
1988	1,918,975		87,661	87,661	87,661	87,661	87,661	87,661	87,661	87,661	87,661	87,661	87,661	87,661	105,434	105,434	105,434	105,434	105,434	105,434	105,434	105,434	
1989	1,987,500		90,177	90,177	90,177	90,177	90,177	90,177	90,177	90,177	90,177	90,177	90,177	90,177	108,213	108,213	108,213	108,213	108,213	108,213	108,213	108,213	
1990	1,839,548		88,896	88,896	88,896	88,896	88,896	88,896	88,896	88,896	88,896	88,896	88,896	88,896	106,675	106,675	106,675	106,675	106,675	106,675	106,675	106,675	
1991	1,744,096		79,938	79,938	79,938	79,938	79,938	79,938	79,938	79,938	79,938	79,938	79,938	79,938	95,925	95,925	95,925	95,925	95,925	95,925	95,925	95,925	

No. of Units for Replacement From ---->		1991	1990	1989	1988	1987	1986	1985	1984	1983	1982	1981	1980	1979	1978	1977	1976	1975	1974	1973	1972	
		79,938	88,896	90,177	87,661	85,548	83,230	81,544	79,859	78,173	76,488	74,802	73,376	86,338	84,628	82,916	81,204	80,044	78,884	77,724	76,564	1,628,186
Ave. Unit Wt = (lbs)	2898	2898	2950	3000	3050	3100	3150	3200	3250	3300	3350	3400	3450	3500	3600	3650	3700	3750	3800	3850	3942	

TONS TO BE REPLACED BY YEAR

Tons to be Replaced From Yr.---->		1991	1990	1989	1988	1987	1986	1985	1984	1983	1982	1981	1980	1979	1978	1977	1976	1975	1974	1973	1972	
		115750	131121	135266	133999	132594	131057	130471	129770	128998	128117	127184	126873	151094	152330	151322	150229	150083	149680	149820	150909	2,756,354

Source: Quantification of Metallic Discards in California, Cal Recovery, Inc., 1992

APPENDIX A-3

Quantification of Metallic Discards in California
Cal Recovery, Incorporated
December 1992

Final Report

Report 1349-A

Draft Report

QUANTIFICATION OF METALLIC DISCARDS IN CALIFORNIA

Submitted to:

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20 California Street, Suite 400
San Francisco, California 94111

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December 1992

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QUANTIFICATION OF METALLIC DISCARDS IN CALIFORNIA

INTRODUCTION

Objective

In an effort to conserve California's scarce landfill capacity, Assembly Bill 1760 was approved in October 1991 in order to decrease the disposal of metallic discards (e.g., large appliances and auto bodies) and increase the recycling of these wastes. Among other requirements, the bill prohibits a solid waste facility from "...accepting for disposal any major appliance, vehicle, or other metallic discard which contains enough metal to be economically feasible to salvage as determined by the facility operator after January 1, 1994". The bill also prohibits any person, except as specified, from placing the aforementioned discards in mixed municipal waste or disposing in or on land.

To plan accordingly for recycling and for the potential ban on disposal of certain metallic discards, the bill requires the California Integrated Waste Management Board (CIWMB) to develop and submit a management plan for the removal of materials which require special handling from major appliances and vehicles. The objectives of this study are to determine the potential quantities of metallic discards generated in California in 1991 by county, and to estimate the percentage that were diverted and disposed. The current estimates of diversion and disposal will be useful in estimating quantities of metallic discards in the future for the purpose of managing these wastes.

Types of Metallic Waste Studied

Table 1 provides a listing of the materials evaluated as part of this study. As noted earlier, Assembly Bill 1760 targets "major appliances, vehicles, and other metallic discards". For reference, the definition of these materials and other pertinent items, as defined in AB 1760, Chapter 3.5 in Part 3, Division 30 of the Public Resources Code (PRC), are reiterated here:

Table 1. Types of Metallic Discards

1	CFC Containing Metals
2	PCB Containing Metals
3	**Air Conditioners**
4	**Auto Bodies and Parts**
5	**Dehumidifiers**
6	**Freezers**
	Chest
	Upright
7	**Refrigerators**
8	**Dishwashers**
	Portable
	Built-In
9	**Dryers**
	Electric
	Gas
10	**Machinery**
11	**Microwaves**
12	**Residential Furnaces**
13	**Washers**
14	**Electronic Products**
15	**Metal Furniture**
16	**Ranges/Ovens**
	Built-In Elect.
	Built-In Gas
	Free-Standing Elect.
	Free-Standing Gas
17	**Water Heaters**
18	**Wood Burning Stoves**
19	**Other**

- Metallic Discard - any large metal article or product, or any part thereof, including, but not limited to, metal furniture, machinery, major appliances, electronic products, and wood-burning stoves

- Vehicle - any device used for transportation: including bicycles, airplanes, and other transportation devices not used on highways, and automobiles and other vehicles as defined in Section 670 of the Vehicle Code

- Major Appliance - any domestic or commercial device, including, but not limited to, a washing machine, clothes dryer, hot water heater, dehumidifier, conventional oven, microwave oven, stove, refrigerator, freezer, air-conditioner, trash compactor, and residential furnace

- Materials which require special handling - sodium azide canisters in unspent airbags which are determined to be hazardous by federal and state law or regulation, encapsulated polychlorinated biphenyls (PCBs) in major appliances, and chlorofluorocarbons (CFCs) injected in air conditioning/refrigeration units or any other hazardous waste or hazardous material regulated by the Department of Toxics Substances Control

It should be noted that the definition of "major appliance" means <u>any</u> domestic or commercial device and includes those items defined as white goods in Assembly Bill 939. "White goods" is a generic term used to define large enamel-coated appliances and although commonly referred to in Source Reduction and Recycling Elements (SRRE's), the term is used sparingly in this report due to the availability of appliance-specific data.

METHODS

<u>Data Resources</u>

One of the primary data sources used by CalRecovery as a basis for determining the quantities of major appliances generated in California was distributor sales estimated by the Association of Home Appliance Manufacturers' (AHAM). AHAM maintains an extensive database on estimated annual new appliance sales by state and also conducts periodic surveys of retailers, manufacturers, and households to gather information on various aspects of appliance use including length of ownership, replacement practice, and other service-related information. The

Appliance Recyclers Center of America was also contacted during this study, however, they were unable to provide information of use to this project.

Data sources contacted for the quantification of vehicles included the California State Department of Motor Vehicles (DMV), the Motor Vehicle Manufacturers Association (MVMA), the National Automotive Dealers Association (NADA) and the Institute of Scrap Recycling Industries (ISRI).

For the purpose of apportionment of generated quantities, the Association of Bay Area Governments (ABAG) and the California Department of Finance (DOF) supplied CalRecovery with the most recent county population projections.

Methods of Calculation

Although the AHAM data proved to be useful for the appliance categories, the data do not include those necessary to determine the potential quantities of all generated metallic discards by material type. Subsequently, determination of the quantities generated for the various discarded material types was conducted in a different manner. The following sections describe the procedure for determining quantities.

Appliances

Where available from AHAM, sales records of the past 20 years for specific appliance types (e.g., built-in and free standing stoves) in California were assembled. A number of appliances studied during this report had not been tracked and recorded by AHAM to the extent necessary for CalRecovery to estimate the respective quantities of discards. Appliances for which data are lacking are water heaters, microwaves, and free-standing gas ranges. Therefore, past sales data for these appliance groups were estimated based on sales records and saturation levels of similar appliances and/or national sales quantities. Using the AHAM sponsored Length of Ownership Study [1] in which the percentage of appliances replaced in a given age bracket due to costly repairs is reported, the estimated number of appliances that were replaced for

each consecutive year after the initial sales year was determined. The percentage of appliances which were expected to be retired each year was determined from a straight-line extrapolation of the existing lifespan data by age category. The number of replaced appliances was calculated for each of the 20 years through 1991. From this accumulation of annual estimates, the total number of appliances which would be eventually replaced or discarded was estimated. An average appliance weight was then multiplied by the number of units per year to calculate the generated tonnage from that year. The average weights of appliances as they change over time (i.e., generally becoming lighter) on a per year basis were determined by a straight-line extrapolation of average weights reported by AHAM [2]. See Table 2 for the change in metallic discard weights over time. CalRecovery estimated the average weight of those appliances where historical appliance weight data were not readily available from AHAM or other sources (e.g., water heaters). For reference purposes, Table 3 shows the estimated number and tons in descending order for selected appliances sold in California in 1991. See Appendix A for an example of a graph and table with estimated appliance life span and generated quantities, respectively.

Vehicles

Annual data on newly registered vehicles were collected from the DMV. Newly registered vehicles are defined as all new and first time registrations in California for a given year. The Department had readily available only a short historical record of these data. For purposes of estimating the number of new vehicle registrations in previous years, CalRecovery used the readily available new vehicle registration data from the DMV and backcalculated the registration for previous years using the percent change in the population for the state. Information on the number of cars in operation from a given production year was used to determine the life expectancy of newly registered vehicles. The MVMA reported the number of passenger cars in operation by production year for the past 13 years. The median age of vehicles on the road was used as a guideline to compare with the estimated life of a vehicle (see Findings and Conclusions section). The weight of an average vehicle for each year was based on straight

Table 2. Average Weights (lb) for Metallic Discards Reported in Various Years a)

	1972	1977	1982	1991	1992	Reference
Air Conditioners	132				105	[2]
Auto Bodies and Parts	3,942			2,896		[3]
Freezers	345		280		250	[2]
Refrigerators	345		258		235	[2]
Dishwashers						[2]
Portable	170		160		135	[2]
Built-In	120		105		95	[2]
Dryers		150			135	[2]
Microwaves			75		55	[2]
Ranges/Ovens	180		170		175	[2]
Washers	195				175	b)
Water Heaters	150				130	b)

a) Unless otherwise noted, average weights shown are midpoints of ranges based on manufacturers specification sheets.
b) CalRecovery estimates.

Table 3. Estimated Number and Weight (tons) of Appliances Sold in California in 1991.

	Number	Percent (%)
Refrigerators	837,400	23.9
Automatic Washers	588,000	16.7
Water Heaters	437,796	12.5
Built-In Dishwashers	430,100	12.3
F.S. Gas Ranges	285,500	8.1
Gas Dryers	241,900	6.9
Electric Dryers	210,000	6.0
F.S. Elect. Ranges	154,300	4.4
Built-In Elect. Ranges	90,800	2.6
Room Air Conditioners	90,000	2.6
Upright Freezers	45,000	1.3
Compactors	32,200	0.9
Built-In Gas Ranges	28,600	0.8
Chest Freezers	26,900	0.8
Portable Dishwashers	12,400	0.4
Total	**3,510,896**	**100.0**

	Weight (Tons)	Weight Percent (%)
Refrigerators	78,280	31.4
Water Heaters	30,863	12.4
Automatic Washers	40,714	16.3
F.S. Gas Ranges	19,529	7.8
Built-In Dishwashers	16,797	6.7
Electric Dryers	12,869	5.2
Gas Dryers	11,860	4.8
F.S. Elect. Ranges	9,783	3.9
Room Air Conditioners	8,185	3.3
Built-In Elect. Ranges	6,855	2.7
Upright Freezers	4,775	1.9
Built-In Gas Ranges	3,054	1.2
Chest Freezers	2,711	1.1
Portable Dishwashers	1,524	0.6
Compactors	1,519	0.6
Total	**249,318**	**100.0**

line interpolation of the average reported weights for 1972 vehicles and for 1991 vehicles [3]. Our estimate of the generated tonnage of automobiles for discard in 1991 was calculated using the same procedures that we applied previously in the case of appliances (see Appliances section and Appendix A).

Other

In addition to vehicles and appliances, other metallic discards were quantified in this study. Quantities of other metallic discards were not estimated in the same manner as automobiles and appliances due to lack of pertinent published data. Based on ~~CalRecovery's solid waste~~ characterization experience, this category ~~was~~ estimated to consist of 10% of the total generated tonnage of the combined Oversized Bulky Wastes (OBW), Other & Unsorted Waste, and Other Special Waste reported in the CIWMB statewide Source Reduction and Recycling Element (SRRE) tally [5].

RESULTS

Table 4 summarizes the results of the study. The estimates of diversion rate are based on either CIWMB "white goods" diversion rate (as determined from cumulative state-wide SRRE data [5]) or in the case of automobiles, on the "auto bodies" diversion rate. Diverted tons are calculated by multiplying generated tons by the diversion rate in percent. Disposal tonnage is calculated by subtracting diverted tonnage from the generated tonnage. To estimate the quantity of generated discards by county, the materials were apportioned by using the respective county's percentage of the State's population based on Department of Finance county population data [4]. The estimated breakdown of metallic discards by county is shown in Table 5.

FINDINGS AND CONCLUSIONS

The CIWMB maintains an ongoing compilation of statewide waste generation. Assuming new appliances likely replace a great majority of old appliances, the total quantity of white goods generated (disposed plus diverted) statewide in 1990 as reported by the CIWMB [5] was

Table 4. Quantification of Metallic Discards

		1991 Units Generated for Discard 1)	Generated (tons)	Disposed (tons)	Diversion Rate 2) (%)	Diverted (tons)
1	CFC Containing Metals (#3+#6+#7)	758,042	93,951	93,951	26	24,427
2	PCB Containing Metals 3)	507,228	467,746	467,746	26	121,614
3	Air Conditioners 4)	129,899	8,185	6,057	26	2,128
4	Auto Bodies and Parts	1,628,195	2,756,354	275,635	90	2,480,719
5	Dehumidifiers	a)				
6	Freezers	71,007	7,486	7,486	26	1,946
	Chest	17,950	2,711	2,006	26	705
	Upright	53,057	4,775	3,534	26	1,242
7	Refrigerators	557,136	78,280	78,280	26	20,353
8	Dishwashers	338,821	18,321	18,321	26	4,763
	Portable	18,587	1,524	1,128	26	396
	Built-In	320,234	16,797	12,430	26	4,367
9	Dryers	342,497	24,729	24,729	26	6,430
	Electric	178,398	12,869	9,523	26	3,346
	Gas	164,099	11,860	8,776	26	3,084
10	Machinery	b)				
11	Microwaves	c) 615,155	20,204			
12	Residential Furnaces	b)				
13	Washers	437,796	40,714	40,714	26	10,586
14	Electronic Products	d)				
15	Metal Furniture	e)				
16	Ranges/Ovens	451,413	39,221	39,221	26	10,197
	Built-In Elect.	78,649	6,855	5,073	26	1,782
	Built-In Gas	34,982	3,054	2,260	26	794
	Free-Standing Elect.	112,572	9,783	7,239	26	2,544
	Free-Standing Gas	225,210	19,529	14,451	26	5,078
17	Water Heaters	c) 437,796	30,863	30,863	26	8,024
18	Wood Burning Stoves	e)				
19	Other	f)	302,000			
	TOTAL (EXCLUDES 1 AND 2)	5,009,715	3,326,357	521,306		2,545,146

1) Based on Product Life Distribution, assuming 99% replacement rate in 20 years, and variation in weight of average appliance over time.
2) Diversion rates based on CIWMB statewide diversion of white goods and auto bodies [5].
3) Assumes 15% of total excluding auto bodies and parts.
4) Excludes vehicle air conditioners.

a) Negligible, not considered to be a major household appliance, although may contain CFC's.
b) Information not available
c) Assumed state sales based on national sales.
d) Not considered to contain high metallic content
e) Negligible
f) Assumed to be 10% of combined OBW, Other & Unsorted, and Other Special Waste as reported in SRRE tally.

Table 5. Estimated Quantities of Metallic Discards by County

County	CA. Dept. of Finance Population	Percent (%) Population	Metallic Discards Generated (tons) Appliances	Autos	Other	TOTAL
Alameda	1,313,300	4.24	11,358	116,813	12,799	140,969
Alpine	1,200	0.00	10	107	12	129
Amador	32,150	0.10	278	2,860	313	3,451
Butte	191,200	0.62	1,654	17,006	1,863	20,523
Calaveras	35,700	0.12	309	3,175	348	3,832
Colusa	17,000	0.05	147	1,512	166	1,825
Contra Costa	836,900	2.70	7,238	74,439	8,156	89,833
Del Norte	27,600	0.09	239	2,455	269	2,963
El Dorado	137,200	0.44	1,187	12,203	1,337	14,727
Fresno	713,700	2.30	6,172	63,481	6,955	76,608
Glenn	25,800	0.08	223	2,295	251	2,769
Humboldt	123,600	0.40	1,069	10,994	1,205	13,267
Imperial	117,400	0.38	1,015	10,442	1,144	12,602
Inyo	18,750	0.06	162	1,668	183	2,013
Kern	584,100	1.88	5,051	51,953	5,692	62,697
Kings	107,500	0.35	930	9,562	1,048	11,539
Lake	54,100	0.17	468	4,812	527	5,807
Lassen	28,700	0.09	248	2,553	280	3,081
Los Angeles	9,087,400	29.32	78,591	808,289	88,560	975,440
Madera	97,200	0.31	841	8,646	947	10,433
Marin	237,000	0.76	2,050	21,080	2,310	25,440
Mariposa	15,600	0.05	135	1,388	152	1,675
Mendocino	83,400	0.27	721	7,418	813	8,952
Merced	187,100	0.60	1,618	16,642	1,823	20,083
Modoc	10,150	0.03	88	903	99	1,089
Mono	10,400	0.03	90	925	101	1,116
Monterey	366,600	1.18	3,170	32,608	3,573	39,351
Napa	114,800	0.37	993	10,211	1,119	12,323
Nevada	83,600	0.27	723	7,436	815	8,974
Orange	2,512,200	8.11	21,726	223,450	24,482	269,659
Placer	186,900	0.60	1,616	16,624	1,821	20,062
Plumas	20,750	0.07	179	1,846	202	2,227
Riverside	1,289,700	4.16	11,154	114,714	12,569	138,436

continued

Table 5. Estimated Quantities of Metallic Discards by County (continued)

County	CA. Dept. of Finance Population	Percent (%) Population	Metallic Discards Generated (tons) Appliances	Autos	Other	TOTAL
Sacramento	1,099,100	3.55	9,505	97,761	10,711	117,977
San Benito	38,150	0.12	330	3,393	372	4,095
San Bernadino	1,530,600	4.94	13,237	136,141	14,916	164,294
San Diego	2,602,200	8.40	22,505	231,456	25,359	279,320
San Francisco	728,700	2.35	6,302	64,815	7,101	78,219
San Joaquin	502,000	1.62	4,341	44,651	4,892	53,885
San Juis Obispo	221,900	0.72	1,919	19,737	2,163	23,819
San Mateo	670,100	2.16	5,795	59,603	6,530	71,928
Santa Barbara	379,000	1.22	3,278	33,711	3,693	40,682
Santa Clara	1,531,800	4.94	13,247	136,248	14,928	164,423
Santa Cruz	231,600	0.75	2,003	20,600	2,257	24,860
Shasta	157,700	0.51	1,364	14,027	1,537	16,927
Sierra	3,340	0.01	29	297	33	359
Siskiyou	44,800	0.14	387	3,985	437	4,809
Solano	364,700	1.18	3,154	32,439	3,554	39,147
Sonoma	407,200	1.31	3,522	36,219	3,968	43,709
Stanislaus	393,400	1.27	3,402	34,991	3,834	42,227
Sutter	69,000	0.22	597	6,137	672	7,406
Tehama	52,700	0.17	456	4,687	514	5,657
Trinity	13,450	0.04	116	1,196	131	1,444
Tulare	330,000	1.06	2,854	29,352	3,216	35,422
Tuolumne	51,700	0.17	447	4,599	504	5,549
Ventura	686,900	2.22	5,941	61,097	6,694	73,732
Yolo	149,200	0.48	1,290	13,271	1,454	16,015
Yuba	61,100	0.20	528	5,435	595	6,558
Total	30,989,040	100.00	268,003	2,756,354	302,000	3,326,357

a) Includes 10% of combined Oversized Bulky Wastes (OBW), Other & Unsorted, and Other Special Waste as reported in CIWMB statewide SRRE tally [5].

compared to the quantity of appliances estimated to be discarded in 1991 in California as estimated by CalRecovery in the present study. The CIWMB estimated that the total generated quantity of "white goods" in California, which includes appliances such as washing machines, dryers, hot water heaters, stoves and refrigerators, was 266,000 tons. As a result of this study, CalRecovery estimates that 268,000 tons of appliances were generated (see Table 5) and 249,300 tons sold (see Table 3) in 1991. All three of these quantities are within $\pm$ 10% of each other. The similarity of the data supports the assumption stated earlier that new units replace old units as a first order approximation. The differences in total quantities given above may be attributable to first time buying, second unit purchases, differences in category composition/definition, and/or reporting methods.

Using the same rationale discussed above, for automobiles newly registered in 1991 with an average vehicle weight of 2900 lb, the total weight is estimated to be approximately 2.52 million tons. The 1991 total generated quantity of vehicles determined in this study is approximately 2.76 million tons. The difference in these two quantities is also within $\pm$ 10%. On the other hand, the CIWMB estimate of the combined quantity of approximately 44,000 tons of generated auto bodies and auto shredder waste is substantially lower than either of the two previous estimates. Based on this comparison, there appears to be either a fundamental disagreement over the definition of the two categories or a failure on behalf of the reporting jurisdictions to account for auto waste. Based on CalRecovery's experience in conducting past waste characterizations in California, there does not appear to be a substantial portion of the estimated 2.76 million tons of automobiles generated in the state being landfilled. Certainly, there does not appear to be as much auto related discards as newspaper (2.76 million vs. 2.65 million tons). Therefore, junkyards and the scrap industry must be accounting for the great majority of the generated quantity. In fact, a representative of the scrap industry estimated without substantiation that approximately 2 million tons of vehicles per year were being scrapped. Although it appears that the diverted quantities reported by the CIWMB should be

considerably higher, the difference in the quantities may be based on a reluctance on behalf of jurisdictions to claim diversion credit for materials which were extremely difficult to identify and quite possibly more difficult to substantiate.

The limitations and conditions of this analysis include:

- Assumption that approximately 99% of all appliances/vehicles will eventually be replaced or discarded within 20 years after purchase. Although certain appliances have life expectancies longer than others (i.e., gas ranges vs. microwaves), the length of ownership study referred to in this report did not breakdown age data for appliances over 20 years old. Therefore, those appliances which were replaced and were over 20 years old are accounted for within the twenty year life expectancy used to estimate replaced quantities as demonstrated in Appendix A. Although this method would appear to skew the results for certain appliances by slightly inflating the replaced quantities for a given year, it may actually account for those 20+ year old appliances which are finally being replaced from the previous units sold.

  While the data reviewed during this study indicates that approximately 55% to 60% of passenger vehicles are replaced within 12 years after purchase, CalRecovery assumed that the remaining 40% to 45% would be replaced in the next 8 years (i.e., approximately 99% replaced in 20 years). Additionally, DMV personnel note that in the last few years, overall registration is increasing faster than new vehicle registration. In other words, more people are keeping their current vehicles longer, and therefore fewer new cars are being sold, and less new vehicles are entering the state due to incoming population.

- The lifespan distributions of appliances are based on an AHAM study conducted in 1990 and therefore, includes "newer" appliances which in some cases (i.e., water heaters, microwaves) are assumed to have useful lifespans that are slightly longer than "older" models. This may skew results for those products where substantial design/manufacturing improvements have occurred.

- Although not addressed in this study, seasonal variations may occur in the quantities of appliances discarded. For instance, spring and fall clean-ups would likely result in larger quantities of discarded appliances than during other times of the year.

- The length of ownership data used in this report is from a national study, therefore, California appliance ownership data could vary significantly for certain appliances (i.e., air conditioners). Also, although the data from the report were broken down into yearly percentages for the purpose of estimating generated quantities, it was initially reported in age brackets, indicating that the respondents may have been reporting the estimated age of an appliance as opposed to the actual age.

The approach to quantification of metallic discards discussed throughout this report is based on quantities generated. This approach avoids some of the obstacles encountered during a diversion/disposal analysis. With this approach, concerns over double accounting, definition and processing differences, and conversion factors become less significant therefore making "generated materials" easier to define. There are of course, limitations inherent in this approach in addition to those outlined above, mainly due to the transient nature of the State's population in which a subsequent change in the amount of metallic discards being generated would most likely be observed on a regional basis only. However, the intent of this study is to estimate the amount of metallic discards generated using the best available data. At present, published information on the estimated number of appliances sold, newly registered vehicles, length of ownership data, and respective unit weights are the best available data to quantify generated metallic discards.

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4. Population Estimates of California Cities and Counties, January 1, 1991 and January 1, 1992, Report 92 E-1, State of California, Department of Finance, May 1992.

5. CIWMB Interim Database Report, Estimated Average 1990 Waste Stream Composition Including Diversion of Excluded Waste Types, Revised November 23, 1992.

APPENDIX A-4

Appliance Turn-In Services
Appliance Recycling Centers of America

Appliance Turn-In Services

Appliance Recycling Centers of America, Inc.
2601 Broadway Road Northeast
Minneapolis, Minnesota 55413
1-800-456-2722

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I. EXECUTIVE SUMMARY

Appliance Recycling Centers of America, Inc. (ARCA) establishes its centers as wholly-owned subsidiaries in new locations, through contracts with major generators of appliances, such as utility companies, implementing an Appliance Turn-In Program. The centers do not provide services directly to individuals. ARCA's centers provide a full range of appliance collection, processing, and recycling services. ARCA's turnkey service approach enables its customers to provide residents with a convenient and environmentally-sound method for recycling energy-inefficient, operating, surplus refrigerators, freezers, and room air conditioners.

ARCA establishes and operates state-of-the art appliance recycling centers in its customers' communities. The centers house the customer service; data collection and analysis; energy monitoring; incentive fulfillment; transportation; and appliance processing operations. Experienced ARCA employees assist with the start-up and training phase of the center. Permanent employees are hired from the local area and trained according to ARCA's procedures and standards.

ARCA's customer service personnel respond to inquiries and requests for service from the utility's residential electric customers, and schedule appliance pickup appointments. The transportation crews remove the appliances from the homes and deliver them to the center for processing.

ARCA uses environmentally-sound processing systems to remove and properly manage hazardous and environmentally-harmful appliance components and materials such as chlorofluorocarbon (CFC) refrigerants. ARCA obtains all identification numbers, permits, and licenses that are required by the U.S. Environmental Protection Agency, and state and local governments, in order to fully comply with all federal, state, and local laws and regulations regarding the collection, processing, and recycling of appliances. ARCA contracts with qualified local metal processing facilities to recover and recycle the metals from the processed appliances.

II. COMPANY HISTORY AND EXPERIENCE

Appliance Recycling Centers of America, Inc. (ARCA) is the nation's leader in providing appliance collection, processing, and recycling services. ARCA's track record in the management of unwanted major household appliances is the result of the growth and expansion of a Minnesota company that began in 1976. More than one million appliances have been recycled by ARCA since the company began. ARCA's centers are currently located in Minnesota, Wisconsin, Connecticut, Ohio, Michigan, and British Columbia. During 1991 alone, ARCA's centers managed more than 165,000 appliances for its customers in the United States and Canada.

ARCA's history and experience enables the company to offer comprehensive, turnkey appliance turn-in services of the highest quality, along with environmentally-sound processing systems, to meet the rapidly growing desire for this innovative Demand-Side Management service.

III. DESCRIPTION OF FACILITY AND SERVICES

ARCA works with its customers to design and implement services that will provide residents with a convenient and environmentally-sound service for collecting, processing, and recycling energy-inefficient operating, surplus appliances, including refrigerators, freezers, and room air conditioners.

A. Center Description

ARCA establishes centers that are capable of housing the operations necessary to support the appliance recycling services. Photographs of these operations are included in Appendix A. ARCA's centers are located in leased facilities sited in appropriately zoned industrial areas. The centers have loading docks for efficiently receiving and transporting all appliances. All center operations are conducted indoors and no appliances or materials are stored out of doors. Processed appliances are delivered to local metal processing facilities on a daily basis.

ARCA's centers operate according to local, state, and federal laws and regulations regarding the collection, processing, and recycling of unwanted major household appliances. ARCA obtains all necessary identification numbers, permits, and licenses from the U.S. Environmental Protection Agency (EPA) and appropriate state and local regulatory agencies, including those required for the handling and storage of all components and materials removed during the processing of appliances. Additional licenses, permits, and approvals, required by state and local governments for collecting and transporting the appliances and operating the center, are also obtained by ARCA.

Center management and personnel are thoroughly trained to implement appropriate safety procedures. The centers promptly report any incidents or accidents to the appropriate federal and state regulatory agencies, and local emergency service providers (fire department, hospital, or clinic), as necessary.

B. Customer Services

ARCA hires, trains, and supervises customer service personnel to receive and respond to telephone inquiries and requests from residents, schedule collection appointments, and enter data and information into the center's computer system. This computer program is used to manage the operations, track the appliance recycling center's activities, and facilitate the incentive fulfillment service.

C. Appliance Collection Services

ARCA uses a fleet of well-maintained trucks to provide its appliance collection services to residents. ARCA employs, trains, and supervises uniformed employees to provide the appliance collection services.

D. Appliance Processing Services

The appliances are brought to the center and unloaded from the collection trucks or transfer trailers with two-wheel handcarts. The appliances are placed into the receiving/holding area of the center for inspection and categorization by appliance type. ARCA's appliance processing technicians inspect each appliance and then

remove capacitors, ballasts, mercury switches, and batteries before they recover the CFCs and other refrigerants.

1. **Capacitors, Ballasts, Mercury Switches, and Batteries**

Appliances manufactured between 1929 and the early 1980s may contain electrical capacitors that contain polychlorinated biphenyl (PCB) dielectric fluid. The use of PCBs was banned by the EPA in 1977; however, businesses were allowed to continue to use remaining stocks of capacitors. Some appliances, such as those having fluorescent light fixtures with a ballast, may contain PCBs. The EPA has estimated that five percent of all appliances contain PCB capacitors.

PCBs are suspected as a carcinogen and are known to be resistent to degradation when disposed of in landfills. Metal processing facilities that ARCA's centers contract with require that all capacitors be removed from appliances. Small amounts of PCBs, if present in appliance capacitors, can contaminate the insulation and other shredder "fluff" materials. Federal regulations require that shredder fluff contaminated with concentrations of PCBs, in excess of 50 parts per million, be treated as a hazardous waste.

Some appliances, such as old chest-type freezers, may contain a mercury switch or mercury-containing battery. Mercury is toxic to humans and can enter the body through inhalation, skin absorption, or ingestion. At high temperatures, mercury vaporizes forming extremely toxic fumes.

ARCA's technicians remove and separately manage <u>all</u> appliance capacitors, ballasts, mercury switches, and batteries at the specially constructed and controlled component removal gate in the center's processing area. The center's processing technicians are trained to locate and identify capacitors, ballasts, mercury switches, and batteries. For safety purposes, processing technicians are required to wear all appropriate safety equipment and protective clothing.

ARCA's processing technicians remove the front and rear panels from the appliances in order to perform a thorough inspection and carefully remove all capacitors, ballasts, mercury switches, and batteries.

The removed components are placed in clearly marked 5-gallon plastic pails at the component removal gate. Throughout the workday, the pails are emptied into Department of Transportation (DOT)-approved storage and shipping containers. The containers are stored in a separate area that is clearly marked and posted for PCBs and mercury, as required by the EPA and the Occupational Safety and Health Administration (OSHA). The storage area floor is constructed of leakproof materials and is surrounded by a six-inch barrier.

ARCA's centers contract with licensed and approved hazardous waste transport/disposal contractors to ensure the professional management of all capacitors, ballasts, mercury switches, and batteries. The capacitors, ballasts, and batteries are delivered to federally-approved hazardous waste disposal facilities for high-temperature incineration. Mercury switches are delivered to a licensed mercury recovery and recycling facility for processing.

2. Refrigerant Fluids/Gases

CFC refrigerants are believed to cause long-term damage to the earth's stratospheric ozone layer and contribute to global warming when they are released into the atmosphere. The 1990 Clear Air Act requires the recovery of CFCs during the service, repair, and disposal of appliances. This provision of the act will become effective on July 1, 1992. In 1997, the venting of CFC substitute refrigerants will also be prohibited.

Refrigerators and freezers typically contain R-12 or R-114 chlorofluorocarbon (CFC) refrigerants. These refrigerants are commonly referred to by their DuPont trade name of Freon. A small percentage of refrigerators may also contain R-717 (ammonia) or R-764 (sulfur dioxide) as a refrigerant fluid/gas. Room air conditioners most frequently contain R-22 hydrochlorofluorocarbon (HCFC) refrigerant; however, some room air conditioners may contain R-500, R-502, or R-503 as refrigerant fluids/gases.

Each type of refrigerant must be kept separately throughout the processing operation in order to ensure the recyclability of the refrigerants. ARCA's processing

technicians are trained to identify each type of refrigerant and to separate refrigerators according to the specific type of refrigerant fluid/gas used.

ARCA has developed proprietary equipment and processing methods to limit the release of refrigerant fluids/gases into the atmosphere, reduce the potential for direct contact by employees, maximize the capture efficiency of its refrigerant recovery systems, and produce high-quality reclaimed refrigerant materials.

At ARCA's centers, refrigerators, freezers, and room air conditioners are inspected, to identify the refrigerant, and then sent to the appropriate refrigerant evacuation work station. ARCA has developed and manufactures its own refrigerant evacuation equipment and systems. The JS-91 evacuation unit and the RC-10 manifold work together to remove refrigerants from ten appliances at a time. ARCA's centers are equipped with work stations to recover CFC and HCFC refrigerants. Additional work stations can be added to accommodate future increases in volume.

ARCA's refrigerant evacuation system is capable of recovering 92-95 percent of the refrigerant fluids/gases in appliances. This capture efficiency rate, along with ARCA's specially designed hand tool for tapping the coolant lines to recover refrigerants, reduces the risk of CFCs escaping into the atmosphere--a problem which frequently occurs with other refrigerant evacuation systems. ARCA's JS-91 and RC-10 system removes a majority of the air and moisture found in sealed refrigeration systems.

The recovered CFC refrigerants are stored separately by type in 1,000-pound DOT-approved reusable steel tanks. When filled, the tanks are transported to ARCA's Research and Development Division, which is located in Wisconsin, for further processing prior to reuse. ARCA has established a complete analytical laboratory to test CFC refrigerants that have been recovered at ARCA's centers. The laboratory facility allows ARCA to monitor the purity of the refrigerants and provide high-quality, recycled refrigerants for sale to the appliance industry.

3. Ammonia and Sulfur Dioxide Refrigerants

A small percentage of older refrigerators that may be collected through an Appliance Turn-In program may contain either ammonia (R-717) or sulfur dioxide (R-764) as the refrigerant gas. These refrigerants present a number of technical difficulties and require specialized equipment that is not used in the processing of CFC refrigerants.

In order to process appliances containing ammonia or sulfur dioxide refrigerants safely, ARCA has developed a mobile refrigerant recovery center which will make regular visits to each ARCA center. The mobile center will have the capability of safely recovering sulfur dioxide from cooling systems and preparing the material for reuse by industry. Ammonia units will be transported to ARCA's laboratory and distillation facility in Wisconsin for processing.

ARCA's mobile processing center is designed to process two sulfur dioxide units at a time. The system circulates a caustic solution in a 550 gallon tank. A vacuum is created to remove the sulfur dioxide from the appliance. The sulfur dioxide is mixed with the caustic solution to produce a solution that can be used for dechlorination in wastewater treatment processes.

The advantages of ARCA's system over other methods are: (1) no pressurized containers are used, (2) poisonous gases are avoided, (3) a safe, reusable product is created, and (4) a corrosive material rather than a poisonous gas is transported as a result.

When the appliances containing ammonia are received at the laboratory and distillation facility, they are placed in a special ammonia processing room.

After the ammonia is removed from the appliance, the refrigerant tubes are cut and sodium chromate, which is used as an additive to the ammonia, is drained from the system. ARCA ships the recovered sodium chromate to a chromate producer's facility for reclamation/reuse.

4. Compressor Oil

Refrigerators, freezers, and room air conditioners contain a high-grade mineral oil as a lubricant in the sealed refrigeration system. Some of the compressor oil, which is able to mix readily with refrigerant fluids/gases, is removed during the refrigerant evacuation process. ARCA's system uses oil separators and a special degassing unit to separate the remaining CFCs from the compressor oil. The compressor oil is stored in approved drums and regularly collected by local oil recyclers.

5. CFC-11 Recovery From Blown Polyurethane Foam Insulation

Improvements in the energy efficiency of refrigerators and freezers has been achieved, in large part, due to the increased use of highly efficient CFC-11 blown foam insulation. This has been possible because two-thirds of the energy use of refrigerators and freezers is due to heat transfer through the walls, not from door openings and food cooling. By the early 1980s, approximately seventy-five percent of all residential refrigerators and freezers were insulated with CFC-blown polyurethane rigid foam insulation.

Rigid foam insulation is produced by injecting CFCs into a liquid mass of plastic polymer material to create the bubbles that form the insulating capabilities of the foam. The CFCs remain in the cells as an insulating gas. Home refrigerators typically incorporate three to six times more CFC-11 blowing agent in the rigid foam in their walls than R-12 in their cooling systems. According to the Association of Home Appliance Manufacturers (AHAM), approximately 2 pounds of CFC-11 is used to blow foam insulation inside the walls and doors of refrigeration equipment. Refrigerators and freezers today use one to three inches of rigid closed-cell foam for insulation.

The rate of CFC leakage from rigid insulating foams is less than one percent per year. Approximately 80 percent of the original CFC-11 will be present in the foam after 20 years. The amount of CFC-11 emitted during disposal makes up about 10 to 15 percent of the emissions from all rigid foams. According to studies conducted by Oak Ridge National Laboratory, shredding foam ordinarily releases 50 percent of the CFC.

ARCA has recently completed an investigation of the commercially available technologies available in Europe for the recovery of CFC-11 from polyurethane foam insulation. At the present time there are no large-scale facilities in operation recovering CFC-11 from polyurethane insulation in refrigerators and freezers in the United States or Canada. While experimental and pilot programs are being tested in a small number of locations, there is only one technology that has proven successful on the scale necessary for ARCA's appliance recycling centers. In late 1991 ARCA signed an agreement with Adelmann GmbH of Karlstadt, Germany, to become the manufacturer and distributor of the A-55 CFC-11 recovery system. The Adelmann system is currently in use in 17 locations in Germany, the Netherlands, Switzerland, and Austria. The system will be installed in our Connecticut center in the fall of 1992. It will also be available for installation in other qualifying ARCA centers.

The Adelmann A-55 system has been tested by the Rheinisch-Westfalischer TUV (TSA Technical Surveying Association) an independent testing institute equivalent to the Underwriters Laboratory (UL). The equipment has a certified recovery rate of 99.0 percent. In addition, the TSA has tested and approved the equipment in relation to emission measurements (maximum workplace concentrations), safety, and security factors.

The refrigerators and freezers are dismantled by first removing glass and steel shelves, and plastic drawers, and then stripping the wiring from the appliances. The R-12 refrigerant and the compressor oil are extracted and captured. The compressor is removed, and the outer steel case of the refrigerator or freezer is separated from the plastic liner material. The underlying polyurethane foam is recovered.

The polyurethane rigid foam is placed in a gas-tight lock and passed into a shredding unit where a rotary cutter reduces the panels into smaller pieces. The material is then fed into a high-pressure compression chamber and then into a high-density press. The CFC-11, which is released during the shredding and compressing processes, is taken into a multi-stage condensation unit. The A-55 system produces a compressed polyurethane foam, CFC-11, and water. The compressed polyurethane foam can be used to manufacture high-quality building panels, which have similar properties to chipboard, plasterboard, or plywood panels. The captured CFC-11 is stored and sent

to a certified national or regional facility for reclamation. Plastic materials, such as acrylic, ABS (acrylonitrile-butadiene-styrene) and polystyrene, will also be recovered and recycled.

E. Intermediate Processing of Recyclable Metals

ARCA conducts negotiations with qualified metal processing facilities and executes agreements for the shredding and recycling of the processed appliances. ARCA supplies tractors and semitrailers to transport the processed appliances, which are free of all capacitors, ballasts, mercury switches, and refrigerants, to the metal processing facility. The recovered steel, aluminum, and copper are sold to steel mini-mills and other metal recyclers for use in new products.

IV. PROOF OF INSURANCE

ARCA purchases and maintains adequate insurance for conducting its appliance collection, processing, and recycling services. ARCA's normal Comprehensive General and Vehicle Liability Insurance is written for not less than:

Comprehensive General Liability

Combined Single Limit, Bodily Injury, and Property Damage

$1,000,000 each occurrence
$2,000,000 annual aggregate

Comprehensive Vehicle Liability

Combined Single Limit, Bodily Injury, and Property Damage

$1,000,000 annual aggregate

Workers' Compensation insurance is secured prior to the development and operation of the appliance recycling center.

Appendix B:

Responses to Comments Received on

"Metallic Discards in California,"

Science Applications International Corporation,

August 1993

The SAIC report entitled "Draft Report to the Legislature on Metallic Discards Management" was prepared by Science Applications International Corporation (SAIC) under Board Contract No. IWM-C1079-A1. The purpose of the SAIC report was to provide Board staff with information on the current processes of handling metallic discards, including the special materials within certain discards, in California. Also incorporated in the SAIC report is a list of management options/ recommendations for Board consideration in the development of a Metallic Discards Management Plan, hereafter referred to as the Board's Management Plan.

Board staff presented the SAIC report to the Policy, Research, and Technical Assistance Committee on June 2, 1993 to receive guidance as to the preferred approach in developing the Board's Management Plan.

Most of the written comments received at the June 2nd committee meeting were directed at the management options/recommendations that are outlined in Chapter 7 of the SAIC report.

Staff's responses to the comments received at the Policy, Research, and Technical Assistance Committee are presented below.

The numbers in brackets represent the commenters. The following is the key:

1) Appliance Recycling Centers of America (ARCA)

2) Association Home Appliance Manufacturers (AHAM)

3) Whirlpool

4) Russell Range, Inc

5) San Bernardino County, Department of Environmental Health Services

6) California Department of Toxic Substances Control (DTSC)

COMMENT (5): Are the respondents to the survey (56 responses received) representative of the industries surveyed or were the respondents weighted more toward one aspect of the survey, such as the regulatory agencies rather than the dismantlers?

RESPONSE: At the time the survey was conducted, it was felt that all groups impacted by AB 1760 were represented. Fifty-six responses to the survey were received. Twenty-two out of 116 mailed to auto dismantlers/wrecking yards were returned, nine out of seventy-six mailed out to appliance dealers/service repair shops were returned, six out of ten mailed out to landfill operators were returned, one out of five mailed out to electric utilities were returned, five out of the fifteen mailed out to recyclers/reclaimers were returned, four out of the seventy-one mailed out to local enforcement agents were returned, and nine were received from other various sources. Response rates are fairly typical and representative with the exception of enforcement agencies, where the return rate was very low.

INTENDED CHANGE: Survey results will be published in the SAIC report.

COMMENT (2): The SAIC report does not specify the proportion of appliances that are recycled, disposed in landfills, or illegally disposed.

RESPONSE: On page 2-6, the SAIC report states that approximately 26 percent of white goods generated in 1990 were diverted from landfill disposal. This rate is based on the latest data compiled from California's city and county source reduction and recycling elements. A recent U.S. EPA study, however, estimates that 40 percent of appliances nationwide are diverted. According to the survey conducted by SAIC, the percentage of appliances diverted from disposal is significantly higher than 40 percent. The intent of this SAIC report is to identify the impacts of those appliances that will require additional processing due to the Clean Air Act and AB 1760. Regardless of what percentage is landfilled or recycled, all appliances are now or soon will be required to be diverted and in some cases additional processing will be needed. The proportion of appliances that are illegally disposed is very difficult to quantify, and to a greater extent will most likely occur in rural areas.

INTENDED CHANGE: No change to either the SAIC report nor the Board's Management Plan will be made.

COMMENT (5): The SAIC report states that appliance repairers are not considered a generator of appliances. Appliance repair companies tend to service appliances in-home whenever possible to reduce the risk of having to dispose of a non-repairable appliance. The smaller, more portable appliances, however, are often taken to repair shops.

RESPONSE: Many portable appliances are often taken to repair shops by the consumer. However, if these appliances cannot be repaired, then the unit will generally be returned to the consumer.

INTENDED CHANGE: No change to either the SAIC report nor the Board's Management Plan will be made.

COMMENT (5): The SAIC report states that small collectors do not process the appliances they collect since this step would have a severe impact on the economics of their operations. Many small collectors, however, salvage out the more valuable materials from appliances (i.e., copper tubing from air conditioners and refrigerators) before transporting the appliance to a salvage yard. This salvaging results in CFC release into the atmosphere.

RESPONSE: As referenced on page 1-4 of the SAIC report, metallic discard processing means the removal of special materials (i.e., CFCs, PCBs). Although the removal of valuable materials (i.e., copper tubing) is not specifically stated in the report, the SAIC report does state that smaller appliance handling operations may not be complying with current law. The small collector will no longer be allowed, by law, to salvage these valuable materials (i.e, copper tubing used for condensers and evaporators in the refrigeration cycle) prior to refrigerant recovery. Currently, federal fines are imposed on those who intentionally release CFCs into the environment.

INTENDED CHANGE: No change to either the SAIC report nor the Board's Management Plan will be made.

COMMENT (2): The SAIC report states that potential revenues from the sale of recovered CFCs are "insignificant" based on a one ounce per refrigerator recovery rate ($.12 per refrigeration unit for recovered CFCs). Based on commenters experience, approximately seven ounces of

refrigerant is still intact in operating units at the time of disposal, barring damage during the disposal handling process (80 percent of refrigerators and freezers still have operational compressors at time of disposal and that 85-90 percent of the original charge is still intact). It is estimated that a recovery rate of seven ounces of refrigerant would result in a revenue of $.67 per refrigerator. Long term revenue sales would be approximately $4.70 per refrigerator.

RESPONSE: The statements made in reference to the one ounce per refrigerator recovery rate is incorrect due to the lack of available data. CFC recovery rate data is minimal, highly variable, and needs further study.

INTENDED CHANGE: This portion of the SAIC report will be removed.

COMMENT (2,5): The SAIC report states that "the mandate to remove PCB-containing capacitors may require that all pre-1978 appliances be processed, thus substantially increasing appliance processor costs". As indicated in a letter from the U.S. EPA Office of Pesticides and Toxic Substances to state agencies, PCB capacitors were known to have been used in microwave ovens, and to a limited extent in household refrigerators and freezers. There is no evidence that small PCB capacitors were used in clothes washers and dryers, dishwashers, hot water heaters, garbage disposers, trash compactors, conventional ovens, ranges, or stoves. The SAIC report's suggestion that all pre-1978 appliances be processed to remove capacitors is both unjustified and disingenuous.

RESPONSE: Current law states that all PCB-containing capacitors must be removed from the metallic discard, prior to recycling, and managed as a hazardous waste. The problem that now confronts the recycler is how to identify an appliance or capacitor that contains PCBs. SAIC took a conservative approach (for cost estimating purposes only) in stating that all pre-1978 appliances be processed for PCB removal. This approach was based on the uncertainty of identifying PCB containing appliances.

INTENDED CHANGE: The Board is recommending in its Management Plan that information be developed by the Board in cooperation with DTSC to narrow the appliance types that may contain PCB capacitors and identify PCB-containing capacitors.

COMMENT (5): How will the increase in costs to remove PCB items affect the number of facilities available to process discards containing PCB items? If the number of facilities dwindle, what impact will this have on illegal dumping? Will all metallic discard processors/recyclers be required to obtain a permit to store, transport, and dispose of PCBs? Will they be required to obtain a permit as a hazardous waste generator?

RESPONSE: The Board proposes in its Management Plan to monitor the impacts of removing PCB items within one year from the effective date of the metallic discards ban.

If the processor/recycler generates, stores, transports, or disposes of PCB wastes, they will have to comply with the regulations set forth in Title 22 of the California Code of Regulations and enforced by the Department of Toxic Substance Control.

INTENDED CHANGE: No change to either the SAIC report nor the Board's Management Plan will be made.

COMMENT (5): Will the value of scrap metal drop with the increased (mandatory) recycling of appliances? Can the market handle the increased tonnages of metal scrap? Will it be necessary to subsidize the price of scrap metal to compensate for the increased costs that will be incurred with the onset of regulations for recovery of CFCs and PCBs?

RESPONSE: The value of scrap metal is driven by worldwide market demand and it would be a very difficult challenge to subsidize this price, at a state level, to compensate for increased appliance costs.

According to the SAIC report, appliances constitute approximately 9 percent of the metallic discards generated in California and it is anticipated that the increase in tonnages of scrap metal on the foreign market, due to mandatory recycling of appliances in California, is minimal and will have negligible effect on the value of scrap metal.

INTENDED CHANGE: No change to either the SAIC report nor the Board's Management Plan will be made.

COMMENT (1): The public health and environmental effects of releasing ammonia and sulfur dioxide refrigerants needs further study and consideration.

RESPONSE/INTENDED CHANGE: The Board is recommending in its Management Plan to: 1) develop and distribute literature, in conjunction with DTSC and OEHHA, on the proper handling of refrigeration units containing ammonia and sulfur dioxide refrigerants, and 2) identify ammonia and sulfur dioxide refrigerant recyclers.

COMMENT (1): In the near future, CFCs from foam insulation will constitute a larger environmental hazard than the illegal venting of refrigerants from the sealed cooling systems. It is recommended that the Board address this important issue.

RESPONSE: The CFC-11 contained in foam insulation is not fully addressed within current Federal or State legislation, regulations, or statutes. The U.S. EPA has ruled not to require the management of foam insulation containing CFC-11 (federal register Vol. 58, No. 92, page 28702). The Board staff recommends utilizing the federal EPA's position on an interim basis.

INTENDED CHANGE: The Board proposes to continue its efforts, in conjunction with the proposed metallic discards task force and the federal EPA, to monitor industry's activities in processing CFC-11 impregnated foam found within metallic discards.

COMMENT: Will allowances be made for smaller facilities to exempt them from the requirements to divert metallic discards from the facility due to stockpiling space or the lack of resources to recycle? Will they be held responsible for the special wastes found in white goods? Small remote facilities may be more likely to undergo unsolicited scavenging if metallic discards are left at the site unburied. This could result in the release of special materials found in metallic discards.

RESPONSE: No provision is made in AB 1760 to exempt facilities based on size, space, or the lack of resources to recycle. Solid waste facility operators will be held responsible for special materials, found in metallic discards, if they process the metallic discard (see definition of metallic discard processing on page 1-4 of the SAIC report). If it is not economically feasible for the solid waste facility operator to recycle the discard, the facility operator

may dispose of the discard as long as the requirement of the Clean Air Act has been met (i.e, in the case of a refrigeration unit, the CFCs have been extracted). Scavenging is prohibited at any disposal site as stated in CCR 14, Section 17686. It is the operators responsibility to prevent any scavenging.

INTENDED CHANGE: No change to either the SAIC report nor the Board's Management Plan will be made.

COMMENT (5): Under EPA's Safe Disposal Program, the final processor is responsible for the removal of the refrigerant. If the final processor chooses not to recover the refrigerant themselves, they must require certification or verification from the supplier of the appliance that the refrigerant has been properly recovered. How will the final processor handle documentation on the removal of CFCs by unknown parties, especially with abandoned appliances?

RESPONSE: The final processor must insure that the removal of CFCs from the discard has been accomplished by a federally certified person or establishment. If this is not the case, the final processor will be liable for further processing the discard. In regards to abandoned appliances, it may be the responsibility of the landowner to properly process these appliances (i.e., state, local government, private). Who is responsible for abandoned items will be determined by State law or local ordinances.

INTENDED CHANGE: No change to either the SAIC report nor the Board's Management Plan will be made.

COMMENT (6): The SAIC report states that DTSC regulates PCBs at concentrations above 5 ppm. This should be revised to 5 mg/l or more. Milligrams per liter (mg/l) should be used when discussing the soluble threshold limit concentration (STLC).

RESPONSE/INTENDED CHANGE: The SAIC report will be modified to reflect the above change.

COMMENT (6): The discussion in subsection 6.3.4 of the SAIC report states that if sufficient volumes of special materials are generated to make the processing/recycling facility a small quantity generator, then these wastes must be managed as hazardous according to Title 22 regulations. California does not exempt generators or their wastes from regulation as hazardous waste because of their generation rate. Businesses that generate any amount of hazardous waste are regulated as hazardous waste generators.

RESPONSE/INTENDED CHANGE: The SAIC report will be modified to reflect the above change.

COMMENT (6): The discussion on page 7-9 of the SAIC report proposes that DTSC be responsible for permitting locations that remove the CFCs, PCBs; and other special materials from major appliances. DTSC regulates these materials only after they are removed from the appliance. DTSC does not regulate the process of removing such materials.

RESPONSE/INTENDED CHANGE: The SAIC report will be modified to reflect the above change.

COMMENT (5): Will statute requirements prohibiting the landfilling of metal discards also prohibit the same for metal vehicle body parts? If so, how will it be determined which parts are suitable for landfilling and which parts must be recycled?

RESPONSE: Metallic discards, as defined in AB 1760, means any large metal article or product, or any part thereof, including, but not limited to, metal furniture, machinery, major appliances, electronic products, and wood-burning stoves. Automobile bodies and parts are included as part of this definition. According to AB 1760, no facility is to accept for disposal any metallic discard which contains enough metal within the discard to be economically feasible to salvage.

INTENDED CHANGE: No change to either the SAIC report nor the Board's Management Plan will be made.

COMMENT (2,3): The SAIC report lacks information on the improper (illegal) disposal of major appliances due to imposed generator collection and processing fees.

RESPONSE: The SAIC report states that illegal dumping of appliances in rural areas can be significant if fees charged to generators are too high. This can be the case in any rural or urban situation. The Board's Management Plan has outlined three programs that may assist in curbing illegal activity: 1) a public outreach program to inform generators and processors of current laws and guidance to process the discard in an environmentally sound and safe manner, 2) a task force to provide further guidance and recommendations to enhance the recycling of metallic discards, and 3) State and Board funding mechanisms to assist in removing special materials from metallic discards.

INTENDED CHANGE: No change to either the SAIC report nor the Board's Management Plan will be made.

COMMENT (1): Establish the responsible state agencies for implementing the metallic discards management plan.

RESPONSE: The Board has identified the agencies that may assist in implementing the Board's Management Plan. These agencies are the Department of Toxic Substance Control, California Air Resources Board, Office of Environmental Health Hazard Assessment, and the federal EPA. The Board's proposed Task Force will consist of the above regulatory agencies, as well as representatives from environmental and industrial sectors.

INTENDED CHANGE: No change to the SAIC report will be made. The Board's Management Plan will include a representative from the environmental sector on the Task Force.

COMMENT (5): Will each solid waste facility operator be able to determine the feasibility of salvaging metallic discards or will guidelines be issued by the state? If guidelines are issued, will it take into account the feasibility of remotely located facilities in salvaging metallic discards? Will a solid waste facility be able to landfill materials that are deemed economically infeasible and will the facility be responsible for removing all "special materials" prior to disposal?

RESPONSE: As currently stated in AB 1760, the determination of economic feasibility is made by the landfill operator. The Board has recommended in its Management Plan that the economic feasibility issue be further evaluated in the proposed Metallic Discards Task Force. This task force may develop criteria to assist landfill operators in making an economical feasibility determination.

AB 1760 only requires that special materials be removed from appliances prior to crushing for transport or transferring to a baler or shredder for recycling. However, the federal Clean Air Act requires that CFC refrigerants be removed from the metallic discard prior to disposal or recycling. Therefore, landfill operators are responsible for removing, at a minimum, CFC refrigerants prior to disposal.

INTENDED CHANGE: No change to either the SAIC report nor the Board's Management Plan will be made.

COMMENT (5): Will regulations address the issues of improper handling to reduce inadvertent release of CFCs into the atmosphere?

RESPONSE: The Board has recommended in the Management Plan that information on the proper handling of refrigeration units be developed and distributed to appliance processors in California. If the Board determines within a one year period after the ban that the industry is not adequately processing metallic discards containing CFCs, the Board will make further recommendations to address the problem.

INTENDED CHANGE: No change to either the SAIC report nor the Board's Management Plan will be made.

COMMENT (1,2): Commenters support the formation of a Metallic Discards Task Force, with participation of the appliance industry and other interested parties, in order to assemble the expertise needed to understand the complexities of appliance disposal and recycling.

RESPONSE: The Board has recommended in its Management Plan that a Metallic Discards Task Force be formed to discuss and share information regarding the recycling of metallic discards. The Metallic Discard Task Force will consist of approximately 12 members representing the regulatory, environmental, industrial and public sectors. This task force will provide further guidance and recommendations to enhance the recycling of metallic discards.

INTENDED CHANGE: No change to either the SAIC report nor the Board's Management Plan will be made.

COMMENT (2,3): The options stated in chapter 7 of the SAIC report are not supported by the body of the report (i.e., manufacturer responsibility, generator disposal fees and cause for illegal disposal).

RESPONSE: The Board's Management Plan expands on option 1 of the SAIC report, the Current Management System. The other options in chapter 7 of the SAIC report will be further addressed by the Board's proposed Task Force.

INTENDED CHANGE: Neither the SAIC report nor the Board's Management Plan will contain reference to a preferred option.

COMMENT (2,5): Provide cost estimates and feasibility analysis for the options discussed in chapter 7 of the SAIC report.

RESPONSE: The Board has chosen a modification of option 1 of the SAIC report, Current Management System, for incorporation into the Board's Management Plan. The Board's Management Plan includes a non-regulatory monitoring program to ascertain the overall effectiveness of AB 1760 and the implementation of the Board's Management

Plan. If Board staff determines that the industry is not adequately processing metallic discards, then Board staff and the task force will examine other options.

INTENDED CHANGE: No change to either the SAIC report nor the Board's Management Plan will be made.

COMMENT (1,5): What impact will the permitting program, option 2 in chapter 7 of the SAIC report, have on the scrap metal facilities? Will permitting requirements also be in place for transporters of white goods? How will the reduction in operators affect the availability of locations which accept white goods? What agencies will be responsible for implementing this program? What steps will be taken to handle the increase in illegal dumping that may occur?

Permitting and licensing programs should be implemented that will direct appliances to facilities which are equipped to manage materials in an environmentally sound manner. Requirements should be established for financial capabilities and pollution liability insurance.

RESPONSE: The Board is not pursuing any additional permitting requirements at this time. The Board has chosen a modification of option 1 of the SAIC report, Current Management System, for incorporation into the Board's Management Plan. The Board has recommended in their Management Plan, however, to monitor the removal of special materials after six months from the effective date of the ban. If it is determined within a one year period after the ban that the industry is not adequately processing metallic discards containing special materials, the Board in conjunction with the Air Resources Board, DTSC, LEAs, and local air districts, will make further recommendations to address the problem.

INTENDED CHANGE: No change to either the SAIC report nor the Board's Management Plan will be made.

COMMENT (5): Will the Advance Disposal Fee (ADF), option 3 in chapter 7 of the SAIC report, cover all costs of processing and recycling appliances? How will the ADF be disbursed to help cover the added expenses incurred by this program? All questions from the previous comments also apply.

RESPONSE: The Board is not currently pursuing option 3 of the SAIC report, the Permitting and Financial Assistance Program. The Board has recommended in its Management Plan, however, that a Metallic Discards Task Force examine the need for and potential mechanisms for funding the removal of special materials on a state-wide basis.

INTENDED CHANGE: No change to either the SAIC report nor the Board's Management Plan will be made.

COMMENT (5): How will the operators under the Guaranteed Acceptance Program, option 4 in chapter 7 of the SAIC report, recover the costs of handling discarded appliances if they are accepting these materials at no charge? Who will be responsible for the incurred costs of transporting discarded appliances to facilities for recycling? What steps would be required of retailers, landfills, and transfer stations to accept, at no charge, discarded appliances? Why not require the recyclers to accept appliances free of charge instead?

RESPONSE: The Board is not currently pursuing option 4 of the SAIC report, the Permitting and Guaranteed Acceptance Program. The Board has recommended in its Management Plan, however, that a Metallic Discards Task Force examine the need for and potential mechanisms for funding the removal of special materials on a state-wide basis.

INTENDED CHANGE: No change to either the SAIC report nor the Board's Management Plan will be made.

COMMENT (1): Recommend that the Board give consideration to a modification of the manufacturer's responsibility option, option 5 in chapter 7 of the SAIC report, by encouraging a cost-sharing partnership between the appliance retailers, manufacturers, material suppliers, and appliance owners.

RESPONSE: The Board is not currently pursuing option 5 of the SAIC report, the Manufacturer's Responsibility, or any part thereof. The Board has recommended in its Management Plan that a Metallic Discards Task Force be formed to discuss and share information regarding the recycling of metallic discards. This task force will provide further guidance and recommendations to enhance the recycling of metallic discards.

INTENDED CHANGE: No change to either the SAIC report nor the Board's Management Plan will be made.

COMMENT(2,3,4) Several commenters oppose the recommendation that manufacturers be required to take back obsolete appliances. This option is not justified by the information in the body of the SAIC report which documents how well white goods are already being handled in the California waste management system. Manufacturers have no experience, expertise, or infrastructure in place to take back and process appliances. The manufacturers would have to rely on the existing infrastructure for such service.

Excessive costs and/or difficulties in documenting and implementing this program could result in fewer manufacturers choosing to sell their goods within the state.

Also, there is the legal and logistical issue of assigning responsibility to take back products manufactured by companies that no longer exist.

Would this program only cover appliances which were purchased in the state of California? Is this program comparable to programs within other states?

RESPONSE: The Board is not currently pursuing option 5 of the SAIC report, the Manufacturer's Responsibility. The Board has recommended in its Management Plan that a Metallic Discards Task Force be formed to discuss and share information regarding the recycling of metallic discards. This Task Force will provide further guidance and recommendations to enhance the recycling of metallic discards.

INTENDED CHANGE: No change to either the SAIC report nor the Board's Management Plan will be made.

Appendix C:

Responses to Comments Received on

"Metallic Discards Management Plan"

August 1993

The Board's report entitled "Draft Metallic Discards Management Plan" was presented to the Policy, Research, and Technical Assistance Committee on August 11, 1993.

Staff's responses to the comments received on the Management Plan are presented below. The numbers in parentheses represent the commenters. The following is the key:

(1) Appliance Recycling Centers of America (ARCA)

(2) Schnitzer Steel and Flanigan & Flanigan

(3) General Electric and Landels, Ripley, & Diamond

(4) Norcal Waste Systems

(5) Pacific Gas & Electric (PG&E)

(6) Department of Toxic Substances Control (DTSC)

(7) City of Los Angeles

(8) Science Applications International Corporation (SAIC)

(9) Sacramento Municipal Utility District (SMUD)

(10) Resource Environmental

(11) California Air Resources Board (CARB)

COMMENT (7): Clarify whether solid waste transfer stations and landfills are required to remove special materials from metallic discards.

RESPONSE: AB 1760 requires that special materials be removed from major appliances and vehicles in which they are contained prior to crushing for transport or transferring to a baler or shredder for recycling. There is no exemption in this law for anyone recycling metallic discards containing special materials.

INTENDED CHANGE: There is no change to the Management Plan.

COMMENT (8): What problems are expected when the metallic discards ban becomes effective (e.g., illegal dumping)?

RESPONSE: Problems associated with implementation of the metallic discards ban (AB 1760) will be investigated through the Board's proposed
monitoring program and through feedback from the Task Force.

INTENDED CHANGE: There is no change to the Management Plan.

COMMENT (7): The proposed educational outreach program should be modified to include hands on training.

RESPONSE: A certification program for persons recovering and recycling CFCs is currently being implemented through the U.S. EPA. Information concerning this program can be obtained through the U.S. EPA's Stratospheric Ozone Hotline number at 1-800-296-1996. The need for further training regarding other special materials will be a task assigned to the Task Force. The State has no funds nor statutory authority to develop and implement a certification program

INTENDED CHANGE: This task will be assigned to the Task Force.

COMMENT (4,5): The education outreach program needs to target solid waste facilities and the general public in addition to metallic discards recyclers.

RESPONSE: The Board's intention is to target the public and metallic discard processors.

INTENDED CHANGE: The Management Plan has been changed to incorporate the general public and solid waste facilities.

COMMENT (1): If State resources are limited in implementing the outreach program, emphasis should be placed in assisting local governments on how to handle illegally disposed appliances.

RESPONSE: One purpose of the Board's outreach program is to minimize illegally disposed appliances. The Board will monitor this activity up to one year from the effective date of the metallic discards disposal ban and may take further action if needed.

INTENDED CHANGE: There is no change to the Management Plan.

COMMENT (4): The term of the proposed Metallic Discards Task Force needs to be stated in the Management Plan.

RESPONSE: The Task Force will meet, as scheduled by Board staff, for a one year period following the metallic discards ban.

INTENDED CHANGE: The Management Plan has been changed to incorporate the term of the Task Force.

COMMENT (7): Who will the Task Force report to?

RESPONSE: The Task Force will work with CIWMB staff to research issues and develop recommendations. The Task force will have the opportunity to report their recommendations to the Policy Committee on items that have policy implications requiring Board action.

INTENDED CHANGE: There is no change to the Management Plan.

COMMENT (7): The issue of training and certification of metallic discards handlers and recyclers should be included among the tasks identified for the Task Force.

RESPONSE: This issue will be included among the tasks identified for the Task Force.

INTENDED CHANGE: The Management Plan has been changed to identify this task.

COMMENT (3): The monitoring period should be extended to at least twelve months, in order to establish a trend line on the frequency of PCB capacitors appearing in discarded appliances.

RESPONSE: The Board is proposing to monitor the removal of PCB-containing devices after six months from the ban. The monitoring period may be extended if staff determines that additional data regarding PCB-containing devices is needed.

INTENDED CHANGE: The Management Plan has been changed to extend the monitoring period, if needed, regarding PCB-containing devices.

COMMENT (7): Reconsider whether businesses would need more than six months for training prior to the monitoring program.

RESPONSE: The intent of the monitoring is non-regulatory in nature and is meant only to ascertain the effectiveness of the removal of special materials within metallic discards. The Board proposes that monitoring begin after six months from the effective date of the ban. The ability of businesses to learn about and comply with the law will be ascertained during this period.

INTENDED CHANGE: There is no change to the Management Plan.

COMMENT (4): In the Administration and Financing sections, the Management Plan states that the Board has chosen a modification of option 1 (Current Management System) for implementation. For ease and clarification, re-iterate option 1 of the SAIC report after this statement. Also in the Financing section, existing facilities that process metallic discards should be identified.

RESPONSE: Option 1 (Current Management System) was not reiterated in the Management Plan since it is referenced in the SAIC report which is attached as Appendix A to the Plan. Existing facilities or programs that process metallic discards in California are acknowledged in the Management Plan.

INTENDED CHANGE: The Management Plan has been changed to address existing facilities or programs that recycle metallic discards in California.

COMMENT (5): The Public Utilities Program is not a source of funding but rather an opportunity for collaboration amongst other parties.

RESPONSE: The Management Plan acknowledges that although these programs are not funding sources, they do help to offset the costs of properly handling appliances.

INTENDED CHANGE: The Management Plan has been changed to recognize the Public Utilities programs not as a funding mechanism but one to reduce energy consumption in the utility network.

COMMENT (1): Identify who to contact for the Board's Finance Programs (i.e., hotline number).

RESPONSE: The staff contact for the Board's Finance Programs can be obtained through the Board's Hotline number at 800-553-2962.

INTENDED CHANGE: The Board's Hotline number has been identified in the Management Plan

COMMENT (5,9): It is unclear whether AB 1760 addresses CFCs

(10) contained within foam insulation. If it is determined that AB 1760 does address foam insulation, then it is recommended to follow the U.S. EPA's ruling not to require the management of foam insulation containing CFC-11 due to the: 1) uncertainty about the amounts retrievable, 2) the viability of widespread use of CFC-11 removal technology, and 3) potential role for destruction technology in the future.

RESPONSE: According to AB 1760, materials which require special handling include CFCs injected in air-conditioning/refrigeration units or any other hazardous waste regulated by the Department of Toxic Substances Control (DTSC). DTSC designates CFC-11 as a hazardous waste in California.

INTENDED CHANGE: The Board has recommended following the U.S. EPA's ruling to not require the management of foam insulation containing CFC-11 (Federal Register dated May 14, 1993, Vol. 58, No. 92, Page 28702).

COMMENT (1): The Management Plan states a price of recovered CFCs at $.65-$1.00 per pound which is much less than the price that the commenter currently receives which is $3.00 per pound.

RESPONSE: The price of CFCs at $.65-$1.00 per pound was the current price at development of the SAIC report. This price has increased and will continue to increase due to demand for recovered CFCs.

INTENDED CHANGE: There is no change to the Management Plan.

COMMENT (11): The Management Plan states that the CAA is citizen enforced. The CAA is citizen complaint driven with U.S. EPA responding to tips on CFC venting. The Management Plan states that California's laws governing CFC processing are similar to the federal requirements. State regulations are not similar. The only similarity is in the definition of CFC/hazardous waste. The Management Plan states that the South Coast Air Quality Management District and Bay Area Air Quality Management District have adopted stratospheric ozone policies. The Management Plan can be strengthened by stating that these Districts have also adopted rules as part of their policies.

RESPONSE: Board staff feels the above comments clarify and strengthen the Management Plan.

INTENDED CHANGE: All comments have been incorporated into the Management Plan.

COMMENT (4): The Management Plan should state the expected CFC recovery rates from various refrigeration appliances.

RESPONSE: CFC recovery rate data is minimal, highly variable, and needs further study. Recovery rate data will be examined through the Board's monitoring program.

INTENDED CHANGE: There is no change to the Management Plan.

COMMENT (3): The Management Plan should place more emphasis on the need for recovered CFCs to maintain industrial and commercial chillers, residential and commercial central air conditioners, household refrigerators/freezers, room air conditioners, and automobile air conditioners.

RESPONSE: Board staff have determined that the above comment does strengthen the need for recovered CFCs to maintain existing equipment.

INTENDED CHANGE: The Management Plan has been changed to reflect the need for reusable CFCs in larger volume applications in addition to appliances and vehicles.

COMMENT (8): The Management Plan should state that, at present, there is no mechanism (e.g., certification, permit, enforcement) to implement the requirement of removing PCB capacitors.

RESPONSE: DTSC regulates the generation, storage, transport and disposal of PCB capacitors. The removal of PCB capacitors from a discard is required prior to disposal and recycling of the discard.

INTENDED CHANGE: There is no change to the Management Plan.

COMMENT (3): The Management Plan needs to emphasize that only a very small number of appliances contain PCB capacitors. Acknowledge the U.S. EPA estimate that 5 percent of appliances contain PCB capacitors. We estimate that approximately one percent of appliances in the post-1993 waste stream are likely to contain PCBs.

RESPONSE: The Management Plan in conjunction with the SAIC report in Appendix A does make reference to the U.S. EPA's determination concerning PCB containing appliances. However, this issue lies within the jurisdiction of DTSC and any determination concerning the processing and management of PCBs in California will be made by DTSC. The CIWMB will work to narrow the list of appliances that contain PCB capacitors and also to identify capacitors that may contain PCBs.

INTENDED CHANGE: There is no change to the Management Plan.

COMMENT (3): The Management Plan makes reference to pre-1978 appliances containing PCB capacitors. However, after the PCB manufacturing ban of 1978, appliance manufacturers were allowed a grace period which ended December 31, 1978. In actuality, the Management Plan should make reference to pre-1979 appliances.

RESPONSE: Board staff has determined that the above comment does clarify the Management Plan.

INTENDED CHANGE: The Management Plan has been changed to reflect pre-1979 appliances.

COMMENT (1): On page 6, the Management Plan states that PCB-containing capacitors are encased in a metal shell. A capacitor waste management plan developed by Ontario Hydro finds that PCB-containing capacitors may also be encased in non-metallic shells.

RESPONSE: According to data available during development of the Management Plan, capacitors containing PCBs were encased in metal shells. However, the Ontario Hydro information will be given to the Task Force for use in developing literature to identify PCB-containing capacitors.

INTENDED CHANGE: There is no change to the Management Plan.

COMMENT (1): On page 7, the Management Plan states that generators of PCBs must be licensed and permitted. Identify who and what is required through DTSC when generating, storing, transporting, and disposing of PCB wastes.

RESPONSE: Persons who generate, store, transport, and dispose of hazardous wastes must comply with the requirements of CCR Title 22, administered by DTSC. Specific requirements may be obtained from DTSC.

INTENDED CHANGE: There is no change to the Management Plan.

COMMENT (4): Are there any regulations that guide a processor on how to manage PCBs once removed from an appliance? If so, who enforces these regulations? Is there a small quantity generator exemption in TSCA?

RESPONSE: The management of PCBs is regulated and enforced by DTSC. There is no small quantity generator exemption.

INTENDED CHANGE: There is no change to the Management Plan.

COMMENT (5): The Management Plan states, under the Public Utilities Programs, that older and inefficient appliances are being diverted as a means to conserve energy. Only operating refrigerators (and in some cases freezers or room air conditioners) are being diverted at this time.

RESPONSE: Board staff have determined that the above comment does clarify the Management Plan.

INTENDED CHANGE: The Management Plan has been changed to reflect that only operating refrigerators are being accepted by the Public Utilities Programs.

COMMENT (1,6): What about the mercury found in fluorescent tubes?

RESPONSE: The issue of managing discarded fluorescent lamps is currently being examined by DTSC in cooperation with Board staff.

INTENDED CHANGE: Mercury found in fluorescent lamps contained within some appliances has been identified as a special material within the Management Plan.

COMMENT (3): On page 3, the Management Plan uses an SAIC life expectancy of 20 years per appliance. The issue of life expectancy directly impacts the quantity of the residual PCB in metallic discards. Information received by the commenter has shown materially shorter life expectancies.

RESPONSE: The 20-year life span was based on the Association of Home Appliance Manufacturers data on average appliance life (including second-hand use). Shortening appliance lifespans is important because it also decreases the estimated risk or likelihood of finding PCBs in the waste stream. This issue will be taken up by the task force.

INTENDED CHANGE: There is no change to the Management Plan.