THE IMPACTS OF LEAD INDUSTRY ECONOMICS AND HAZARDOUS WASTE REGULATIONS ON LEAD-ACID BATTERY RECYCLING: REVISION AND UPDATE

Prepared for
Office of Policy Analysis
Environmental Protection Agency

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EXECUTIVE SUMMARY

This report presents the results of a follow-up study to Putnam, Hayes & Bartlett's June 1986 study for the EPA entitled "The Impacts of Lead Industry Economics on Battery Recycling."[1] In the present study, we review the trends in lead-acid battery recycling over two and one-half decades. We also investigate a number of issues that directly influence lead-acid battery recycling rates such as lead industry economics and environmental regulations pertaining to spent lead-acid batteries.

The primary conclusions of this study are the following:

- Between 1960 and 1985, lead-acid battery recycling rates were extremely volatile. Responding to a rapid increase in lead prices, they reached an all-time high in 1965 of 97 percent. They exhibited gradual declines through the early 1970s and gradual increases during the late 1970s, averaging approximately 72 percent, until reaching a second major peak in 1980 at 83 percent. Between 1980 and 1983, recycling rates fell rapidly to an all-time low in 1983 of 61 percent. By 1985, recycling rates had recovered to levels near 70 percent.

- Despite the recent recovery of recycling rates to levels that are only slightly lower than historical levels, there is reason to be concerned about the future. There has been a clear downward trend in recycling rates since 1960. Recycling rates averaged 80 percent during the 1960s. During the 1970s, the average recycling rate declined to 72 percent. Between 1981 and 1985, the average rate was 69 percent.

- Correspondingly, the number of batteries exiting the recycling chain has increased at an average annual rate of 6 percent from an average of 8 million batteries per year in the 1960s to more than 20 million batteries per year in the middle 1980s.

- Long periods of depressed lead prices and increasingly stringent environmental regulations caused contractions in the secondary lead industry in the early 1980s. The loss of secondary smelting capacity in some areas of the country, particularly the Pacific Northwest, has led to battery recycling problems in certain regions.

- In response to growing awareness about the importance of battery recycling, several states have taken regulatory actions that specifically address lead-acid battery recycling. Some actions are aimed at reducing the number of batteries exiting the recycling chain, while others are aimed at ensuring that existing recycling activities are conducted in an environmentally sound manner.

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[1]Prepared for the Office of Policy Analysis, 13 June 1986.

- There is evidence that the ability of the lead recycling industry to collect spent batteries has been hampered by a loss of many members of the battery recycling chain. For example, the fear of environmental regulations (and Superfund liability in particular) among scrap dealers and smelters has caused an exodus that may not be reversed even with the higher lead prices evident since the end of 1986. This exemplifies the potential of current and future environmental regulations to adversely affect recycling efforts.

In summation, our analysis indicates a trend over time to lower levels of battery recycling. The low lead prices in the 1980s, coupled with a number of government regulations, caused recycling rates to drop sharply before the recycling industry was able to respond to numerous challenges and bring rates back near to historical levels. The recent increases in lead prices from levels of about 20 cents per pound to levels of about 40 cents per pound have probably stimulated recycling efforts in the short run. However, the data needed to assess the impact of the price increases are not yet available and there is anecdotal evidence to indicate that structural changes in the recycling industry brought about by a combination of economic and regulatory factors are limiting the ability of the recycling chain to respond to higher prices. The impact of these structural changes is particularly acute in certain regions of the country where regional secondary smelters have closed.

The general trend toward lower recycling rates, the existence of certain regional problems, and the significant changes in the structure of the recycling chain that have occurred in the 1980s all suggest that the EPA should continue to monitor the status of lead-acid battery recycling. In particular, the EPA should:

- Review data on 1987 recycling performance when it becomes available to determine whether structural changes in the industry caused in part by EPA regulations have reduced the ability of the recycling chain to respond to higher prices.

- Monitor the experience of certain regions of the country such as the Pacific Northwest to see if reduced recycling rates are leading to environmental problems.

- Review the experience of states that have implemented independent regulations to control battery recycling to see if environmental impacts are positive or negative.

These activities should enable the EPA to determine whether reduced recycling could be leading to environmental impacts sufficient to warrant government attention and to identify regulatory activities that could be exacerbating or reducing problems. To the extent that activities in certain states are effective in addressing battery disposal problems, the EPA can serve as a useful clearinghouse of information for other states that may seek ideas. To the extent that the cause of any problems is federal regulations, the EPA should identify such cases and consider whether regulatory revisions are appropriate. Lead-acid batteries clearly have the potential to create environmental harm. Consequently, environmental regulations that govern the handling of spent batteries are appropriate. However, the lead-acid battery recycling chain serves an important environmental function in preventing the improper disposal of a hazardous material. It is important that the EPA understand the impact of the regulations on the recycling chain so that well-intended regulations do not inadvertently increase environmental problems by hampering the lead-acid battery recycling process.

INTRODUCTION

In June 1986, Putnam, Hayes & Bartlett, Inc. (PHB), published a report for the Office of Policy Analysis (OPA) at the EPA entitled "The Impacts of Lead Industry Economics on Battery Recycling." The primary conclusion was that a combination of low lead prices and stringent environmental regulations had led to significant declines in lead-acid battery recycling rates since the early 1980s.

In response to growing concern about battery recycling in the secondary lead industry, the OPA asked PHB to investigate more closely a number of factors that influence battery recycling rates and update the recycling rate calculation based on recent trends in lead industry economics. In addition, we focused our analysis on the regional effects of battery recycling and on the extent to which any states had taken specific regulatory or other actions directed at scrap battery collection.

This report presents the results of the study and is divided into eight sections. The first section reviews the fundamentals of the secondary lead industry and emphasizes the importance of a functioning battery recycling chain for its survival. The second section presents an overview of the economics of the lead industry, focusing on supply, demand, and prices of lead on world markets. The key environmental regulations affecting participants in the recycling chain are identified in the third section. The fourth section presents the results of the battery recycling rate calculations for the period 1960 to 1985. In the fifth section, we discuss in some detail the impact of two key environmental regulations on the members of the battery recycling chain including smelters, scrap dealers, and service stations.

The analysis outlined above is based on nationwide aggregate data and is aimed at a study of the scrap battery mass balance from a national perspective. However, we feel it is equally important to give attention to the regional problems that might have arisen in those areas hardest hit by the variable economics of the secondary lead industry. For this reason, the sixth and seventh sections focus on regional concerns (particularly in the Pacific Northwest) and on the regulatory actions that certain states have taken to address battery recycling. Finally, the conclusions are presented in the last section.

I. ECONOMICS OF THE BATTERY RECYCLING PROCESS

A typical automotive lead-acid battery is made up of approximately 50 percent lead by weight. When such a battery dies, this lead can be recycled by secondary lead smelters. Secondary smelters, which rely on spent lead-acid batteries for the vast majority of their raw material, are a vital component of the battery recycling chain which brings a battery full cycle from the battery manufacturer to the consumer and finally back to the secondary smelter for processing into usable form for further consumption. The linkages between the secondary lead smelters and battery recycling are explored in this section.

Secondary Lead Production

Secondary lead production is one of two sources for refined lead. Secondary lead is produced from old and new lead scrap. New scrap is generated in the process of refining, casting, or fabricating leaded materials. Old scrap comes from obsolete materials. In contrast, primary lead is produced from mined lead.

In general, secondary lead production has been more volatile than primary lead production. Because of the production processes involved, fluctuations in lead demand affect secondary lead producers much more than primary lead producers. Secondary lead production has declined steadily in recent years from its peak in 1979 at 803,000 metric tons to 594,000 metric tons in 1985. In 1985, secondary producers supplied 52 percent of the 1 million metric tons of lead produced in the U.S.[2]

For their raw material input, secondary lead producers rely principally on the 70 million automotive batteries replaced and available for recycling annually. Figure 1 shows that scrap batteries typically account for 75 percent of the raw materials processed by secondary smelters. The remainder comes from drosses and skimmings and other general lead scrap. This percentage has been increasing from approximately 53 percent in the early 1970s to 60 percent in 1980 to over 73 percent in 1986. Clearly, secondary lead smelters play a pivotal role in the battery recycling process.

Battery Recycling Chain

Secondary lead producers are the final element in a well-established battery recycling chain which has a number of paths and players. This chain is responsible for recycling a spent battery into the raw material necessary to produce a new battery. The time required for a battery to move through the full cycle is approximately five years.

The recycling chain, shown in Figure 2, typically works as follows: A consumer returns his spent battery to a battery dealer or service station, who then returns it to a battery distributor and/or scrap dealer. It is then transported to a secondary smelter for battery breaking and smelting. Battery breakers, which separate a battery

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[2]Bureau of Mines, Minerals Yearbook, Lead, Table 1.

Figure 1
SECONDARY LEAD INDUSTRY AND BATTERY PRODUCTION

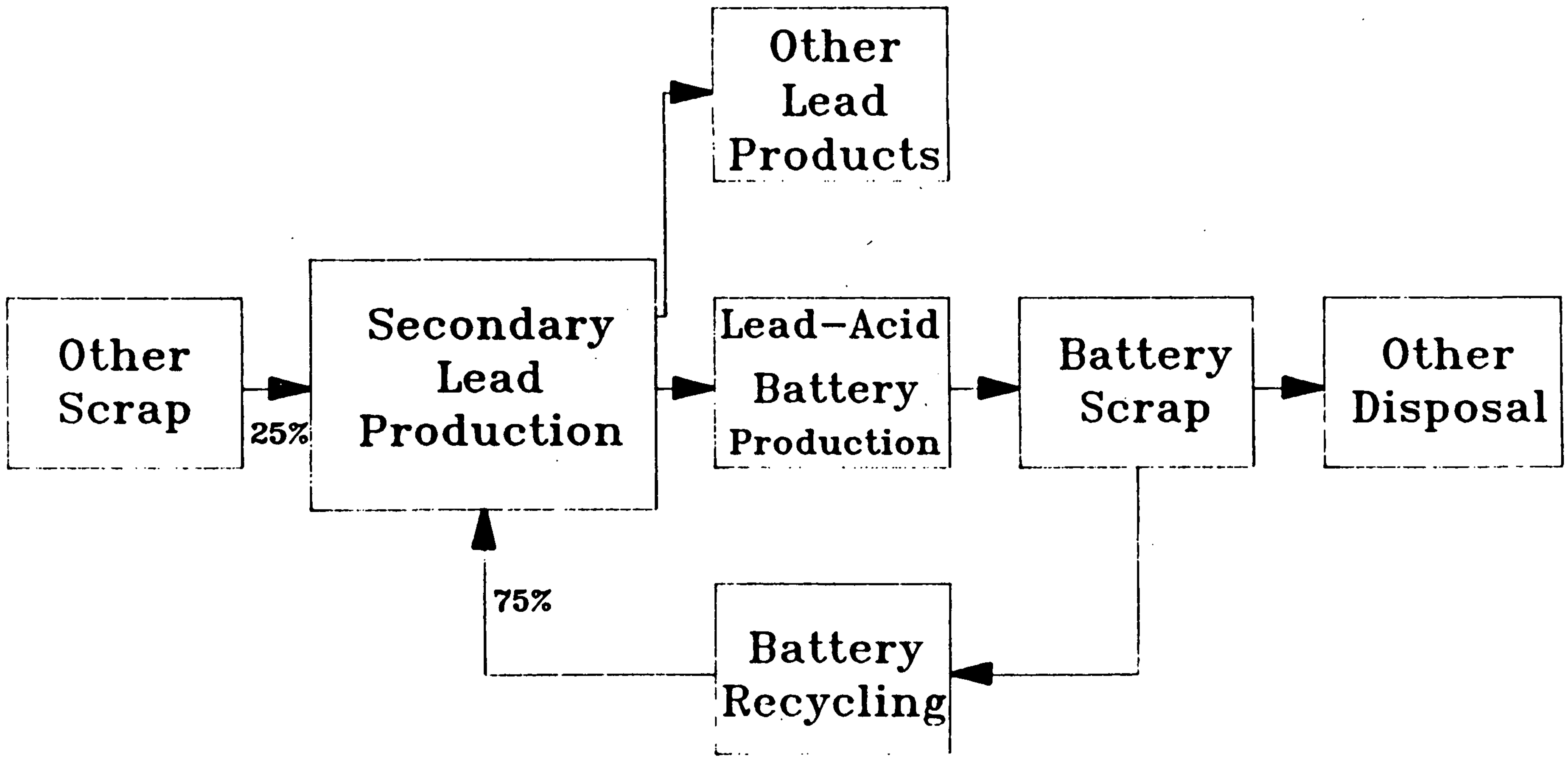
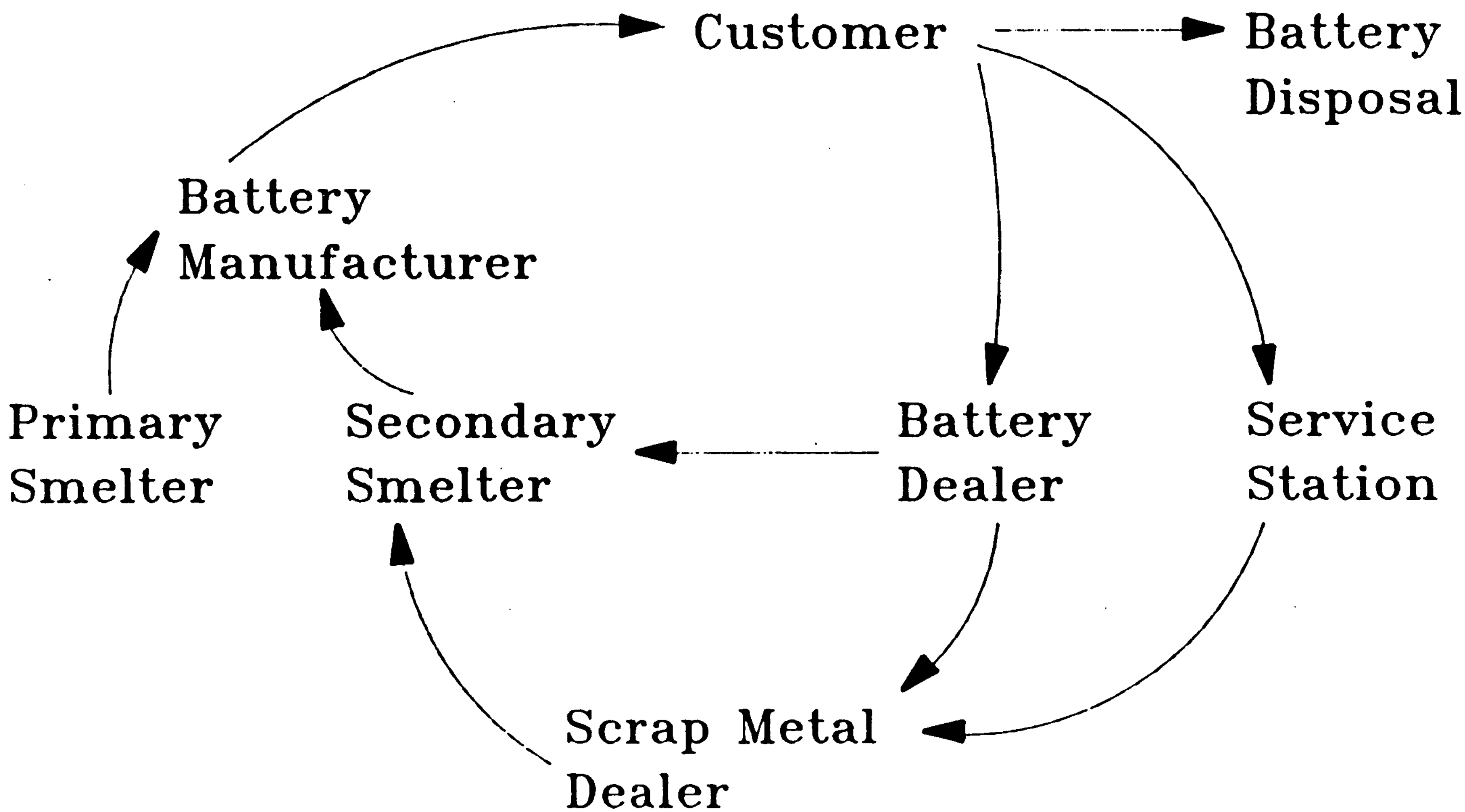


Figure 2
BATTERY RECYCLING CHAIN



into its component parts (e.g., plastic casing, lead plates, and sulfuric acid), were historically independent operations. However, stringent environmental regulations and poor lead industry economics caused most of the independents to cease operations by 1985. The vast majority of the secondary smelters are currently integrated processors and have their own battery breaking equipment. The recycling chain is complete after the lead from scrap batteries has been smelted and shipped to a battery manufacturer for the production of new lead-acid batteries.

All of the participants in the recycling chain are attempting to make a profit from their endeavors. This means that the ultimate value of the lead and other material in the battery has to be high enough to allow all those involved in the recycling chain to realize an adequate return for their efforts. In theory, there is a minimum lead price that the smelter must pay for the scrap battery to cover all the costs of recycling a battery back to the smelter. This minimum price ranges between 15 and 25 cents per pound of lead, depending mostly upon the transportation distances required and the regulations that govern transportation of scrap batteries. This estimate is based on battery breaking and smelting fees on the order of 11 to 15 cents, 2 to 4 cents per pound for transportation of the spent battery to the smelter, and the remainder for storage and handling at various stages of the chain.

Based on the above, the ability to stimulate battery recycling is, at least partially, a function of lead price. Consequently, when lead prices decline, the number of batteries that can be recycled profitably also declines.

II. LEAD INDUSTRY ECONOMICS

The previous section emphasized the link between lead prices and battery recycling. In order to understand better the dynamics of lead prices, this section is devoted to a general discussion of lead industry economics. Further discussion of lead industry economics can be found in the June 1986 PHB study, "The Impacts of Lead Industry Economics on Battery Recycling."

In general, the demand for lead products has been flat or declining since 1980. In addition, primary lead mines have continued to supply lead at low prices due to low variable costs of production and/or the revenues received from sales of co-product metals. This combination of flat demand coupled with oversupply of lead has resulted in relatively low lead prices since 1980. Prices have rebounded at least temporarily during late 1986 and 1987. The factors behind these lead price movements, particularly the trends in lead demand and supply, are reviewed briefly in this section.

Demand

The three primary end uses of lead are storage batteries, leaded gasoline, and lead paints. In 1976, storage batteries accounted for 55 percent of the 1.35 million metric tons of lead consumed in the United States. During the same year, leaded gasoline and lead paints and pigments accounted for 16 percent and 7 percent of lead demand, respectively. By 1985, storage batteries accounted for a much larger (73 percent) share of the 1.1 million metric tons of lead consumed. By contrast, the use of lead in gasoline had declined to 4 percent of total lead consumption, and the use of lead in paints and pigments was 6 percent of total lead demand in 1985.[3]

In fact, of the major end uses of lead, the storage battery industry is the only lead-consuming industry that has experienced any growth. The two other major end uses of lead mentioned above -- lead in gasoline and lead in pigments and paints -- have experienced major declines in usage due to environmental and health regulations in the United States. Both of these end uses are expected to be phased out completely over the next decade. Many other end uses of lead, such as lead in typesetting and lead foil, have been displaced by technological advances or other materials.

The only potential source of expansion in lead demand, aside from storage batteries, is new technology. The full-scale usage of new applications is well into the future; however, there is some medium-term potential for lead in certain areas of application such as the use of load-leveling batteries for airplanes, lead in fiber optics telecommunications lines, and lead caskets for permanent storage of high-level nuclear waste.

Thus, at least in the near term, storage batteries represent the only major source of continued growth for the lead industry. Its steady growth has at least partially offset the declines in lead usage in other sectors and led to relatively constant annual

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[3] Bureau of Mines, Minerals Yearbook, Lead, Table 12.

demand in the United States since 1980 between 1.1 and 1.2 million metric tons of lead. Worldwide demand for lead has also been relatively stagnant since 1980 between 3.8 and 4.0 million metric tons (see Figure 3).

Since the demand for lead is dominated by storage batteries, in order to assess the future demand for lead we must examine recent trends in the battery market. The SLI (starting, lighting, and ignition) automotive battery market is typically separated into three categories: original equipment (OE), replacement, and export. OE batteries are used for new equipment whereas replacement batteries are used to replace spent batteries in used equipment. The OE market is correlated with the number of **new** vehicles on the road each year (15 million in 1984), and the replacement market is correlated with the **total** number of vehicles on the road (150 million in 1984). Clearly, the replacement market is much bigger than the OE market. In 1986, over 80 percent of total U.S. battery shipments of 74 million units (excluding exports) were replacement batteries. Figure 4 shows that the domestic replacement market has grown at an average annual rate of 2 percent between 1976 and 1986.

The demand for lead in batteries depends not only on the automobile market but also potentially on battery technology. In the United States, the average battery lasts approximately three to four years. Its exact life depends on weather conditions and on how it is used. Battery manufacturers have made significant technological progress that has led to longer battery lives; for example, as a result of the "DieHard" battery, battery life has been relatively constant at three to four years since the 1970s. The same can be said for lead content per battery, which decreased steadily in the 1960s to approximately 17 pounds per battery, peaked in the middle 1970s at 23 pounds (responding to the need for heavy-duty batteries to power heavy cars), and has declined slightly since then. In 1985, lead content per battery was calculated to be approximately 20 pounds (see Appendix A). It is not likely that battery technology will have much effect on battery lead content or battery life in the near future.

Based on all of these factors, battery industry specialists such as the Battery Council International predicted in 1986 that the U.S. battery market will grow at a rate between 1 and 2 percent per year into the early 1990s.[4] Additionally, it is clear that future growth in the lead market will continue to be dominated by the battery market. Growth in battery sales will act to offset declines in other end uses due to product obsolescence and environmental regulation, and will yield a relatively constant demand for lead into the 1990s.

<u>Supply</u>

On the supply side, western world primary production has remained fairly stable at approximately 2.4 million metric tons per year. In the United States, seven lead mines in Missouri have continued to produce approximately 80 to 90 percent of U.S. mined production and 12 percent of western world production. Unlike many mines that

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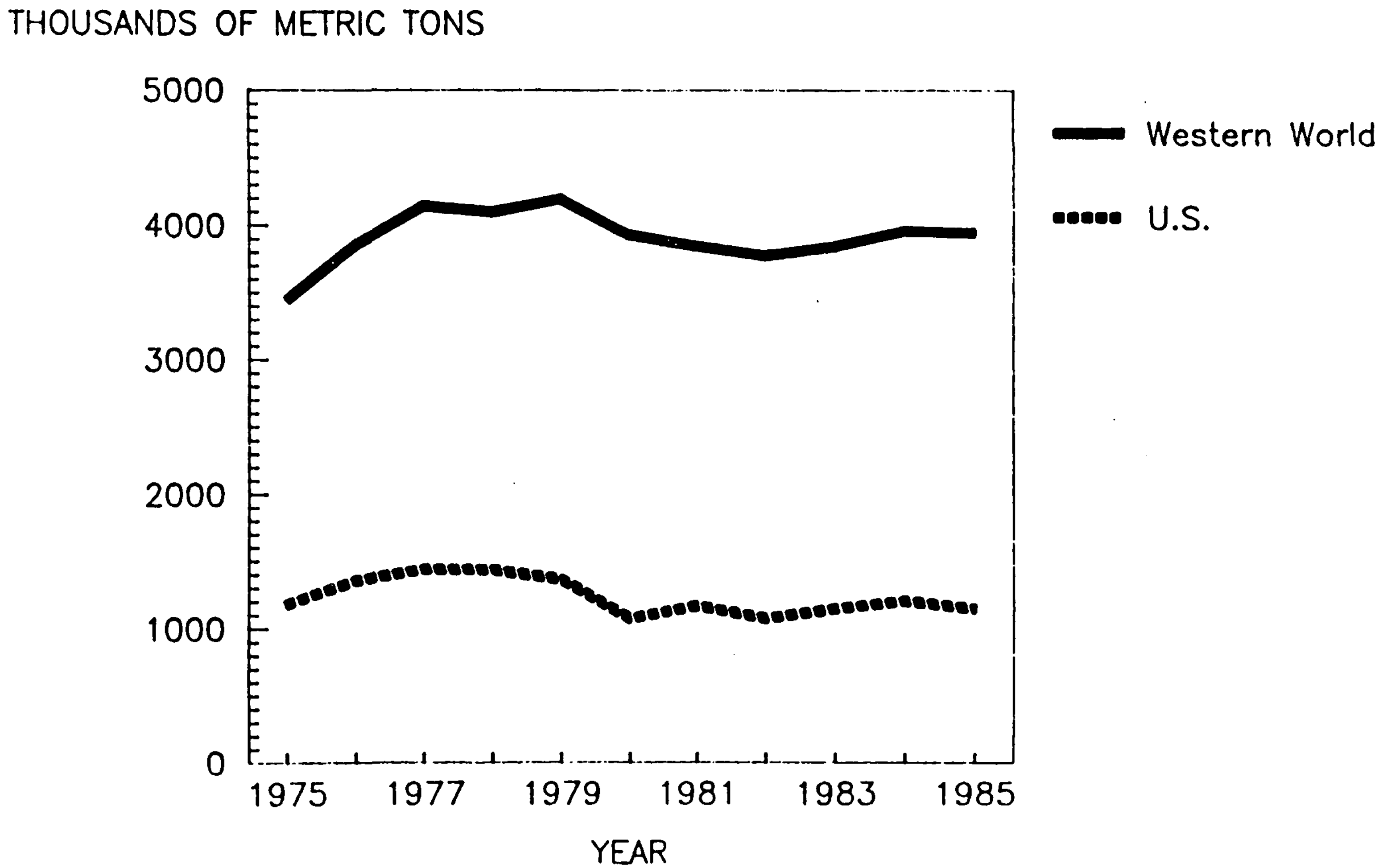
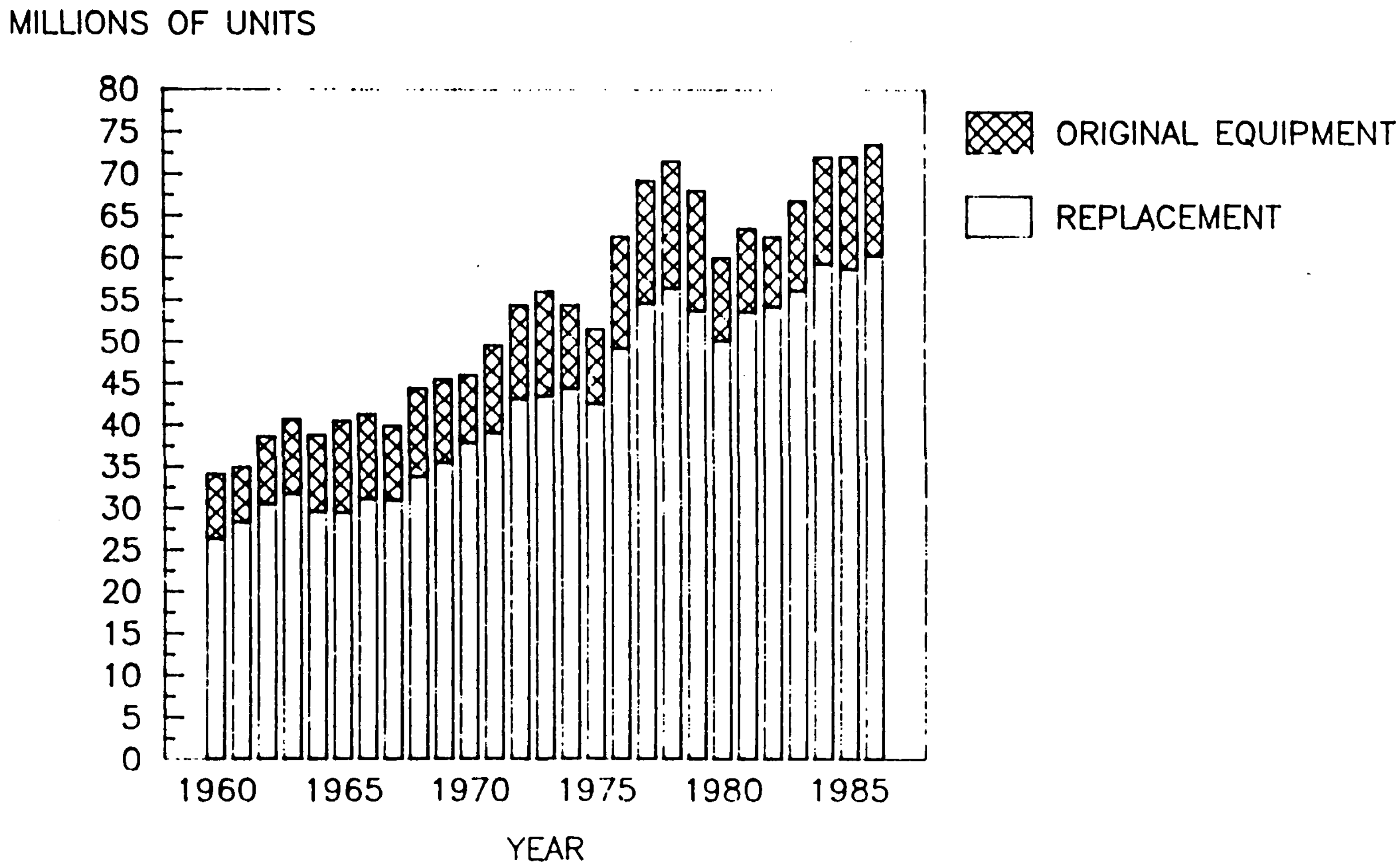
[4] "Battery Shipment Review and Five Year Forecast," <u>The Battery Man</u>, January 1987, pp. 18-20.

Figure 3
DEMAND FOR LEAD IN THE U.S. AND WESTERN WORLD



Source: Metallgesellschaft Aktiengesellschaft and Bureau of Mines

Figure 4
BATTERY SHIPMENTS 1960 – 1986



Source: Battery Council International

produce lead as a by-product or co-product, the Missouri mines are primarily lead mines. Within this category they are among the lowest cost producers, and by virtue of their size have a major impact on the domestic and world lead price.

The lead industry has historically been burdened with a relatively flat demand coupled with worldwide oversupply of the metal. A major factor leading to oversupply is the growth of lead produced in conjunction with growing metals markets such as zinc, copper, and silver. During times of expanding markets for these metals, lead is produced as a by-product or co-product at virtually no additional cost. This kind of lead production put downward pressure on lead prices through the early to middle 1980s.

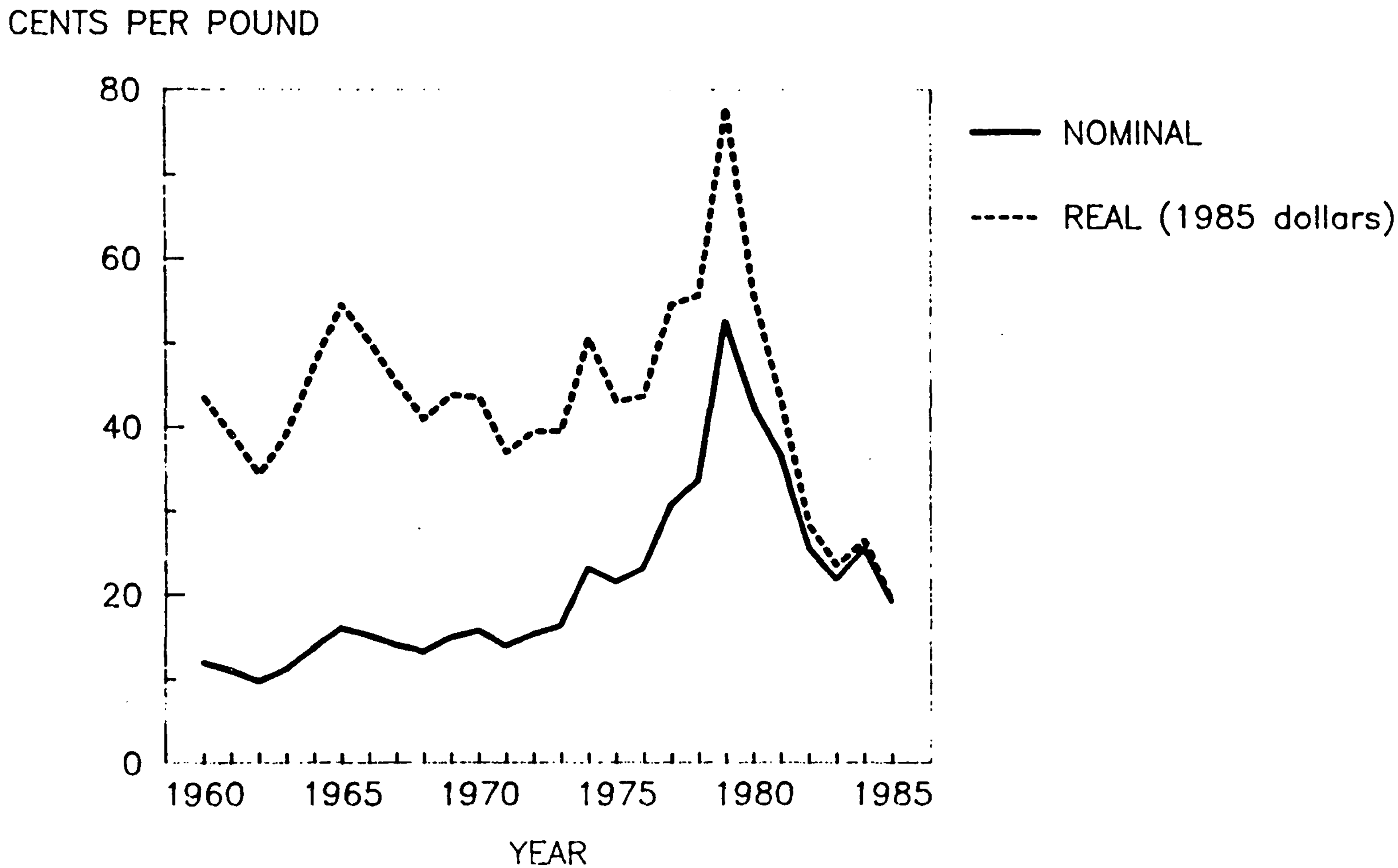
Since 1986, however, the dynamics of lead supply have changed. Strikes in lead mines in the United States have kept the lead industry somewhat supply constrained. Cominco, a major domestic primary lead producer with over 110,000 metric tons of capacity, suffered a shutdown due to labor strikes. In addition, a giant merger in 1986 between St. Joe Minerals and Homestake Mining Company consolidated approximately two-thirds of U.S. lead mining capacity into the hands of Doe Run Mining Company, which has maintained production at less than capacity levels. These events have led to a restructuring of the primary lead industry and to a supply-constrained situation which started in late 1986. This situation has had a major impact on lead prices.

Prices

The historical combination of stagnant lead demand and oversupply resulted in the lead price profile shown in Figure 5. Lead prices remained relatively constant during the 1960s and early 1970s with a slight run-up in prices in 1965. They peaked in 1979 at over 52 cents per pound, before beginning a dramatic decline to prices below 20 cents in 1985. The price profile is even more volatile when prices are adjusted for inflation. In constant (1985) dollars, lead prices peaked at 78 cents in 1979 and declined by more than 75 percent in only six years to 19 cents per pound in 1985.

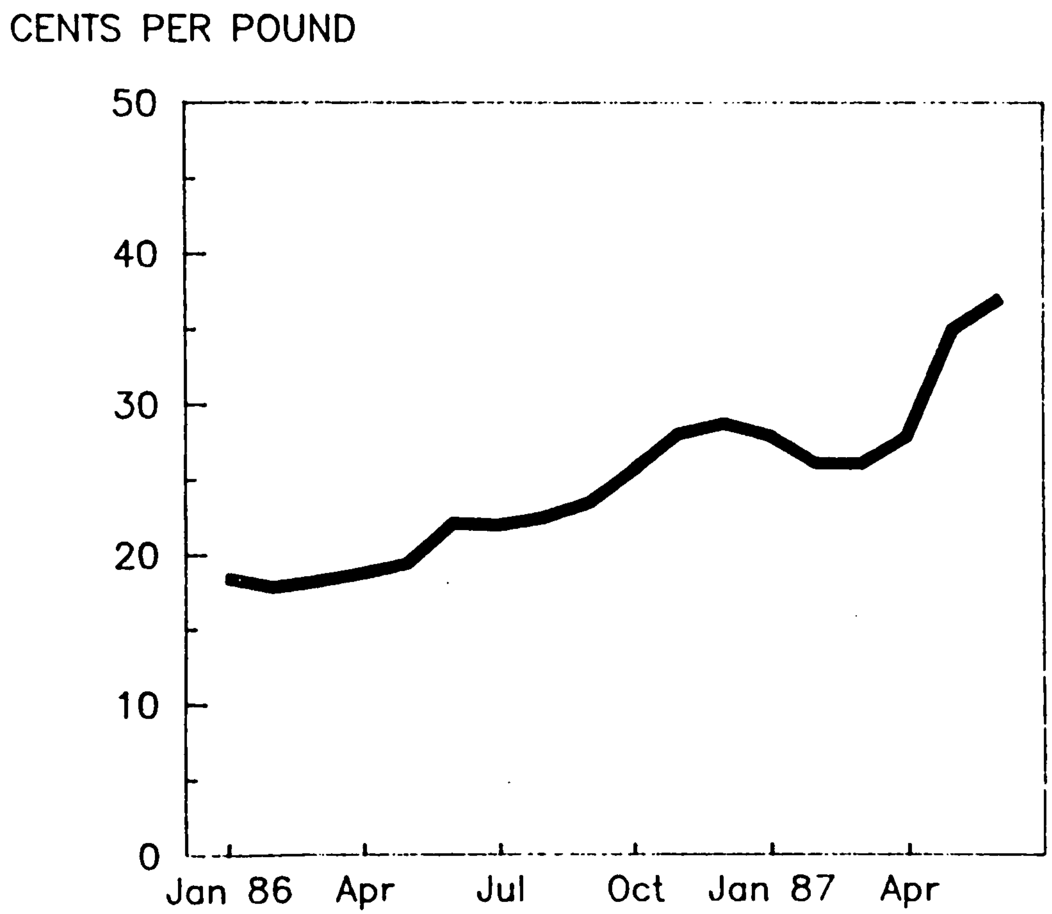
However, since 1986, a supply-constrained situation has initiated the rapid recovery in lead prices to levels above 40 cents by the middle of 1987. Mine closures, strikes, and consolidation efforts have improved the supply/demand balance and led to the recent price profile shown in Figure 6. However, it is not clear that price levels in the 40 cents per pound range can be sustained in the long run unless Missouri mine operators are able to exercise continued production restraint.

Figure 5
U.S. PRODUCER LEAD PRICES



Source: Bureau of Mines

Figure 6
U.S. PRODUCER LEAD PRICES: 1986 & 1987



Source: Metals Week

III. ENVIRONMENTAL REGULATIONS AFFECTING THE SECONDARY LEAD INDUSTRY

The depressed lead prices during the middle 1980s have not been the only factor to influence battery recycling. In addition, stringent environmental regulations have increased the costs of doing business for secondary smelters and have created a concern about liability for all the members of the recycling chain. This section highlights the impact of these environmental regulations on the secondary lead industry.

Since the late 1970s, secondary smelters have faced significant costs and technological challenges posed by EPA under the Clean Air Act, Clean Water Act, OSHA, and RCRA. Each is discussed very briefly below.

Clean Air Act

The Clean Air Act (CAA), together with the National Ambient Air Quality Standards (NAAQS), promulgated lead emissions limits of 1.0 micrograms of lead per cubic meter released into the atmosphere at the smelter fence line. This standard is to be fully implemented by 1 January 1988.

In their 1986 study of environmental compliance costs, the Bureau of Mines concludes that operating costs to meet the current NAAQS standard of 1.5 micrograms per cubic meter for a typical secondary smelter are on the order of 1.2 cents per pound of lead produced. However, compliance costs vary widely depending on factors such as the size of the smelter, location, plant technology, and plant age.[5]

Clean Water Act

Beginning in 1984, the Clean Water Act governed effluent limits to 80 ppm of lead in the water for smelters and 120 ppm for battery plants. The regulation requires that nonferrous smelters comply with the "best available technology" (BAT) limits by March 1987. There continues to be controversy over whether such limits are attainable with BAT.

The Bureau's estimated CWA compliance operating costs are 0.19 to 0.75 cents per pound of lead.

OSHA

The Occupational Safety and Health Administration (OSHA) set in-plant maximum permissible exposure limits of 50 micrograms of lead per cubic meter in the air.

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[5]Further discussion of the compliance cost estimates can be found in the following Bureau of Mines 1986 report: "Domestic Secondary Lead Industry: Production and Regulatory Compliance Costs," Intermountain Field Operations Center, Denver, Colorado, July 1986.

Battery plants and secondary smelters must have met the standards by 1986. The Bureau's estimated OSHA compliance costs are 0.65 cents per pound of lead produced.

In 1983, OSHA regulations also set a blood lead limit of 50 micrograms of lead per 100 grams of blood to apply to all employees in the industry. Today, an employee with a blood lead level at or above that level must be immediately removed from that location until the blood level has been reduced to no more than 40 micrograms per 100 grams of blood. Monthly monitoring programs must also be provided. Although estimates of the costs required to meet the blood lead standard are not available, this standard can be a significant cost item at some smelters.

RCRA

The Resource Recovery and Conservation Act (RCRA) classifies as hazardous waste all effluent, with lead or lead compound concentrations of 500 ppm or more, or pH levels below 2.0. According to the Bureau of Mines, RCRA adds 0.35 to 1.6 cents per pound of lead (depending on the smelter size) to the smelter's operating costs.

Also, as part of RCRA, effective January 1985, spent lead-acid batteries (or parts thereof) are classified as hazardous materials. RCRA imposes costly restrictions on owners and operators of facilities that store spent batteries before reclaiming them. Since some secondary smelters store lead-acid batteries on site, they become land disposal facilities and need a RCRA permit or interim status to operate. Before a RCRA permit will be issued, the operator must be issued a Part B application (costing $30,000 to $50,000 for an average-sized smelter), install a groundwater monitoring system (costing $30,000), and obtain $6 million of non-sudden liability insurance. These costs can be prohibitive, and, in the case of the liability insurance, may simply be unavailable.

Because many smelters have been unable to meet all of these requirements by the deadline of November 1985, many have lost their interim status. Stringent enforcement of the provisions could force the closure of a number of smelters in the industry.

Current federal legislation exempts from RCRA those persons who generate, transport, or collect spent batteries or persons who store spent batteries but do not reclaim them. These exemptions apply to components of the battery chain such as backhaulers, battery dealers or distributors, service stations, or scrap metal dealers. Regardless of these exemptions, however, many of these businesses ceased handling spent batteries when depressed lead prices persisted over long periods.

Compliance Costs

In total, the Bureau of Mines indicates that compliance with current environmental regulations (including OSHA standards, environmental equipment operations and maintenance, supplemental labor costs for pollution control equipment, and hazardous material handling costs) will raise operating and maintenance costs by about 2.3 cents per pound of lead produced.

Recent regulatory pressures threaten to tighten the environmental pressure on smelters even further. For example, the NAAQS will be reduced from 1.5 micrograms of lead per cubic meter to 1.0 by January 1988. It is possible that the NAAQS will be further reduced to 0.5 micrograms of lead per cubic meter. This alone could add .5 to 1.3 cents per pound of lead to smelter operating costs.

Secondary Smelter Closures

The combination of depressed prices and regulatory pressures has had a significant impact on participants in the lead-acid battery recycling chain. At the end of 1980, nominal smelting capacity of domestic secondary smelters stood at approximately 1.3 million metric tons. By 1986, this capacity had shrunk by almost 40 percent to 800,000 metric tons. Roughly two-thirds of those secondary smelters operating in 1976 were closed by 1986. In addition, the long-lasting depression in lead prices resulted in much of the industry's capacity operating under bankruptcy proceedings in 1986. Figure 7 documents the closures of secondary smelting capacity since 1982 and Table 1 lists the operating status of domestic smelters at the end of 1986.

However, by 1986 (even before the lead price increases in late 1986) it appeared that the contractions in the secondary lead industry were basically complete. In 1986, the secondary smelters produced approximately 600,000 metric tons of lead.[6] Since secondary lead smelting capacity was approximately 800,000 metric tons during this time, this means that capacity utilization rates were on the order of 75 percent. This is a substantial increase from the 1985 utilization rate of near 60 percent. At current utilization levels, smelters could expect to generate profits even at prices near 20 cents per pound. Therefore, absent the threat of more stringent environmental regulation, most industry analysts predict that secondary smelting capacity will remain relatively stable over the next several years. However, stringent enforcement of current environmental regulations or new regulations could cause further contractions.

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[6]Preliminary estimate, Mineral Industry Surveys, Lead, March 1987, and Bureau of Mines, William Woodbury, personal communication.

Figure 7

SECONDARY SMELTERS IN THE U.S. (AS OF APRIL 1987)

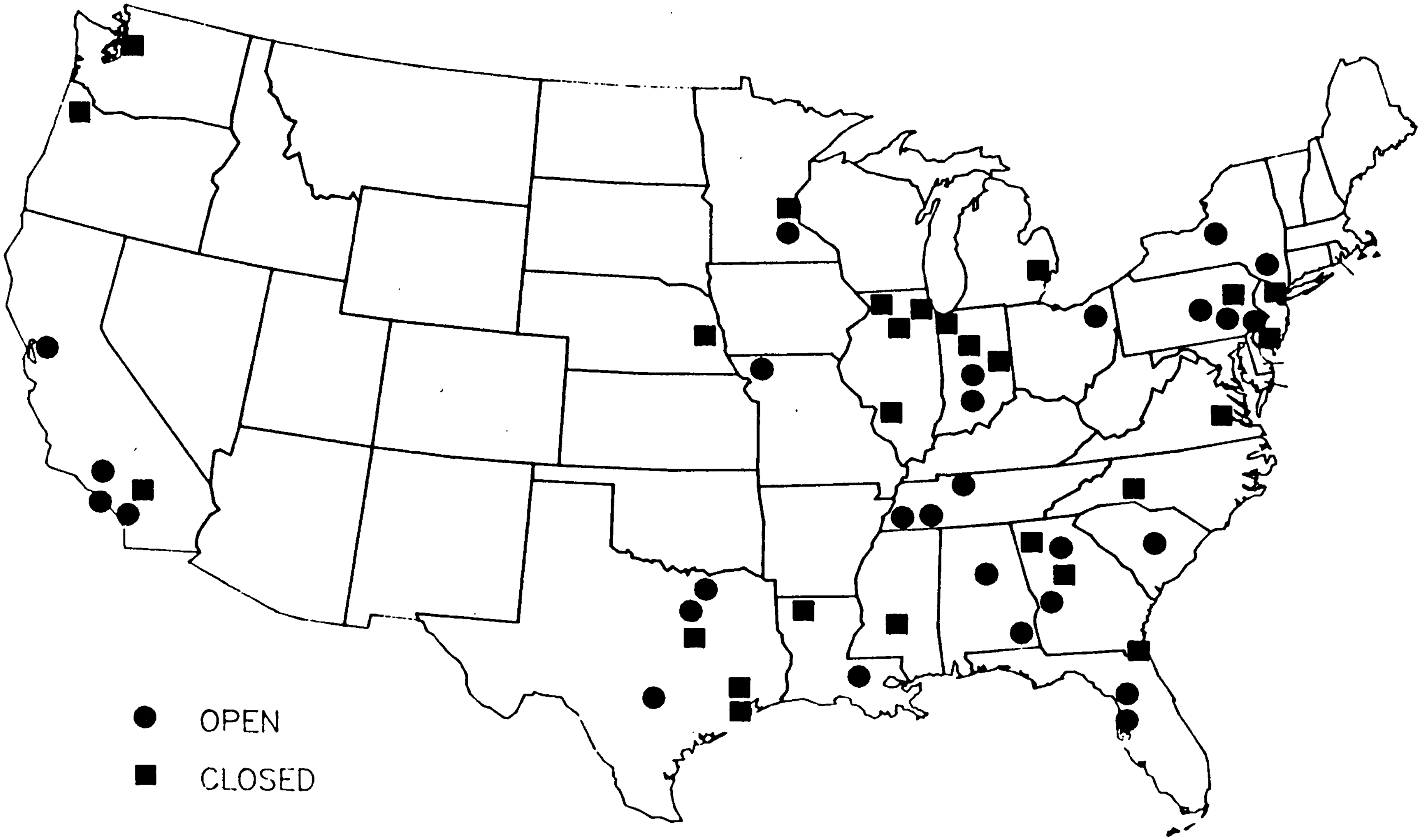


TABLE 1

SECONDARY SMELTERS IN THE U.S. (AS OF APRIL 1987)

Company	Location	Capacity (000 mt) Open	Closed	(Date)
Alco Pacific	Gardena,1 CA	5		
Bergsoe-Bolinden	Muncie, IN		20	
Bergsoe Metal	St. Helens, OR		25	(5/86)
	Seattle, WA		20	(7/84)
Chloride	Tampa, FL	12		
	Columbus, GA	12		
	Florance, MS		12	(11/82)
East Penn Mfg.	Lyon Station, PA	15		
Federated Metals	Newark, NJ		10	(10/84)
	San Francisco	10		
	Whiting, IN		10	(2/83)
	Houston, TX		10	
General Battery	Dallas, TX	25		
	Reading, PA	65		
	Heflin, LA		13	(3/82)
General Smelting	Nashville, TN	10		
GNB Battery	Omaha, NE		25	
	Frisco, TX	35		
	Los Angeles, CA	75		
	Savanna, IL		55	
Gopher Smelting	Eagan, MN	15		
Gulf Coast Lead	Tampa, FL	16		
Houston Lead	Houston, TX		15	(8/81)
Hyman Viener	Richmond, VA		12	
Ilco	Leeds, AL	18		(Ch 11)
Imperial Metal	Philadelphia, PA	6		
Inco U.S.	Jacksonville, FL		15	
Industrial Smelting	Detroit, MI		4	(86)
Inland Metals	Chicago, IL		3	
Master Metals	Cleveland, OH	15		(Ch 11)
Murmur Corp.	Dallas, TX		60	
Nassau Recycle	Staten Island, NY	10		
	Gaston, SC	35		
National Smelting	Atlanta, GA		25	(3/84)
	Pedricktown, NJ		60	(1/84)
Refined Metals	Memphis, TN	30		
	Beech Grove, IN	30		
Ross Metal	Rossville, TN	10		
Roth Brothers	E. Syracuse, NY	5		
RSR	Los Angeles, CA	42		
	Indianapolis, IN	45		
	Middletown, NY	42		

TABLE 1 (CONTINUED)

Company	Location	Capacity(000 mt) Open	Closed (Date)
Sanders Lead	Troy, AL	80	
	Cedartown, GA		10
Schuylkill	Baton Rouge, LA	70	
	Mound City, MO	33	
Southwest Metals	San Bernadino, CA		10
Standard Electric	San Antonio, TX	5	
Taracorp	McCook, IL		14
	St. Louis Park, MN		18
	Granite City, IL		25
	Atlanta, GA	30	
Tonolli	Nesquehoning, PA		45
U.S.S. Lead	E. Chicago, IN	22	
Willard Lead	Charlotte, NC		20
TOTAL CAPACITY		820	540

IV. CALCULATION OF BATTERY RECYCLING RATES (1960-1985)

In the preceding sections, we have described how the lead industry supply and demand balance resulted in a prolonged period of low lead prices during the 1980s. We have also described how these low prices, coupled with significant regulatory pressures, led to a significant decline in the number and capacity of secondary lead smelters. Because lead-acid battery recycling requires the participation of secondary smelters and is sensitive to the price of lead, one might suspect that the recycling rate would have fallen sharply during the 1980s and potentially created a problem of improper disposal of lead-acid battery waste.

To investigate whether a significant decline in recycling has occurred, we have estimated recycling rates over a 25-year period from 1960 to 1985. A comparison of current rates to historical rates can help indicate the extent to which recent smelter closures or low lead prices have resulted in a significant disposal problem.

Battery Recycling Rate Calculation

In this section we describe the mechanics of the battery recycling calculation that quantifies the trends in lead-acid battery recycling in the United States. Our approach is based on the concept of mass balance (see Figure 8). On one side of the equation, we consider the **generation** of battery scrap, that is, the amount of lead scrap that is generated annually from spent batteries, decommissioned vehicles, and battery scrap imports. On the other side, we consider the **consumption** of battery scrap, that is, the amount of battery scrap that is consumed annually by secondary smelters, scrap exports, and scrap inventories.

The recycling rate is then calculated by expressing the consumption of battery scrap as a percentage of the total battery scrap generated. The difference between the amount of battery scrap generated and consumed is the amount of lead that is unaccounted for and exiting the recycling chain annually.

In Appendix A, each component of the recycling rate calculation is described separately.

Battery Recycling Rate Results

The results of the battery recycling rate calculation for the period 1960 to 1985 are shown in Figure 9. The figure shows that recycling rates have fluctuated during this time between a high of 97 percent in 1965 to a low of 61 percent in 1983. In recent years, recycling rates declined very sharply from a 1980 peak above 83 percent to the historical low in 1983. Since 1983, however, recycling rates have recovered to levels around 70 percent (by 1985). The 1985 level is not significantly below historical levels, which averaged approximately 75 percent.

The rebound in recycling rates starting in 1983 demonstrates the ability of the secondary industry to respond and adjust to some significant changes in the business environment. During this time, many components of the battery recycling chain were

Figure 8

SCRAP BATTERY MASS BALANCE

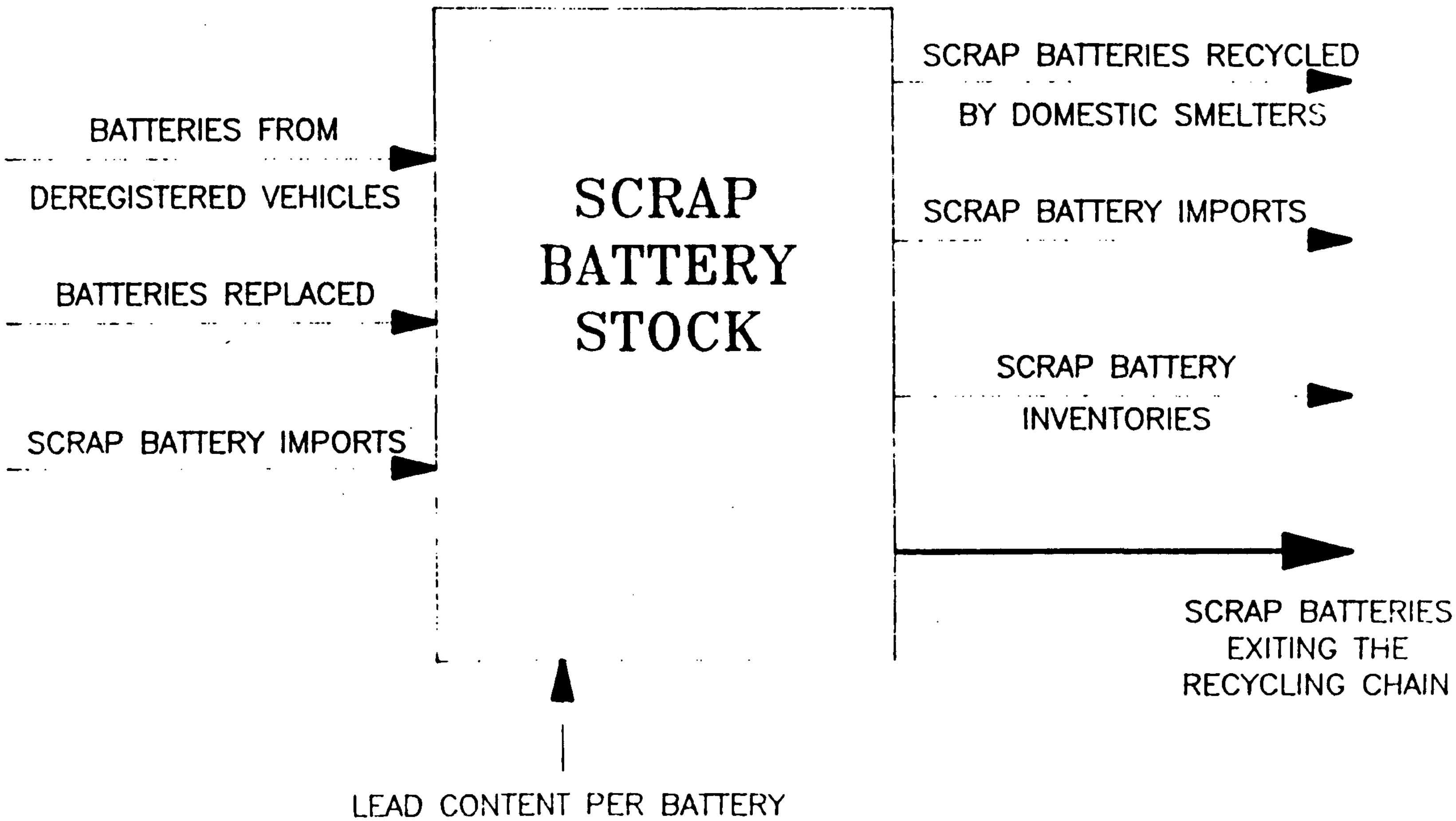
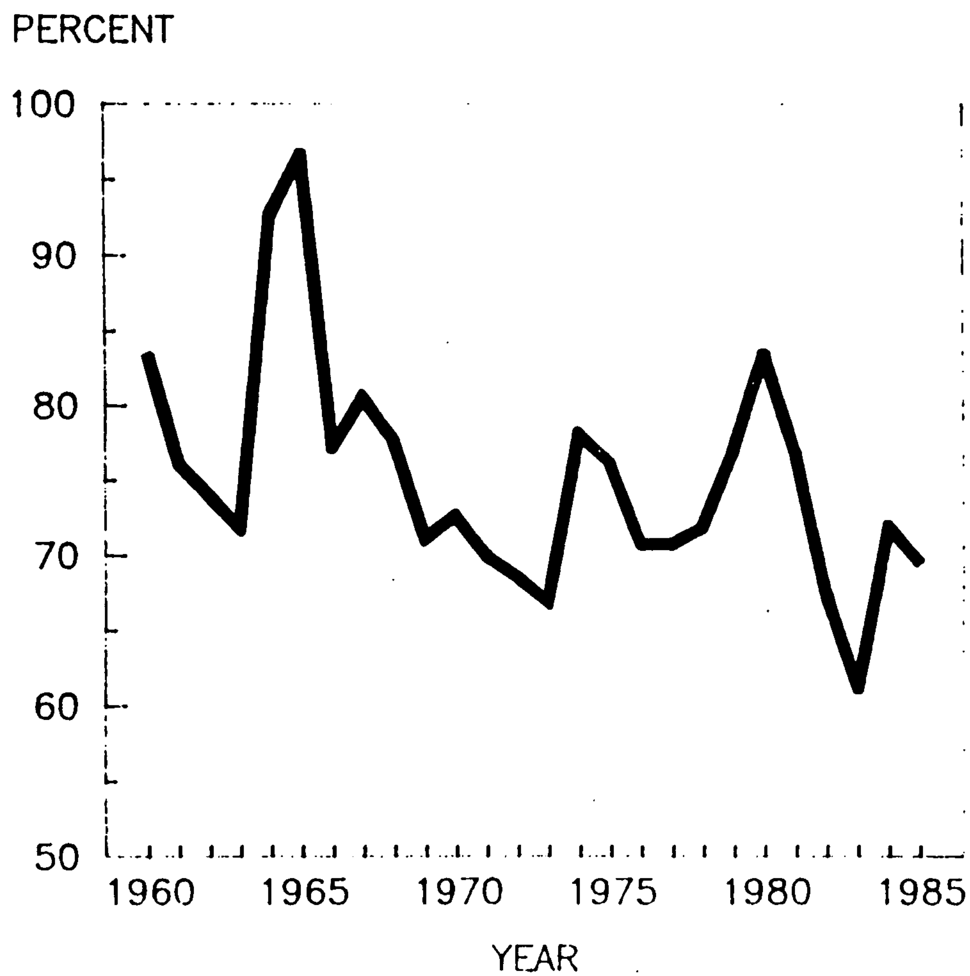


Figure 9
BATTERY RECYCLING RATES: 1960 – 1985



consolidated: some secondary smelters and most independent battery breakers closed and many scrap dealers and service stations stopped handling batteries altogether. Those who did stay in business were able to expand their collection network and absorb much of the surplus. It is too early to tell whether or not these improvements can be sustained in the long term.

Despite the year-to-year fluctuations and the improvements since 1983, Figure 9 also shows a steady downward trend in recycling rates since the 1960s. Recycling rates averaged 80 percent during the 1960s. During the 1970s, the average recycling rate declined to 72 percent. Between 1981 and 1985, the average rate was 69 percent.

We can also consider the trends in the absolute number of batteries exiting the recycling chain over time. Because of steady growth in battery sales, a decrease in recycling rates over time can be translated into an increase in the number of batteries exiting the recycling chain. Note that because of the growth of the battery industry, even constant recycling rates over time would mean that increasing numbers of batteries were exiting the recycling chain. While recycling rates in the mid-1980s are only slightly lower than historical rates in the 1960s and 1970s, we note that the number of batteries that are <u>not</u> being recycled continues to increase (see Figure 10). Between 1960 and 1985, the number of batteries not being recycled increased at an average annual rate of approximately 6 percent. In 1960, there were approximately 5 million batteries (44,000 metric tons of lead) unaccounted for. In 1969, there were 14 million batteries (or 105,000 metric tons of lead) not being recycled. By 1985, the gap between the batteries available for recycling and those actually recycled had widened to 22 million batteries (190,000 metric tons of lead).

To summarize, our calculations show a volatile, but downward, trend in battery recycling rates since 1960 and a general increase in the number of batteries that are not recycled every year. Recycling rates hit an all-time low in 1983 at 61 percent with 26 million batteries not collected. Since that time, recycling rates have rebounded (at least temporarily) to levels that are not significantly lower than historical levels. Despite the rebound in recycling rates, the number of batteries exiting the recycling chain has remained high at over 20 million batteries per year since 1982.

<u>Effect of Lead Prices on Recycling Rates</u>

As expected, fluctuations in recycling rates can be at least partially explained by fluctuations in lead prices. Figure 11 shows recycling rates and lead prices (with different unit scales) on the same graph. As shown in the figure, the lead industry experienced a significant rise in lead prices during the middle 1960s, reaching a peak price of 55 cents (in 1985 dollars) in 1965. The declines in recycling rates between 1965 and 1973 correspond to periods of relatively low lead prices, preceding another price increase in 1974. Yet another price increase between 1979 to 1980 also contributed to increases in recycling during that time.

It is particularly interesting to analyze the linkage between lead prices and recycling rates over time. A changing business environment might have led to a change in the secondary lead industry's ability to respond to changes in lead prices.

Figure 10
NUMBER OF BATTERIES EXITING THE RECYCLING CHAIN

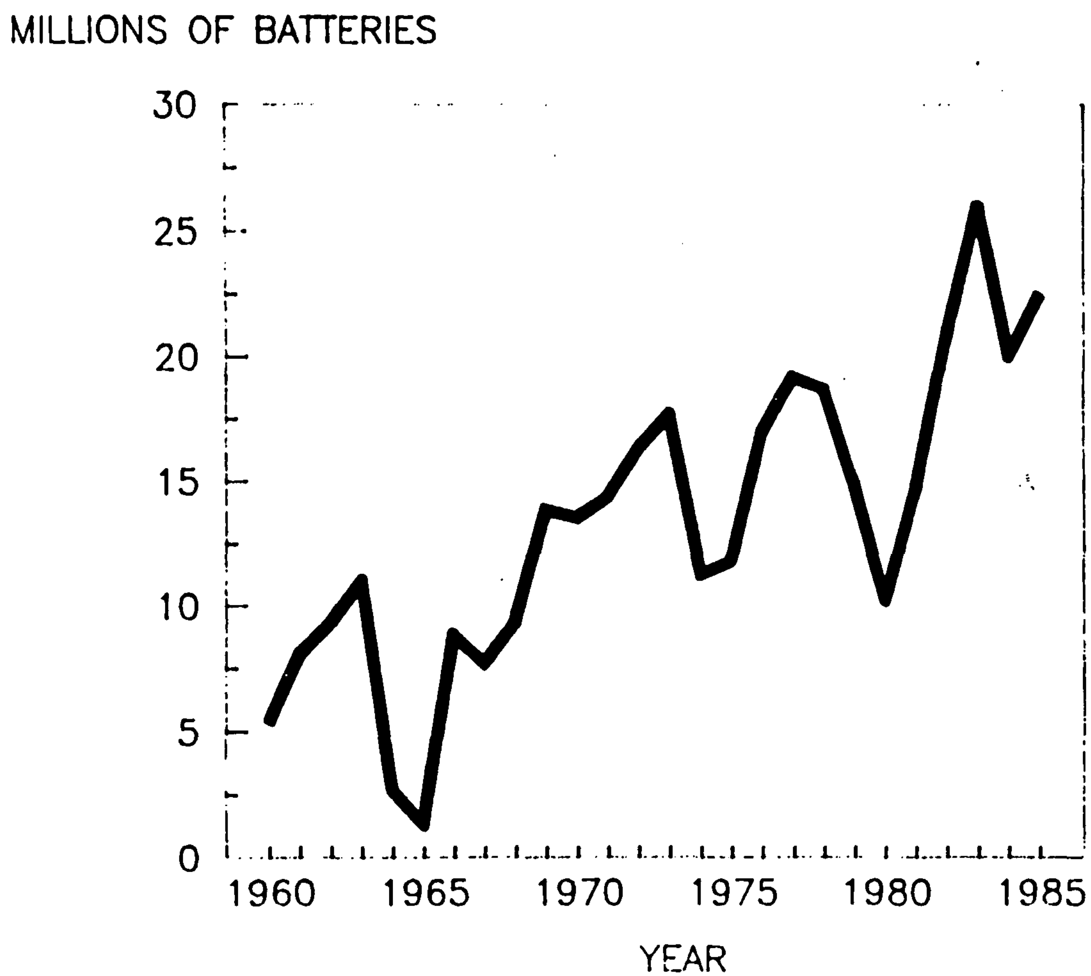
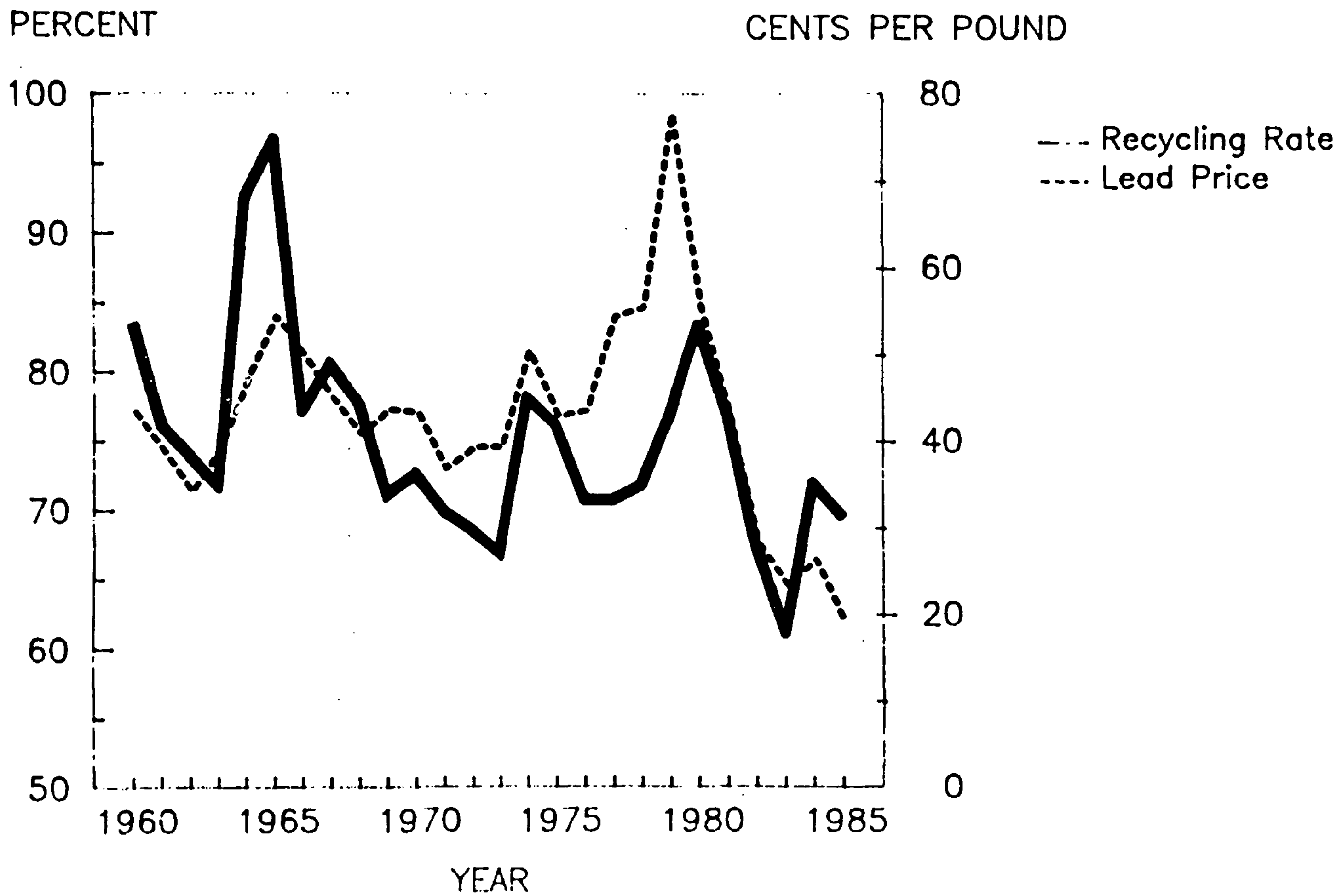


Figure 11
BATTERY RECYCLING RATES AND LEAD PRICES



To test this theory, we performed a relatively straightforward statistical test to analyze the correlation between lead prices and recycling rates over time. Regressions between lead prices and recycling rates were performed over multiple periods. During the 1960-1970 period, approximately 50 percent of the variation in recycling rates could be explained by changes in lead prices. In contrast, during the 1970s and 1980s, less than 40 percent of the variation in recycling rates could be explained by changes in lead prices. Furthermore, the coefficient on lead prices in the regression using data of the 1970s and 1980s was only one-fifth as large as that of the regression for the earlier period. This indicates that recycling rates are less responsive to lead prices in the late 1970s and 1980s than they were in the 1960s and early 1970s.[7]

One possible reason for the damping effect over time is increasing environmental pressures and the threat of Superfund liability in particular. Fear of government regulation may simply prevent certain members of the chain from ever becoming involved in battery recycling again, regardless of the lead price and potential profits involved. Unfortunately, 1986 and partial 1987 data are unavailable to track the response of recycling rates to the rapidly increasing lead prices which occurred during early 1987. This is a key relationship to watch in the future.

Uncertainty about Input Assumptions

Before ending the discussion of battery recycling rates, it is important to note that many of the assumptions made in the calculation are subject to uncertainty. The recycling rate calculations only represent single point estimates around which the actual rates lie. In many cases, the data needed to perform the calculation exactly were unavailable and assumptions or approximations for such inputs as the lead content per battery, import levels of new replacement batteries, and inventory levels of scrap batteries at the smelters yards were required.

In addition, even the "hard" data are subject to revision. For example, in late 1986, the Bureau of Mines statistics on the amount of lead actually recovered by secondary smelters in 1984 and 1985 were significantly revised upward by 10 and 18 percent, respectively. As a result of these changes alone, battery recycling rates in those years increased by 5 and 11 percentage points. This is the primary reason that the 1984 and 1985 recycling rates calculated in this study are significantly higher than the 60 percent levels reported in the June 1986 study.

While the recycling rates results are subject to uncertainty, the assumptions made about the key input variables affect all years' recycling rates approximately equally. As a result, we believe that the relative variations in year-to-year rates are robust, even if the actual levels may be slightly above or below the estimates presented here.

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[7]A statistical test which relied on the construction of an F-distribution indicated with 95 percent confidence that the relationships between lead prices and recycling rates during the two periods were different from one another.

The reader who is interested in more details about the assumptions made in the calculation is again referred to Appendix A for a detailed discussion.

V. IMPACT OF ENVIRONMENTAL REGULATIONS ON BATTERY RECYCLING

We have seen in an earlier section that environmental regulations have imposed significant compliance costs on members of the battery recycling chain. In addition, environmental regulations have created concern and fear on the part of some recyclers about their potential long-term liability at a waste disposal facility. CERCLA and RCRA regulations in particular are having significant impacts on the recycling chain, which are discussed in this section.

Superfund Liability

Recycling industry participants are still facing a host of complex regulations that threaten the recycling chain. These government regulations are viewed as a major threat by many scrap dealers. The primary concern cited by a number of scrap dealers interviewed for this study was Superfund liability. Recyclers are fearful that they will be liable for damages stemming from an association with a facility that ultimately becomes a hazardous waste site.

This fear is not entirely unsupported. For example, in a battery site in Alaska (Alaska Husky Battery), environmental officials have recently measured lead levels as high as 74,000 parts per million (7.4 percent) in the soils. For comparison, levels near 1,000-3,000 ppm are considered the safe limit. In addition, the municipal sewer system in the town has been damaged by the dumping of sulfuric acid from these scrap batteries. The future of the site and the ultimate involvement of the EPA are uncertain, but it is clear that some remedial action must be taken to clean up the site. The question of who is liable still looms as a major unresolved issue.[8]

Such concerns have also led the metal scrap industry's largest trade association, the Institute of Scrap Iron and Steel (ISIS), to issue a warning to its members about accepting any material that "poses a potential risk to their businesses." At the association's annual convention in January 1987, the president of ISIS urged that scrap handlers refuse to accept such material, and called environmental rules and regulations "the gravest issue facing the metal recycling industry."[9]

As a result of natural tendencies toward risk averse responses, many of the dealers who previously tolerated low margins of spent batteries to be able to provide a complete range of services to their customers have elected to stop handling batteries altogether. Some industry representatives believe that sources of available scrap are drying up altogether. One smelter in the East reported that 30 percent of its suppliers had dropped out of the scrap battery end of the business.[10]

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[8] Anchorage Daily News, 7 May 1987.

[9] American Metals Market, 15 January 1987, p. 1.

[10] American Metals Market, 16 April 87, p. 9.

Concerns about RCRA

In addition to potential Superfund liability, secondary smelters also face some serious regulatory obstacles in the future. Along with the cost of complying with RCRA regulations discussed in an earlier section, a primary unresolved issue has been the inability to provide financial assurance due to the unavailability of liability insurance. Because most of these smelters cannot obtain liability insurance or demonstrate the financial strength to provide financial assurance, they are in the precarious position of facing the possibility of immediate closure by the EPA. There are many smelters operating as land disposal facilities that have not yet fulfilled the insurance and other requirements necessary to maintain interim status. Stringent enforcement of these regulations could cause continued closures.

VI. REGIONAL CONCERNS ABOUT BATTERY RECYCLING

In addition to the regulatory pressures that affect the industry in general, there is some evidence that the industry consolidation that has occurred since 1982 or so has left certain regions of the country with inadequate recycling capability (see Figure 7). One such region is the Pacific Northwest. The closures of its only two secondary lead smelters in 1984 and 1986 represented a loss of approximately 50,000 metric tons of capacity. In the wake of these closures, many collection and recycling centers stopped accepting scrap batteries from individuals. Other recyclers in the northwest responded by transporting spent batteries to the nearest smelters in the Los Angeles area as well as increasing scrap battery export activity. This section assesses the current situation, relying on information from interviews with members of the West Coast recycling community, since regional data were unavailable.

Domestic Recycling Activity

Because of the closures of the Pacific Northwest smelters and the need to transport spent batteries over long distances, one would expect that all else being equal, recycling rates in this region would be lower than in other parts of the country. When lead prices were near or below 20 cents, it was not economical to transport the batteries to the L.A. smelters more than one thousand miles south. For example, one West Coast recycler explained that his costs to deliver a spent battery to an L.A. smelter include 2-1/2 cents per pound for loading and handling and 2 to 2-1/2 cents per pound for transportation. In 1986, smelters were typically paying 5 cents per pound. With these economics, there was clearly little incentive to recycle from the Pacific Northwest.

Even with higher lead prices in 1987, it was difficult to encourage the transport of spent batteries over such a long distance. One reason is that there existed a significant lag between the lead price increases and the prices that smelters were paying scrap dealers for whole batteries. However, by July 1987, West Coast smelters were typically paying 6-7 cents per pound as compared with earlier levels near 5 cents. We would expect these increases to again encourage an upturn in recycling activity in this region even with long-distance transport involved.

Export of Lead Scrap

Fortunately for the Northwest, export activity has been an additional mechanism for relieving some of the pressure on domestic recycling. Export activity from the ports of Seattle and Portland to destinations in the Far East did increase significantly between 1984 and 1986. Data from the Department of Commerce indicate that exports of lead scrap from these two ports increased from approximately 8 million pounds in 1984 to over 37 million pounds in 1986. Despite these increases of more than 450 percent, it is the opinion of many members of the recycling community that export activity was unable to absorb all the surplus scrap that was generated when recyclers stopped transporting scrap batteries to the L.A. smelters.

Minnesota

The Minnesota legislation, in contrast, focuses on encouraging collection of batteries at the consumer end of the chain. In 1986, a bill was passed which requires all retailers who sell batteries in Minnesota to accept spent batteries at that location (H.F. No 794). The bill contains no discussion about the pricing of this repository service nor does it dictate the actions that retailers must take to dispose of the spent batteries once a sufficiently large pile has accumulated at the site.

The impetus behind the passage of this bill was that scrap dealers in the north of the state voiced concern about a perceived increase in the number of batteries found in roadside ditches and other unsuitable areas. In response, a task force was set up in October 1986 to consider policy alternatives. This task force comprised many members of the recycling industry such as battery manufacturers, the Minnesota smelter (Gopher Smelting & Refining), battery dealers, and scrap metal dealers. After considering a wide range of policy options, there resulted a set of three resolutions that ultimately were merged with a larger omnibus bill and passed effective 1 January 1988:

1. Spent batteries are banned from municipal landfills.
2. Retail and wholesale operators must provide a battery collection center at the point of transfer.
3. Battery retail centers must post signs stating that batteries cannot be disposed of in household garbage but should be recycled, and that the retail center will accept spent batteries.

While the impact of this bill on recycling activity in Minnesota is unclear, this bill has the potential to improve the battery collection system in the state by adding more participants and disseminating information.

Rhode Island

Rhode Island passed a bill in March 1987 (H. 6105) which places a refundable deposit of at least $5.00 on all vehicle batteries sold in Rhode Island starting 1 July 1988. Batteries will be stamped or otherwise marked to show the name of the dealer, the $5.00 deposit value, and that it was sold in Rhode Island. Such batteries must be redeemed by battery dealers and distributors. The distributors must pay a handling charge of at least 50 cents per battery to dealers. Once returned to the distributor, spent batteries can only be disposed of by a facility operated by the state's Solid Waste Management Corporation or by a licensed battery recycling business.

The long-term implications of this bill on the recycling efforts in the state should be monitored in the future.

Observations about State Efforts

In all of these case studies, the regulation enacted was a reaction to a perceived problem with the hope that the regulation would prevent the problem from ever surfacing on a big scale. We are not aware of any direct evidence that improper disposal of spent lead-acid batteries has caused lead contamination in these states.

Certain other New England states (e.g., Maine, Massachusetts, Vermont) are concerned, and have discussed the issue of regulating battery collection and disposal by means of deposit schemes or collection centers, but no final agreement has been reached. In addition, a few other scattered states have peripherally discussed the issue (e.g., Wisconsin, Iowa). In Florida, for example, the disposal of spent batteries in landfills is banned, just as it is in California.

What is most interesting about each of these case studies is that they were purely independent efforts, that is, without any coordination across different states. In fact, when canvassing all U.S. states regarding any action taken to deal with spent lead-acid batteries, the Secondary Lead Smelters Association noted that most states had no knowledge of the efforts taken by any other states. The experiences of these states could provide valuable information for other states that are considering regulatory action pertaining to battery recycling in the future.

VIII. CONCLUSIONS AND RECOMMENDATIONS

Based on the analysis of the battery recycling industry undertaken for this study, we conclude that despite volatility in the year-to-year results, lead-acid battery recycling rates have generally declined since the 1960s. After hitting a historical low of 61 percent in 1983, recycling rates have rebounded to approximately 70 percent in 1985. This 1985 level is only slightly below historical levels.

Recycling rates are linked, at least to some degree, to lead prices. The relatively low recycling rates of the early 1980s can be attributed in part to the long periods of low lead prices during that time. The upturn in recycling rates in the middle 1980s demonstrates the ability of the recycling industry to adjust to a changed business environment. During that time, the secondary lead industry lost 40 percent of its capacity and many other members of the recycling chain also quit the battery recycling business. However, those remaining were able to absorb much of the surplus.

Despite the improvements in recycling rates during the middle 1980s, the general decline in recycling combined with steady growth in battery sales has resulted in an increasing number of batteries that are exiting the recycling chain annually. In 1985, the gap between the number of batteries actually recycled and the number of batteries available for recycling had risen to more than 22 million batteries.

One reason for the decline in recycling activity is environmental regulations that have added significant costs to secondary smelting operations and created a fear among recyclers that they may ultimately be connected with a Superfund site. In addition, recyclers are concerned about their ability to meet current and proposed environmental regulations (primarily RCRA). There are indications that these environmental concerns, which have already contributed to significant contractions in the secondary lead industry, will cause the battery recycling industry to be generally less responsive to lead price increases than in the past. One way to test this will be to trace the impact of the rapid lead price increases in 1987 on recycling rates when those data become available.

The loss of secondary smelting capacity during the 1980s has caused certain regions of the country to experience further battery recycling problems. One such region is the Pacific Northwest which lost all of its secondary lead smelting capacity by 1986. Fortunately, this region has developed a large export market for scrap batteries; however, in times of low lead prices and reduced incentives for domestic recycling such as 1985 and 1986, export activity was not able to absorb all the surplus scrap generated. Although data on a regional basis are not available to perform the calculations, it is clear that many scrap batteries left the recycling chain and were improperly disposed of during that time. While the recent increases in lead prices may again have encouraged domestic recycling activity from the Pacific Northwest, there is a concern that consumers are no longer aware of their recycling options after the departure of so many collection centers and service stations from the battery recycling business. Thus despite improved lead industry economics, recycling in this region may continue to be a problem.

Due to a growing awareness of the battery recycling problem, several states have initiated independent efforts to handle battery recycling in their states. Some states, such as Minnesota and Rhode Island, have established deposit schemes on batteries to discourage batteries from exiting the recycling chain. Other states, such as California, have directed their efforts at improving the efficiency of existing recycling mechanisms by banning scrap batteries from landfills and carefully regulating the transport of scrap batteries. Since all of these efforts are fairly recent, it is too early to examine their impact on the recycling activity in those states.

Based on these conclusions, we recommend continued attention to the problem of recycling spent lead-acid batteries. Those areas that are particularly hard hit by the contraction of lead smelting capacity might benefit most from regional collection programs.

We also recommend that the federal government monitor the effectiveness of certain states' efforts with respect to battery recycling. Based on this monitoring program, the federal government could provide a valuable service by disseminating valuable information to other affected areas of the country.

Most importantly, we recommend that regulators continue to be aware of the fact that well-intentioned regulatory actions can produce unintended and adverse results. There is evidence that certain environmental regulations may be hampering battery recycling efforts across the country. It is the challenge for regulators and the regulated community to work together to ensure that this does not occur.

Just as the domestic recycling activity slows down in response to negative changes in the economic or regulatory environment, the export market can also experience downturns. For example, in early 1987, there were reports that more stringent enforcement of the Department of Transportation regulations pertaining to hazardous material caused export activity to all but stop in the Northwest.[11] The regulations dealt primarily with the proper packaging and labeling of batteries. Since then, shippers, together with Coast Guard officials, worked out a solution. Even still, one Northwest exporter interviewed estimated that only 50 percent of the battery scrap generated in early 1987 in the Northwest was exported, with the remainder being improperly disposed of in landfills, road-sides, dumpsters, or yards.

New enterprise has also been developed in the region to alleviate the pressures on the threatened landfills. For example, since 1985, a company based in Oregon called Env-Pac has been recycling batteries that were otherwise fated for landfills. An Env-Pac spokesman believes that the emergence of Env-Pac coincided with "an awareness of environmental issues by major corporations who are either seeking ways to avoid encountering future waste disposal liabilities or are simply trying to be good corporate citizens."[12] The two-year-old company has rapidly grown to a thriving operation, handling approximately 50,000 batteries in 1986.

<u>Summary</u>

In summary, without regional data to quantify recycling rates, we believe that because of the fact that there are no currently operating secondary smelters in the Pacific Northwest, recycling raies in that region are lower than the national average. Because of persistent low lead prices and sometimes prohibitive transportation costs, many members of the recycling community in the Northwest have stopped handling scrap batteries. In fact, during 1986, there were only two operations in the State of Washington that would still collect batteries from individuals. Fortunately, this region is properly situated to take advantage of scrap battery export to areas in the Far East that demand large amounts of battery scrap. However, the export market has not been able to take all the surplus.

The recent upturn in lead prices may be significant enough to encourage recyclers to handle batteries again. However, there remains a concern that consumers are no longer aware of their recycling options in the Pacific Northwest after the departure of so many collection centers and service stations from the recycling business in the 1980s. Additionally, there is no guarantee that lead prices will remain high over a long period. If lead prices fall back to levels similar to those during the early and middle 1980s, then battery recycling in the Pacific Northwest will continue to be a problem.

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[11] American Metals Market, 27 February 1987, p. 9 and 14 May 1987, p. 1.

[12] The Oregonian, 27 July 1986, p. D1.

VII. STATE REGULATORY ACTIONS

Under the Resource Conservation and Recovery Act, each state is mandated to promulgate environmental regulations that are at least as stringent as the federal regulations. Many states have adopted the federal regulations (discussed in Section III) that apply to spent lead-acid batteries verbatim; a few states have independently passed (or have attempted to pass) regulations that are significantly more stringent.

In June 1987, the Secondary Lead Smelters Association conducted a survey to determine the types of legislative and regulatory actions that individual states have taken with respect to the disposal, collection, and recycling of spent lead-acid batteries. They conclude that to date, there are very few states that have adopted special regulations to deal specifically with a perceived lead-acid battery disposal problem. Some of them, such as California, have focused on making the recycling chain operate in an environmentally sound manner. Other states, such as Minnesota and Rhode Island, have focused on the retrieval of batteries that would otherwise have exited the recycling chain. The experiences of these and other states are discussed briefly in this section.

California

In 1985, California adopted final regulations governing the management of spent lead-acid storage batteries. These regulations require that a person who drains the acid from the battery must be a hazardous waste facility operator. In addition, a cracked or otherwise damaged battery is classified as a hazardous material and must be treated as such (i.e., transported by a registered waste hauler to a registered facility with a hazardous waste manifest or bill of lading, etc.).

The transportation of (more than 10) spent batteries for recycling (except broken batteries) requires the use of a waste manifest, but does not require a registered hazardous waste hauler. However, spent batteries for disposal must be transported by a registered waste hauler. Battery dealers who store less than one ton of spent batteries for less than 180 days are exempt from storage requirements.

Scrap dealers claim that these regulations have led to dramatic reductions in battery scrap handling in California. One dealer said that in the City of Oakland, a major California scrap collection center and port, there is not a single scrap dealer that still handles batteries in 1987.

The California regulations pertaining to spent lead-acid batteries have added to the regulatory burden on recyclers and reduced incentives to recycle batteries by making it more difficult to transport batteries from one stage of the recycling process to the next. This may be one case where well-intentioned regulation has produced counterproductive results.

APPENDIX A: GUIDE TO THE CALCULATION OF BATTERY RECYCLING RATES

The following section describes in some detail the components of the battery recycling rate calculation. As described in chapter IV, we use a mass balance approach to account for all the battery scrap that is **generated** each year from spent batteries and scrapped vehicles and **consumed** each year by recycling or export. The recycling rate equals the amount of battery scrap actually consumed as a percentage of the amount generated. The gap between the amount actually consumed and the amount generated is assumed to have exited the recycling chain.

The first two sections of this appendix outline the procedures used to calculate the annual generation and consumption of lead from battery scrap, respectively. The third section supplies the key equations used to perform the calculation.

1. Generation of Battery Scrap

Battery scrap is generated from three major sources annually. The first and largest source comes from replacement battery sales. One scrap battery is typically generated with every replacement battery purchase. Second, one scrap battery is typically generated with every decommissioned vehicle. In addition, a small amount of battery scrap is imported annually. Each of these sources of battery scrap is discussed below.

Replacement batteries

Automotive battery shipments are categorized as follows: replacement batteries, original equipment batteries, and battery exports. Replacement batteries for cars and trucks make up the vast majority of SLI battery shipments annually. For example, in 1986, approximately 60 million batteries were purchased to replace older spent batteries out of a total of 76 million batteries shipped from U.S. manufacturers that year.

In addition to shipments of replacement batteries by U.S. manufacturers, a small amount of new batteries is imported annually (mostly from the far east) for replacement or original equipment. The exact data on imports of replacement batteries are unavailable for the 1960 to 1985 period. In fact, the Department of Commerce only began counting 12-volt lead-acid storage batteries as a separate category in 1982. These 12-volt batteries can be automotive, motorcycle, or stationary batteries for either replacement or original equipment.

There is growing concern about the effects on the domestic battery manufacturing industry of a rapidly increasing influx of low-cost foreign batteries into the U.S., particularly from the far east (South Korea). As a result, effective January 1, 1987, importers of 12-volt lead-acid batteries are required to indicate to the U.S. Customs Service the specific categories of batteries brought into the country. The more detailed statistics will permit more precise monitoring of import trends in the future (American Metals Market, 1/19/1987, p. 4).

Based on discussions with battery industry specialists and the limited data available, we believe that imports of replacement batteries were essentially negligible until 1981. Since 1982, the number of imports has quadrupled. In 1982, approximately 750,000 12-volt lead-acid batteries were imported. By 1985, the import level had risen to approximately 3.1 million.

Each time a replacement battery is purchased in the U.S. from either a domestic or foreign battery manufacturer, a spent battery is generated that must either be recycled or disposed of. Since the average life of an automobile battery is between 3 and 4 years, a spent battery available as battery scrap in a given year comes from the stock of batteries manufactured four years earlier.

Therefore, the amount of lead scrap generated in year (i) from replacement battery sales equals the number of replacement batteries sold in year (i) multiplied by the average lead content of a battery made in year (i-4). The procedure used to estimate the average lead content per battery is discussed below.

Lead Content Per Battery

The amount of lead from each battery that is available for recycling is a critical variable in the calculation of the amount of lead scrap that is generated annually from scrap batteries. Because specific company proprietary data were unavailable, the lead content per battery for batteries manufactured since the mid 1950s was estimated.

The average lead content per battery was calculated by dividing the total amount of lead consumed each year by U.S. battery manufactures to produce SLI batteries (note that industrial batteries are excluded) by the total number of SLI batteries shipped by U.S. manufacturers in each year. To account for losses in the battery manufacturing process, we assume that 5 percent of the lead used to produce batteries is lost as lead scrap. We also assume that only 95 percent of the lead in batteries is actually recovered in the recycling process (Battery manufacturers indicate that this may be a conservative figure, citing 98 percent recovery rates as more typical.)

A three-year rolling average smoothed the profile of lead content per battery over time and minimized the effect of minor inventory fluctuations.

Note that this result is the recoverable lead per SLI battery, averaged over car and truck batteries (which typically have a higher lead content than car batteries). Assuming the car population has been a relatively constant proportion of the total number of vehicles on the road, there is no need to calculate the lead content of car and truck batteries separately.

These calculations show that during the 1980s, a typical 38 pound car battery contained roughly 20 pounds of recoverable lead. These values are slightly higher than during the 1950s and 1960s, at which time the "DieHard" type battery was introduced, requiring more lead per battery. Since that time (late 1960s), improvements in battery technology have reduced the amount of lead required to produce the same desirable characteristics of an automobile battery (e.g., cranking power and long life). Thus current lead levels represent a slight improvement from the 22-23 pounds of lead in batteries of the 1970s.

Vehicle De-registrations

In addition to replacement batteries, battery scrap is generated when a vehicle is decommissioned. The total number of decommissioned vehicles in each year can be derived from the statistics about the number of vehicles on the road and the number of new vehicle registrations. The number of vehicles on the road at end of the year equals the number of vehicles on the road at the beginning of the year, plus the number of new vehicle registrations in that year, less the number of vehicles decommissioned in that year.

The lead content of batteries generated from decommissioned vehicles (both cars and trucks) equals the number of decommissioned vehicles in year (i) multiplied by the lead content of an average vehicle battery made in year (i-4).

Imports of Battery Scrap

The U.S. has imported anywhere between 700 metric tons and 14,000 metric tons of lead scrap since 1960. This lead is intended for consumption by the secondary lead industry in the U.S. and is tabulated annually by the Department of Commerce. The Commerce data are categorized as "lead waste and scrap" rather than battery lead scrap in particular. However, based on information from battery exporters, we assume that essentially all of this scrap comes from scrap batteries.

The majority of the imported lead scrap comes from countries bordering the U.S.: Mexico and Canada. In general, this battery scrap is transported by land to the nearest smelters in the U.S. from those areas of Mexico and Canada that are farthest from their own smelters.

2. Consumption of Battery Scrap

Battery scrap is consumed in one of several ways. First, many thousands of tons of spent batteries are dismantled into parts (e.g., sulfuric acid, plastic casing and lead plates) and recycled. Ultimately the lead is smelted at a secondary smelter for battery manufacture. Second, for those coastal regions of the country, exports have recently been a significant means of handling battery scrap. Third, some battery scrap may not actually be consumed by a smelter in a given year, but rather is stockpiled in inventory until a subsequent year, when the lead is smelted. Each of these methods of consumption is discussed below.

Secondary Smelting

The Bureau of Mines reports data on the total amount of lead that is recovered from all types of battery scrap by secondary smelters. However, these data include lead recovered from industrial batteries as well as SLI batteries. Since this analysis is concerned with the recycling rate of SLI batteries in particular, estimates of the total lead recovered from industrial batteries (supplied by lead industry analysts) are subtracted from the Bureau of Mines data.

Scrap Battery Exports

A certain amount of lead scrap is exported every year primarily to destinations in the far east (notably Taiwan and Korea) and South America (notably Brazil and Colombia).

In the wake of the previous study of battery recycling, there was speculation that the number of scrap battery exports reported to Commerce was significantly below the actual level of exports. If this were true, it would imply that recycling rates were actually higher than calculated. Therefore, in this effort, we investigated the data on scrap battery exports and interviewed both port officials and scrap traders. We find no reason to believe that the Commerce data for the category "lead waste and scrap" are inaccurate.

Furthermore, industry sources confirm that the vast majority of the lead waste and scrap exports is spent batteries. Therefore, the amount of battery scrap exported is approximately equal to the total lead waste and scrap exported (gross weight) multiplied by 50 percent (assuming a typical battery is 50 percent lead by weight).

Scrap Battery Inventories

One comment regarding PHB's earlier (June 1986) study was that the impact of scrap battery inventories at scrap yards or smelters on battery recycling rates were not considered. Some industry analysts believe that during the early and middle 1980s, low lead prices may have induced the stockpiling of battery scrap by some members of the recycling chain who had hopes of selling it at higher lead prices in the future. We interviewed many scrap dealers about the practice of stockpiling. The overwhelming response was that fear of government regulation had caused them to unload their inventories as quickly as possible, regardless of the current lead price. Therefore, we believe that this inventory effect is small.

Nevertheless, the Bureau of Mines does track the inventory levels of scrap batteries at the smelters. These have been incorporated in the analysis. If inventory levels increase (all else being equal), the recycling rates also increase since less battery scrap ends up exiting the recycling chain.

3. Recycling Rate Equations

Having discussed each major element of the calculation, this section presents the equations used to calculate recycling rates. The values of key input variables as well as the recycling rate results are shown in the table that follows this section.

a) The total motor vehicle batteries available to recover are:

U.S.-made replacement batteries sold in U.S.
\+ Foreign-made replacement batteries sold in U.S.
\+ Auto de-registrations
\+ Truck de-registrations

[SOURCE: Battery Council International (BCI) Statistics Annual 1984 and personal communication with BCI for battery shipments; Department of Commerce for import data; Ward's Automotive Yearbook for de-registrations]

b) The average recoverable lead content per motor vehicle battery (averaged over cars and trucks) is estimated as follows:

95% * (Total lead consumed for all batteries - Lead in Industrial batteries)
/ Total U.S. Battery Shipments

where, total battery shipments includes original equipment, replacement, and export shipments of SLI batteries.

In addition, the recoverable lead (excluding lead in industrial batteries) generated is assumed to be 95% of the lead content per battery.

To account for inventory fluctuations, a three-year moving average of lead content per battery is used to smooth the profile over time.

APPENDIX A (Continued)

[SOURCE: Bureau of Mines Mineral Industry Surveys, BCI, and Lead Industries Association for data on industrial batteries. The 95% recovery rate is based on typical industry rules of thumb.]

c) The average life of a battery is between 3 and 4 years. In our analysis, we used 4 years. Therefore, to calculate the amount of lead scrap generated in each year:

Batteries Available for Recycling * Average recoverable lead per battery (four years earlier)
\+ Imports of lead scrap (lead content).

[SOURCE: Department of Commerce data on imports of lead scrap]

d) To get the total SLI battery lead scrap actually recovered in each year,

Total Lead Recovered at Smelters from all Battery scrap
\- Lead recovered from Industrial batteries (9% of total)
\+ Exports of Lead Scrap (50% of gross weight)
\+ Change in Battery Scrap Inventories at Smelters

[SOURCE: Bureau of Mines (BOM) Mineral Industry Surveys, Tables 11 & 24 & 8 and Bill Woodbury, BOM, personal communication; Department of Commerce for exports]

e) Battery Recycling Rate = Battery Scrap Recovered / Battery Scrap Available for Recovery (per year)

APPENDIX A (Continued)
CALCULATION OF BATTERY RECYCLING RATES FOR 1960-1985

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
U.S. MADE REPLACEMENT BATTERIES (millions)	43.5	44.4	42.6	49.2	54.6	56.4	53.7	50.1	53.6	54.2	56.1	59.3	58.7
+ IMPORTED REPLACEMENT BATTERIES (millions)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.376	0.751	1.565	1.997	3.116
+ VEHICLE DEREGISTRATIONS (millions)													
CARS	8.0	5.9	5.6	7.2	8.8	7.9	8.6	8.9	7.2	6.7	6.8	7.1	8.8
TRUCKS	1.4	0.8	0.9	1.3	1.8	1.7	1.5	1.5	1.4	1.5	1.8	2.0	2.5
= BATTERIES AVAILABLE FOR RECOVERY (millions)	52.9	51.1	49.1	57.7	65.2	66.0	63.8	60.5	62.6	63.2	66.3	70.4	73.1
* AVERAGE RECOVERABLE LEAD PER BATTERY (4 year delay) (pounds)	19.9	20.8	21.4	21.7	22.5	23.3	22.1	21.3	21.6	21.4	20.4	19.6	20.0
SUBTOTAL (000 metric tons)	477.0	481.2	476.5	567.0	666.2	696.9	640.9	583.5	611.8	614.1	611.7	626.5	663.7
+ IMPORTS OF LEAD SCRAP (000 metric tons)	2.5	0.7	1.2	2.0	3.2	2.8	3.1	5.2	2.7	4.8	4.2	5.0	3.2
= TOTAL BATTERY SCRAP AVAILABLE FOR RECOVERY	479.5	481.9	477.7	569.0	669.4	699.7	644.0	588.7	614.5	618.9	615.9	631.5	666.9
LEAD RECOVERED FROM ALL BATTERY SCRAP (000 mt)	335.5	379.6	378.7	418.6	468.7	496.6	495.6	480.6	481.4	439.2	371.5	486.6	478.9
- LEAD RECOV. FROM INDUSTRIAL BATTERIES (000mt) 9%	30.2	34.2	34.1	37.7	42.2	44.7	44.6	43.3	43.3	39.5	33.4	43.8	43.1
= LEAD RECOVERED FROM SLI BATTERIES (000mt)	305.3	345.4	344.6	380.9	426.5	451.9	451.0	437.3	438.1	399.7	338.1	442.8	435.8
+ EXPORTS OF LEAD SCRAP (000 metric tons) 50%	54.3	53.9	45.3	42.5	77.5	98.6	119.7	119.7	59.4	51.8	50.9	45.1	60.1
+ CHANGE IN BATTERY SCRAP INVENTORIES AT SMELTERS (000 mt) 90%	-13.5	4.2	-4.3	0.2	9.0	1.3	-17.3	-7.7	3.8	-10.6	14.5	-12.7	-2.9
= TOTAL BATTERY SCRAP RECOVERED (000 metric tons)	320.3	376.2	363.4	402.4	473.4	502.4	495.3	490.3	471.2	416.0	376.6	453.9	463.2
RECYCLING RATE (%)	66.8%	78.1%	76.1%	70.7%	70.7%	71.8%	76.9%	83.3%	76.7%	67.2%	61.1%	71.9%	69.5%

APPENDIX A (Continued)
CALCULATION OF BATTERY RECYCLING RATES FOR 1960-1985

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
U.S. MADE REPLACEMENT BATTERIES (millions)	26.3	28.3	30.5	31.7	29.6	29.5	31.1	31	33.8	35.5	37.9	39.1	43.2
+ IMPORTED REPLACEMENT BATTERIES (millions)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
+ VEHICLE DEREGISTRATIONS (millions)													
CARS	4.5	4.3	4.3	4.5	5.1	6.0	6.0	6.3	6.2	10.2	10.5	7.1	7.2
TRUCKS	0.7	0.6	0.6	0.7	0.8	0.8	0.9	0.9	1.0	1.4	0.7	1.2	1.2
= BATTERIES AVAILABLE FOR RECOVERY (millions)	31.5	33.2	35.4	36.9	35.5	36.4	38.0	38.1	41.0	47.1	49.1	47.4	51.6
* AVERAGE RECOVERABLE LEAD PER BATTERY (4 year delay) (pounds)	18.2	17.5	17.1	17.2	17.0	16.9	17.2	17.4	17.7	17.9	18.1	18.4	18.9
SUBTOTAL (000 metric tons)	259.6	263.3	274.3	288.1	273.4	279.4	297.0	301.6	329.3	383.3	403.7	395.0	442.1
+ IMPORTS OF LEAD SCRAP (000 metric tons)	5.1	3.5	1.9	14.0	1.7	3.3	3.6	8.5	3.9	6.1	2.7	2.3	1.6
= TOTAL BATTERY SCRAP AVAILABLE FOR RECOVERY	264.7	266.8	276.2	302.1	275.1	282.7	300.6	310.1	333.1	389.3	406.4	397.3	443.7
LEAD RECOVERED FROM ALL BATTERY SCRAP (000 mt)	232.1	218.5	229.1	247.1	276.3	284.1	259.0	275.1	281.4	317.1	317.8	302.1	315.6
- LEAD RECOV. FROM INDUSTRIAL BATTERIES (000mt) 9%	20.9	19.7	20.6	22.2	24.9	25.6	23.3	24.8	25.3	28.5	28.6	27.2	28.4
= LEAD RECOVERED FROM SLI BATTERIES (000mt)	211.2	198.9	208.5	224.9	251.4	258.5	235.7	250.4	256.1	288.5	289.2	274.9	287.2
+ EXPORTS OF LEAD SCRAP (000 metric tons) 50%	1.4	4.7	2.2	2.2	11.9	3.4	0.5	0.4	0.9	2.1	3.8	15.5	32.0
+ CHANGE IN BATTERY SCRAP INVENTORIES AT SMELTERS (000 mt) 90%	9.6	1.7	-6.5	-10.8	-2.8	14.3	-4.6	-1.1	2.2	-14.4	4.5	-5.5	1.0
= TOTAL BATTERY SCRAP RECOVERED (000 metric tons)	220.5	202.7	203.8	216.3	254.9	273.1	231.8	249.6	258.5	276.6	295.2	277.7	304.1
RECYCLING RATE (%)	83.3%	76.0%	73.8%	71.6%	92.6%	96.6%	77.1%	80.5%	77.6%	71.0%	72.6%	69.9%	68.5%

APPENDIX B : DATA TABLE TO ACCOMPANY FIGURES

	LEAD DEMAND (000 metric tons)		BATTERY SHIPMENTS (Millions)		U.S. PROD. LEAD PRICE (cents/pound)		RECYCLING RATE (%)	BATTERIES NOT RECYCLED (millions)
	West.World	U.S.	OE	Replacement	Nominal	Real ($1985)		
1960			7.9	26.3	12.0	43.4	83.3%	5.4
1961			6.7	28.3	10.9	39.1	76.0%	8.1
1962			8.2	30.5	9.6	34.3	73.8%	9.3
1963			9.1	31.7	11.1	39.1	71.6%	11.0
1964			9.3	29.6	13.6	47.2	92.6%	2.6
1965			11.1	29.5	16.0	54.6	96.6%	1.2
1966			10.3	31.1	15.1	50.1	77.1%	8.8
1967			9.0	31.0	14.0	45.1	80.5%	7.7
1968			10.7	33.8	13.2	40.9	77.6%	9.3
1969			10.1	35.5	14.9	43.8	71.0%	13.9
1970			8.2	37.9	15.7	43.5	72.6%	13.5
1971			10.6	39.1	13.9	36.9	69.9%	14.4
1972			11.3	43.2	15.3	39.5	68.5%	16.3
1973			12.6	43.5	16.3	39.5	66.8%	17.7
1974			10.1	44.4	23.2	50.6	78.1%	11.2
1975	3447.3	1179.2	9.0	42.6	21.5	43.0	76.1%	11.8
1976	3856.4	1354.6	13.4	49.2	23.1	43.7	70.7%	17.0
1977	4146.0	1438.5	14.7	54.6	30.7	54.7	70.7%	19.2
1978	4099.9	1432.7	15.2	56.4	33.7	55.6	71.8%	18.7
1979	4198.6	1361.2	14.4	53.7	52.6	77.9	76.9%	14.8
1980	3928.8	1072.5	10.0	50.1	42.5	55.7	83.3%	10.2
1981	3847.4	1169.5	10.0	53.6	36.5	43.1	76.7%	14.7
1982	3776.0	1075.4	8.4	54.2	25.5	28.3	67.2%	20.9
1983	3845.1	1148.5	10.8	56.1	21.7	23.4	61.1%	25.9
1984	3962.5	1207.0	12.8	59.3	25.5	26.5	71.9%	20.0
1985	3947.2	1148.3	13.5	58.7	19.1	19.1	69.5%	22.4

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Frank McGlard

Appendix A

THE IMPACTS OF LEAD INDUSTRY ECONOMICS ON BATTERY RECYCLING

Prepared for
Office of Policy Analysis
Environmental Protection Agency

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13 June 1986

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THE IMPACTS OF LEAD INDUSTRY ECONOMICS ON BATTERY RECYCLING

EXECUTIVE SUMMARY

In recent years the domestic lead industry has been characterized by a stagnant demand and ample supply that has resulted in real price levels at or near historical lows. Combined with significant environmental and occupational health standards, these low prices have resulted in major impacts on the U.S. secondary lead industry where plant closures and reduced economic activity have been experienced. The purpose of the study is to identify the factors leading to the contraction of the secondary lead industry and assess the likelihood of their continuation, to quantify the extent to which the recycling of lead-acid batteries has declined in recent years, and to assess the extent to which improper disposal of unrecycled lead-acid batteries is occurring and creating risks to the environment and human health.

The major conclusions are the following:

- There is very little doubt that low lead prices and increasingly stringent environmental standards have resulted in the closure of many secondary lead smelters and a 20 percent reduction in the lead-acid battery recycling rate to approximately 60 percent from typical historical levels of approximately 80 percent and peak levels near 90 percent. This translates into 120,000 additional metric tons of lead that entered the environment in 1985 rather than the recycling chain. Relative to the peak year for battery recycling in 1980, as much as 180,000 metric tons entered the environment.

- There is a strong indication that lead-acid batteries are not being disposed of at approved facilities. Anecdotal evidence indicates that batteries are going in increasing numbers to municipal landfills and incinerators that are not prepared to accept the hazardous materials.

- In theory, there exists a mechanism by which solid lead chemically combines with certain acidic compounds commonly present in household garbage and forms a soluble material which migrates through soil in a landfill and contaminates leachate and groundwater.

- Empirical evidence based on a review of the NPL sites does not indicate that groundwater contamination from lead in municipal landfills has occurred to a great extent to date. However, because the phenomenon of large and increasing numbers of potentially improperly disposed batteries is relatively recent, an investigation of current sites may not be an accurate indication of potential future problems. Thus the lack of empirical evidence is inconclusive.

Based on these findings, we recommend that the EPA undertake further study to determine whether the improper disposal of lead-acid batteries is likely to cause a significant environmental and health problem in the near future. If the study results are affirmative, then a comprehensive examination of alternative policy measures — such as deposit schemes and regulatory reforms — should follow. Such innovations would provide the required incentives to producers and consumers to utilize the existing recycling system to increase battery recycling activity.

THE IMPACTS OF LEAD INDUSTRY ECONOMICS ON BATTERY RECYCLING

INTRODUCTION

In recent years the domestic lead industry has been characterized by a stagnant demand and ample supply that has resulted in real price levels at or near historical lows. Combined with significant environmental and occupational health standards, these low prices have resulted in major impacts on the U.S. secondary lead industry where plant closures and reduced economic activity have been experienced. The purpose of this study is to identify the factors leading to the contraction of the secondary lead industry and assess the likelihood of their continuation, to quantify the extent to which the recycling of lead-acid batteries has declined in recent years, and to assess the extent to which improper disposal of unrecycled lead-acid batteries is occurring and creating risks to the environment and human health.

This report is divided into four major sections. For purposes of background to the battery recycling problem, the first section presents the recent economic trends in the lead industry, such as ample lead supply, flat demand, and low prices. The second and major section reviews the economics of the secondary lead industry and includes a calculation of battery recycling rates as well as a discussion of the battery recycling chain. Additionally, the impacts of increasingly stringent environmental regulations for lead on the secondary lead industry are discussed. The third section is devoted to empirical evidence and scientific implications regarding the degree of hazard posed by improper disposal of lead-acid batteries. Finally, a fourth section presents the major conclusions and recommendations for further action by the EPA based on the results of this study.

GENERAL LEAD INDUSTRY ECONOMICS

Demand

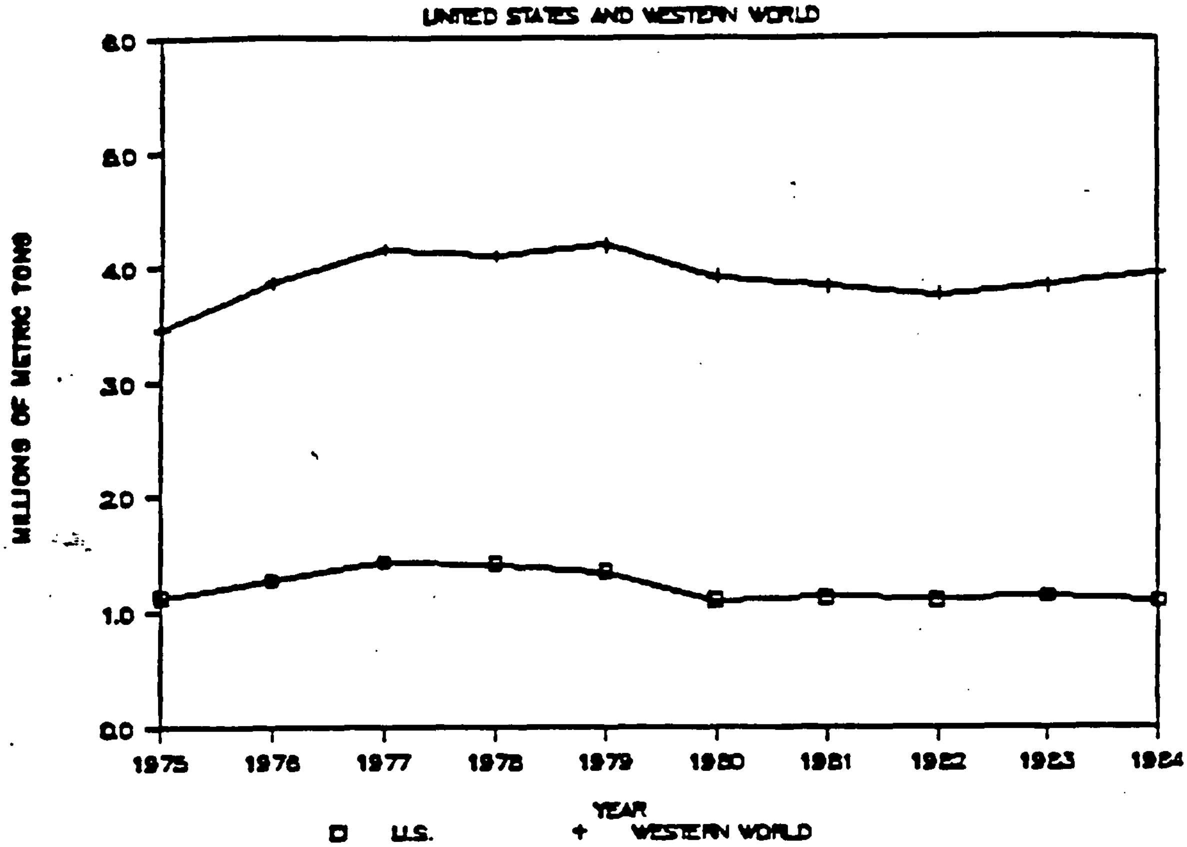
The economics of the lead industry are growing increasingly dim. Since the late 1970s, western world consumption of lead has fallen from almost 4.2 million metric tons in 1979 to a level below 4.0 million metric tons in 1984. This trend is echoed in the U.S. lead industry with 1985 domestic consumption nearing 1 million metric tons from highs above 1.4 million in the late 1970s. Figure 1 illustrates that lead demand has been approximately flat since 1980.

The three primary end uses of lead are in storage batteries, as a gasoline additive (TEL), and in paints and pigments. Figure 2 shows

Figure 1

CONSUMPTION OF REFINED LEAD

UNITED STATES AND WESTERN WORLD



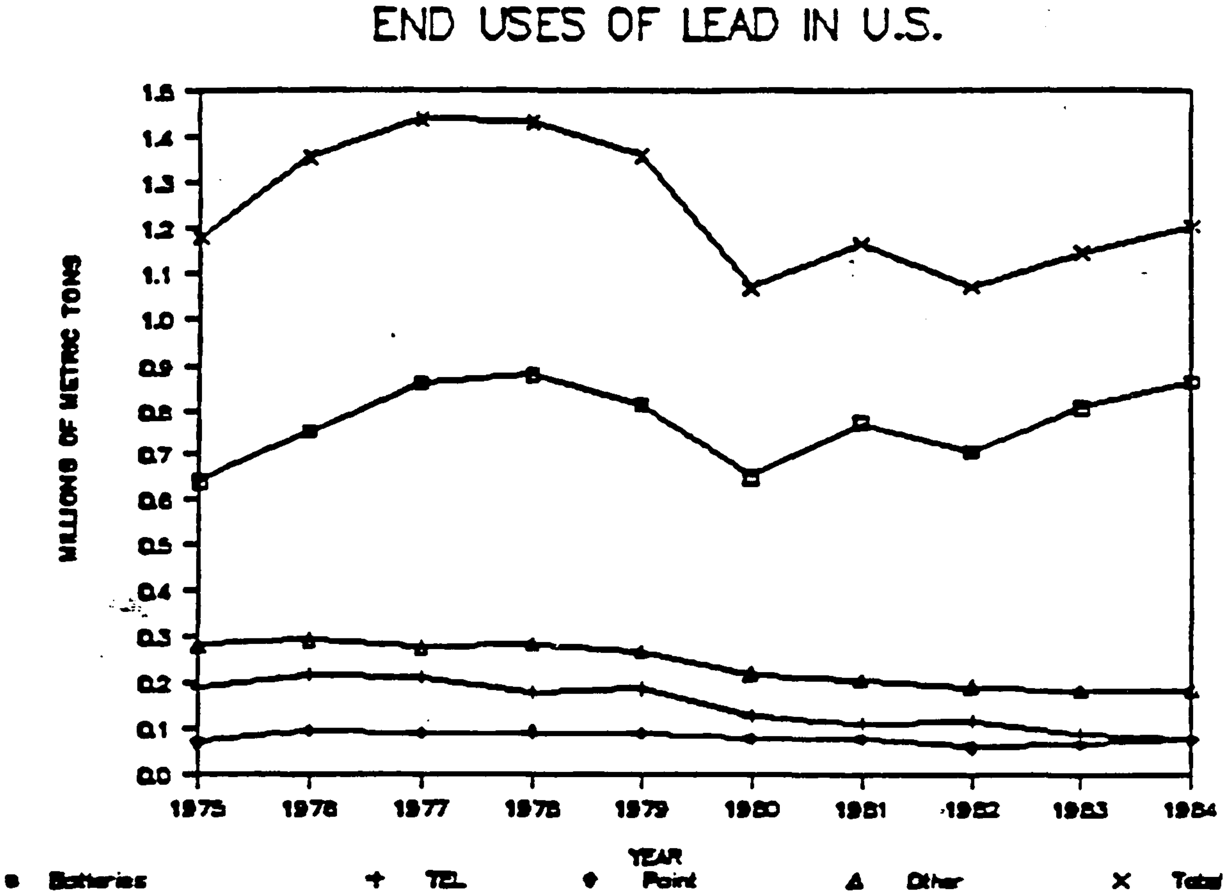
CONSUMPTION OF REFINED LEAD

(Primary and Secondary in 000's of metric tons)

Year	U.S.	Western World
1975	1122.7	3447.3
1976	1272.3	3856.4
1977	1417.9	4146.0
1978	1404.5	4099.9
1979	1345.4	4198.6
1980	1094.0	3928.8
1981	1127.8	3847.7
1982	1106.1	3776.0
1983	1134.2	3845.1
1984	1092.0	3962.5

Source: Metallstatistik 1974-1984, Metallgesellschaft Aktiengesellschaft, 72nd ed., 1985, p.27.

Figure 2



END USES OF LEAD IN U.S.

(000'S of metric tons)

Year	Batteries	TEL	Paint	Other	Total
1975	635.8	189.6	71.9	281.8	1179.2
1976	747.6	218.0	96.0	293.0	1354.6
1977	859.9	211.7	90.9	276.0	1438.5
1978	879.3	178.3	91.6	283.5	1432.7
1979	816.1	187.4	91.0	266.7	1361.2
1980	646.7	128.2	78.6	219.0	1072.5
1981	771.7	111.6	80.4	205.8	1169.5
1982	704.3	119.2	60.9	191.0	1075.4
1983	806.9	89.1	68.7	183.8	1148.5
1984	865.5	79.1	76.3	186.1	1207.0

Source: Statistics Annual 1984, Battery Council International (BCI), p. 26, and
Minerals Yearbook U.S. Bureau of Mines, 1984, (Table 12), 1983, (Table 13), and
Non-Ferrous Metal Data 1984 American Bureau of Metal Statistics, pp. 52,53, and
American Metal Market, January 31, 1986.

that storage batteries accounted for 865,000 metric tons (or 70 percent) of the total 1.2 million metric tons consumed in the U.S. in 1984. The storage battery industry is the only lead-consuming industry that has experienced any (very small) growth. Other end uses have declined steadily since the late 1970s. The consumption trends in each end-use category are reviewed below, with a major section devoted to the storage battery industry. For each lead-consuming product, it is clear that the long-term forecast is not promising. For various technological and/or environmental reasons, the major end-uses for lead are experiencing either no growth or dramatic declines.

The largest end-use category for lead is the storage battery industry, whose recent unspectacular performance is a major source of the flat demand for lead in the U.S. As shown in Figure 2, storage batteries (battery grids, posts, and lead oxides) accounted for over 70 percent of total U.S. lead consumption and over 50 percent of western world lead consumption in 1984.

Approximately 80 percent of the 60 million storage batteries consumed in 1984 in the United States were consumed for automobiles both in Original Equipment (OE) and as Replacement SLI (starting, lighting, and ignition) batteries in used vehicles. As shown in Figure 3, U.S. replacement sales dominate the OE battery market. This is in contrast with a country like Japan, which produced 50 percent more batteries for OE than replacements in 1984 due to Japan's production of approximately 30 percent of the world's motor vehicle fleet. In 1985, the replacement market captured 81 percent of the U.S. battery shipments while the OE market laid claim to 18 percent. These ratios have been fairly stable since the late 1970s.

The performance of SLI OE battery sales is heavily dependent upon automobile sales, which in the United States have declined from 9.3 million automobiles in 1978 to a low of 5.8 million in 1982 before rebounding to the 1984 sales of 7.9 million. The number of motor vehicles on the roads has increased steadily since 1975 at an annual rate of almost 3 percent in the United States and 4.5 percent worldwide. These on-the-road statistics are a major determinant of the replacement battery market and are partly responsible for whatever growth has occurred in the battery industry.

The remaining 20 percent of batteries are used for industrial purposes. Industrial battery sales are very cyclical and seem to mirror overall economic conditions. Major end-uses for industrial batteries are materials handling equipment (especially fork-lift trucks) and stationary systems such as interruptible power. Two areas of possible long-term growth in the industrial battery market are load-leveling batteries for electric utilities and batteries for electric vehicles. However, these areas are unlikely to grow significantly in the near term.

As mentioned above, demand for storage batteries is directly linked to trends in the automobile industry. Significant growth in annual sales for imported automobiles in the U.S. coupled with a trend toward keeping used cars longer (evidenced by the increasing average age of automobiles from 6 years in 1975 to 7.4 years by 1983) have lead to the flat demand for batteries in the United States. Every lost automobile sale per year means one less OE battery sold during that year and one more replacement battery sold every three years on average. Improvements in battery technology have exacerbated the decline in battery demand; batteries now have more cranking power (requiring less lead per battery for the same amount of energy produced), and provide a longer lasting product which performs under severe cold conditions and needs replacement slightly less often. For the past five years, gross battery weights have declined 1 percent per year on average from approximately 42 pounds in 1973 to a current total weight under 36 pounds.* The amount of lead per battery has declined by 16 percent since 1975 from approximately 24.5 pounds to a level of 20.5 pounds on average in 1985. In addition, the average battery life has increased by more than 11 percent since 1977 to approximately three years in 1985.

The second largest end-use category of lead in the United States accounting for almost 7 percent of 1984 domestic lead consumption is as a gasoline antiknock additive — TEL (also shown in Figure 2). Lead consumption for TEL has been falling since 1975 when environmental regulations reduce the amount of lead in gasoline were first adopted in the United States. Consumption of TEL has fallen by 58 percent from almost 190,000 metric tons in 1975 to approximately 80,000 metric tons in 1984. Exports of TEL, historically representing a significant portion of the U.S. TEL market, have continued to decline as other countries have joined the United States in their commitment to reduce lead quantities in gasoline. Therefore, experts predict the use of lead in gasoline worldwide will decline to 10 percent of its 1985 levels by 1989.

The third major use for lead, accounting for approximately 6 percent of U.S. lead consumption in 1984, is in paints and pigments. Use of lead in pigments fluctuates in the short run with nonresidential construction rates which have been on the rise since 1983. However, in the long run, increased consumer awareness regarding the possible adverse health impacts of lead in the workplace and the home is causing a dramatic decline in the use of lead in paints and pigments. Consumption of lead for paints and pigments has declined from 96,000 metric tons in 1975 to 76,000 metric tons by 1984, and is expected to continue to decline.

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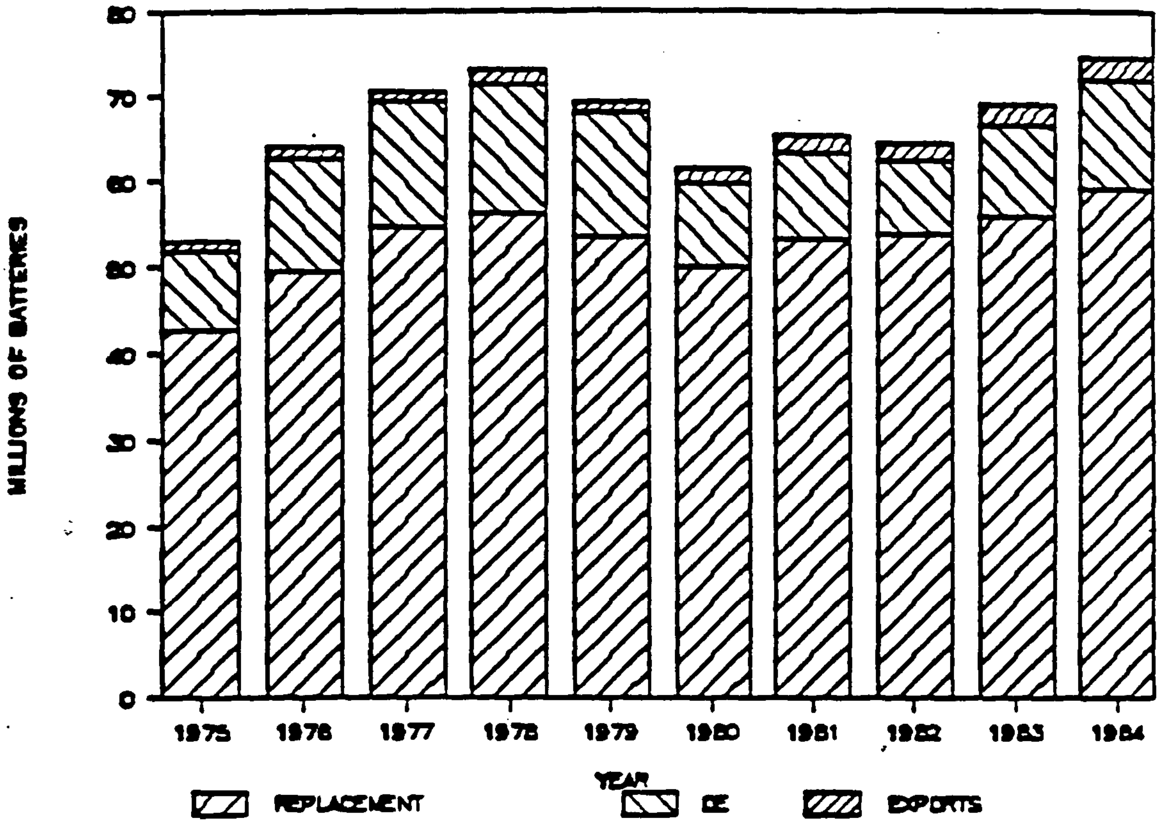
* Battery Man, July 1985.

Figure 3

SLI BATTERY SHIPMENTS

REPLACEMENT VS. ORIGINAL VS. EXPORTS



SLI BATTERY SHIPMENTS

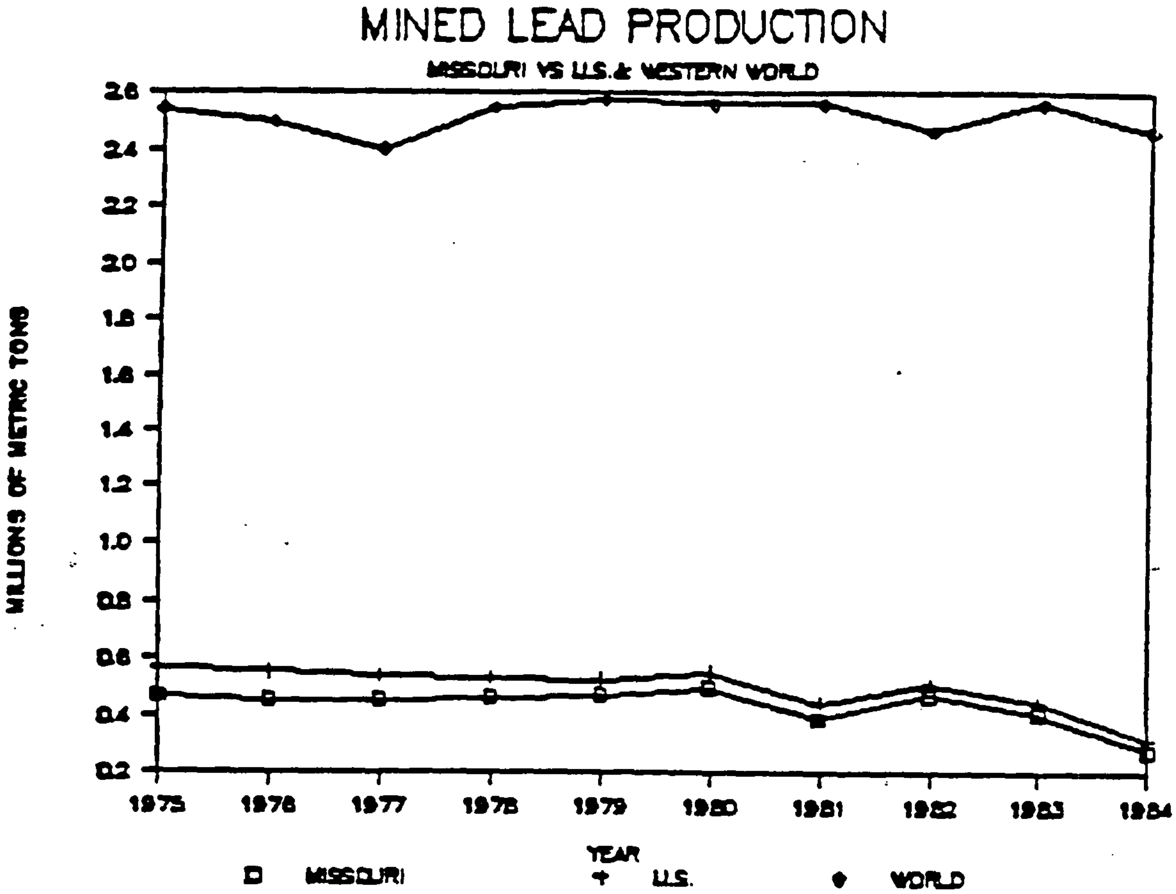
(Millions of Batteries)

Year	Replacement	Original Equipment	Exports	Total
1975	42.6	9.0	1.3	52.9
1976	49.2	13.4	1.5	64.1
1977	54.6	14.7	1.4	70.7
1978	56.4	15.2	1.6	73.2
1979	53.7	14.4	1.2	69.3
1980	50.1	10.0	1.6	61.7
1981	53.6	10.0	1.9	65.5
1982	54.2	8.4	2.0	64.6
1983	56.1	10.8	2.1	69.0
1984	59.3	12.8	2.6	74.7
1985	58.7	13.5	na	72.2

Sou...: Statistics Annual 1984, Battery Council International, p.5, and

Personal communication with Julia Stillwell, author, BCI Statistics Annual.

Figure 4



PRODUCTION OF MINED LEAD

(000's of metric tons)

Year	Missouri	U.S.	Western World
1975	469.1	565.0	2542.0
1976	455.5	554.1	2496.7
1977	454.8	538.6	2401.2
1978	461.8	529.7	2548.6
1979	472.1	525.6	2575.6
1980	497.2	550.4	2562.5
1981	389.7	445.5	2562.4
1982	474.5	512.5	2469.4
1983	409.3	449.0	2561.7
1984	278.3	321.9	2471.2

Source: Metal Statistics 1985, American Metal Market, p.96, and

Mineral Industry Surveys, U.S. Bureau of Mines, November 1985, Table 2.

None of the other uses for lead — such as lead foil and lead shot, which account for the remaining 15 percent of U.S. lead consumption — expect any growth, nor are any new major uses expected in the near future that will have a significant impact on total lead demand.

Therefore, industry sources predict that whatever growth there might be in the lead industry will stem from growth in the battery industry, which they predict will slow to a maximum of 1 to 2 percent per year.

Supply

The existing low demand for lead from the battery industry has recently been coupled with worldwide oversupply of the metal to further erode lead industry economics. The major mine producers of lead in the western world in 1984 are Australia (446,000 metric tons), the United States (332,200 metric tons), and Canada (259,400 metric tons). Other smaller but significant producers are Peru, Mexico, and Morocco. Western world mining output has remained fairly stable at approximately 2.4 million metric tons per year.

In the United States, seven lead mines in Missouri have continued to produce approximately 80 to 90 percent of the total U.S. mined production (see Figure 4) and 12 percent of western world production. Due to the purity and high concentration of the bulk deposits, the Missouri mines produce extremely low-cost lead. These mines and associated smelters act as price leaders for the U.S. lead industry. By 1984, U.S. lead prices reflected marginal costs of producing lead in Missouri; the remaining higher-cost U.S. producers have experienced substantial declines in their production levels and many have closed because lead prices can not cover their marginal costs of production.*

Another factor leading to oversupply is the growth of lead produced in conjunction with growing metals markets such as zinc, copper, and silver. In general, lead is co-produced and/or by-produced with zinc in countries such as Australia and Canada, and with silver in Mexico and Peru. Increased zinc production translates into increased lead production without a commensurate increase in lead demand.

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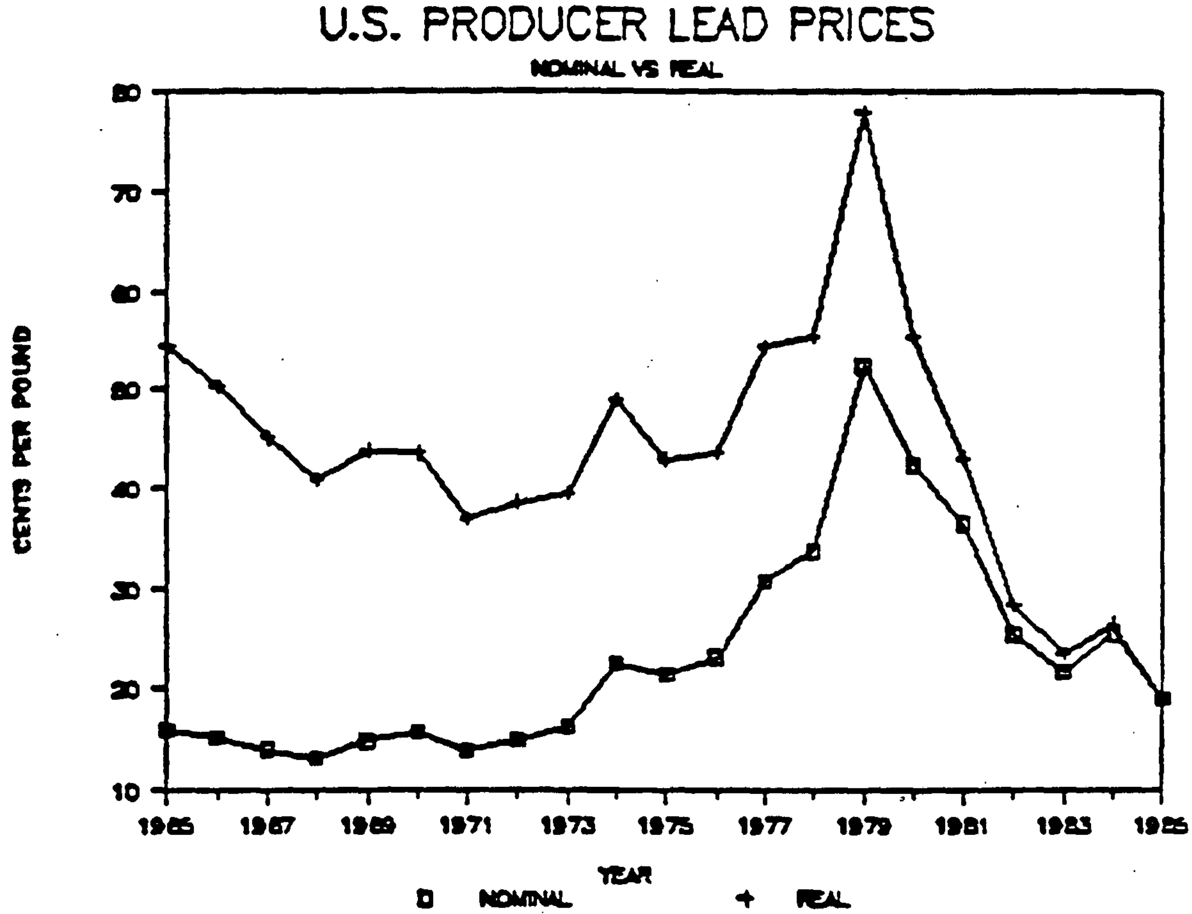
* Note that primary production of lead in Missouri in Figure 6 is artificially low in 1984 because of the mine workers' strikes which lasted most of the year but which ended by the beginning of 1985.

Figure 5



U.S. PRODUCER LEAD PRICES

(For "common" lead in cents per pound)

Year	Nominal	CPI 85	Real	Year	Nominal	CPI 85	Real
1965	16.0	3.41	54.6	1976	23.1	1.89	43.7
1966	15.2	3.31	50.4	1977	30.7	1.78	54.5
1967	14.0	3.22	45.1	1978	33.7	1.65	55.6
1968	13.2	3.09	40.8	1979	52.6	1.48	78.0
1969	14.9	2.93	43.7	1980	42.5	1.31	55.5
1970	15.7	2.77	43.5	1981	36.5	1.18	43.2
1971	13.9	2.66	36.9	1982	25.5	1.11	28.4
1972	15.0	2.57	38.6	1983	21.7	1.08	23.4
1973	16.3	2.42	39.5	1984	25.5	1.04	26.4
1974	22.5	2.18	49.1	1985	19.1	1.00	19.1
1975	21.5	2.00	43.0				

Source: *U.S. Statistical Abstract* 1985, Table No. 1270, p.712, and
Mineral Industry Surveys U.S. Bureau of Mines, November 1985, Table 11.
Mineral Facts and Problems U.S. Bureau of Mines, 1985 edition, Table 7, p.12.

According to the National Association of Recycling Industries (NARI), as much as 40 percent of the world's primary lead production in 1985 is achieved at virtually no cost due to the very high co-product and by-product credits of some mines.* Still other mines in foreign countries operate at subsidized levels and thus are not dependent on lead prices. Consequently, a significant portion of lead mines and smelters operate at very low lead prices while the pure lead producers such as the Missouri smelters depend principally on lead prices to operate profitably.

Prices

The above-mentioned stagnant demand combined with increasing supplies have resulted in the lead price profile in Figure 5. U.S. lead prices have fallen precipitously from over 50 cents per pound in 1979 to slightly above 19 cents in 1985. The 1985 price level represents a value about equal to the cost of producing primary lead at the Missouri mines. Figure 5 shows that in real terms, these prices represent historical lows. Due to supply and demand forecasts supplied by the U.S. Bureau of Mines, there are no indications that prices will recover from their 1985 all-time-low levels of between 18 and 21 cents a pound. At these prices, some lead producers may leave the industry. However, this will only serve to prevent further erosions in prices rather than cause a substantial rise in prices.

ECONOMICS OF THE SECONDARY LEAD INDUSTRY

Battery Recycling Rates

The lead supply has two primary components — primary and secondary production. Primary lead is produced from mined lead whereas secondary lead is produced from old and new lead scrap. New scrap is generated in the process of refining, casting, or fabricating leaded materials. Old scrap comes from obsolete materials. Over 75 percent of the old scrap comes from lead supplied by recycled auto batteries, with the remainder coming from drossings and skimmings and other general lead scrap.

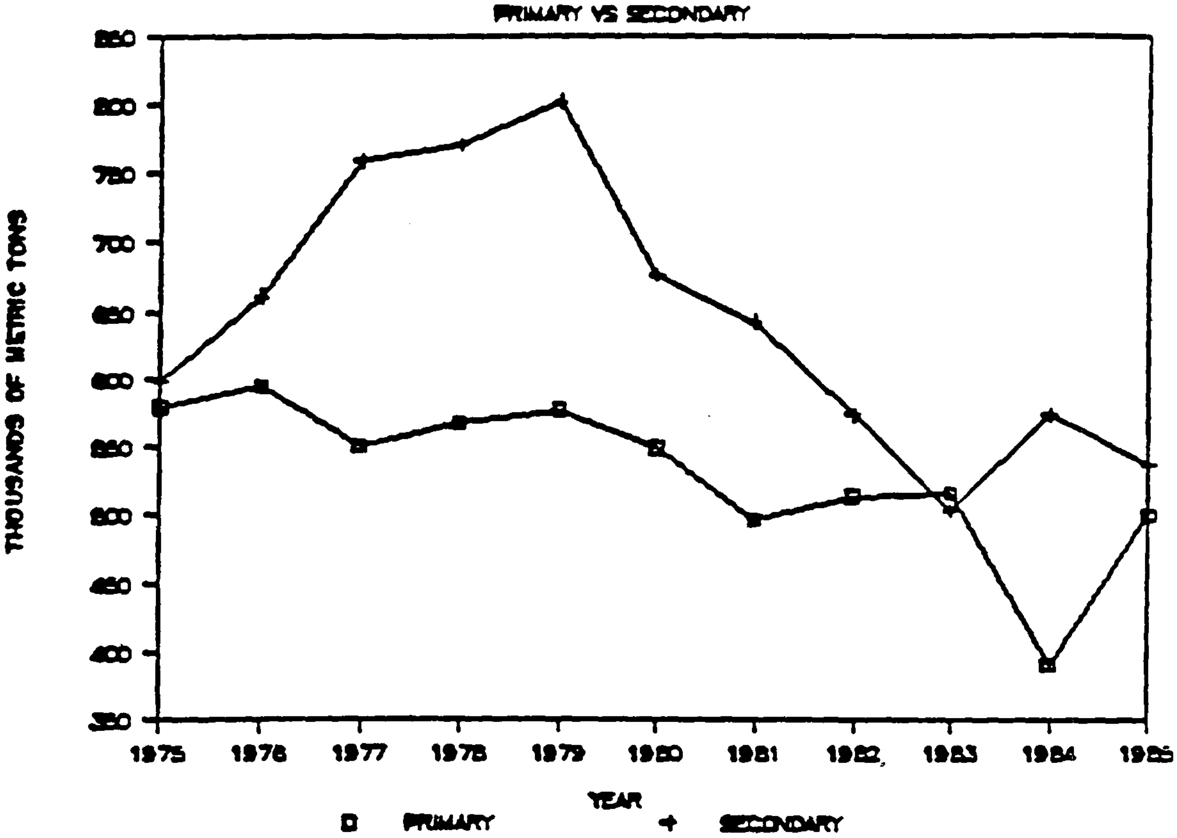
Figure 6 illustrates that in the U.S., the production of secondary lead from old and new scrap has historically exceeded production of primary lead. However, secondary lead production has declined in recent years from its peak in 1979 at 802,700 metric tons to 536,400 metric tons in 1985. A major share (70 percent[1] of this decline has been due to

* NARI Metals Report, 30 October 1985.

Figure 6

U.S. PRODUCTION OF LEAD

PRIMARY VS SECONDARY



PRODUCTION OF LEAD

(000'S of metric tons)

Year	Primary	Secondary
1975	578.2	598.2
1976	593.6	660.9
1977	550.0	759.1
1978	566.4	770.9
1979	576.4	802.7
1980	549.1	677.3
1981	496.4	642.7
1982	513.6	572.7
1983	516.4	503.6
1984	390.9	572.7
1985	500.0	536.4

Source: U.S. Industrial Outlook 1985, pp 20-4, and U.S. Statistical Abstracts 1985, p.712.

reduced recycling of lead-acid batteries. With no increases in lead prices in sight, there is no reason to expect that secondary production will increase from current levels, and it may even decline further.

The declines in secondary lead production are a result of declines in battery recycling activity. To estimate recycling activity, a straightforward model was developed by Putnam, Hayes & Bartlett. (See Appendix 1 for more details.) The battery recycling rate represents the fraction of lead scrap from batteries theoretically available for recycling that is actually recycled. Figure 7 shows that the gap between the amount of battery lead scrap available for recycling and actually recycled has widened since 1980 except for a slight increase in the amount recycled when lead prices increased briefly in 1984. Since 1980, battery scrap available for recycling has increased by 10.2 percent while battery scrap actually recycled has decreased by 26.2 percent.

Figure 8 shows how the widening gap translates into battery recycling rates. In 1980, the recycling rate was approximately 87 percent; in fact, the average recycling rate between 1974 and 1980 was 77 percent. By 1985, however, the recycling rate had declined to 59 percent. Thus in the past six years, recycling rates declined by 20 to 30 percent. This decline represents approximately 120,000 to 180,000 additional metric tons of lead that are exiting the battery recycling chain each year. At 20 pounds of recoverable lead per battery, this translates into an additional 13 to 20 million batteries not being recycled in 1985 alone.

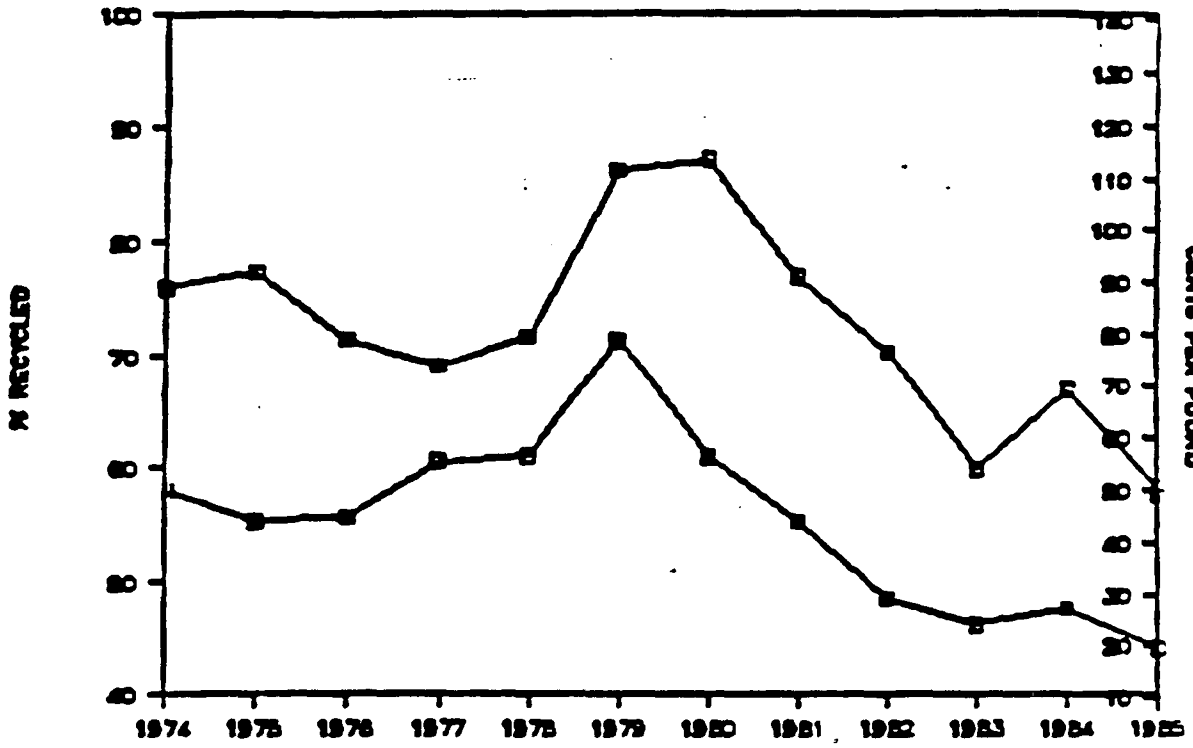
Figure 9 illustrates the intuitive result that battery recycling rates are correlated with lead prices. Battery recycling rates peaked in 1979-1980, the same years that lead prices peaked at 78 cents per pound. Between 1974 and 1978, lead prices were fairly stable at 49 cents per pound; similarly, recycling rates fluctuated slightly around 77 percent. However, as lead prices fell after 1980, recycling rates fell correspondingly.

The degree to which lead prices and battery recycling rates are correlated was tested by running a regression on lead prices and battery recycling rates. A regression that uses current and lagged real prices as explanatory variables explained over 80 percent of the variance in recycling rates. Clearly, this supports the intuitive result that battery recycling rates and lead prices are highly correlated.

These are two conclusions to draw from the above analysis. First, a declining trend of battery recycling is linked to declining secondary smelter lead production caused by low lead prices. Second, the widening gap between batteries available for recycling and batteries actually recycled leads to the inevitable conclusion that spent batteries are not remaining in the recycling chain and are being disposed of in increasing numbers.

FIGURE 9

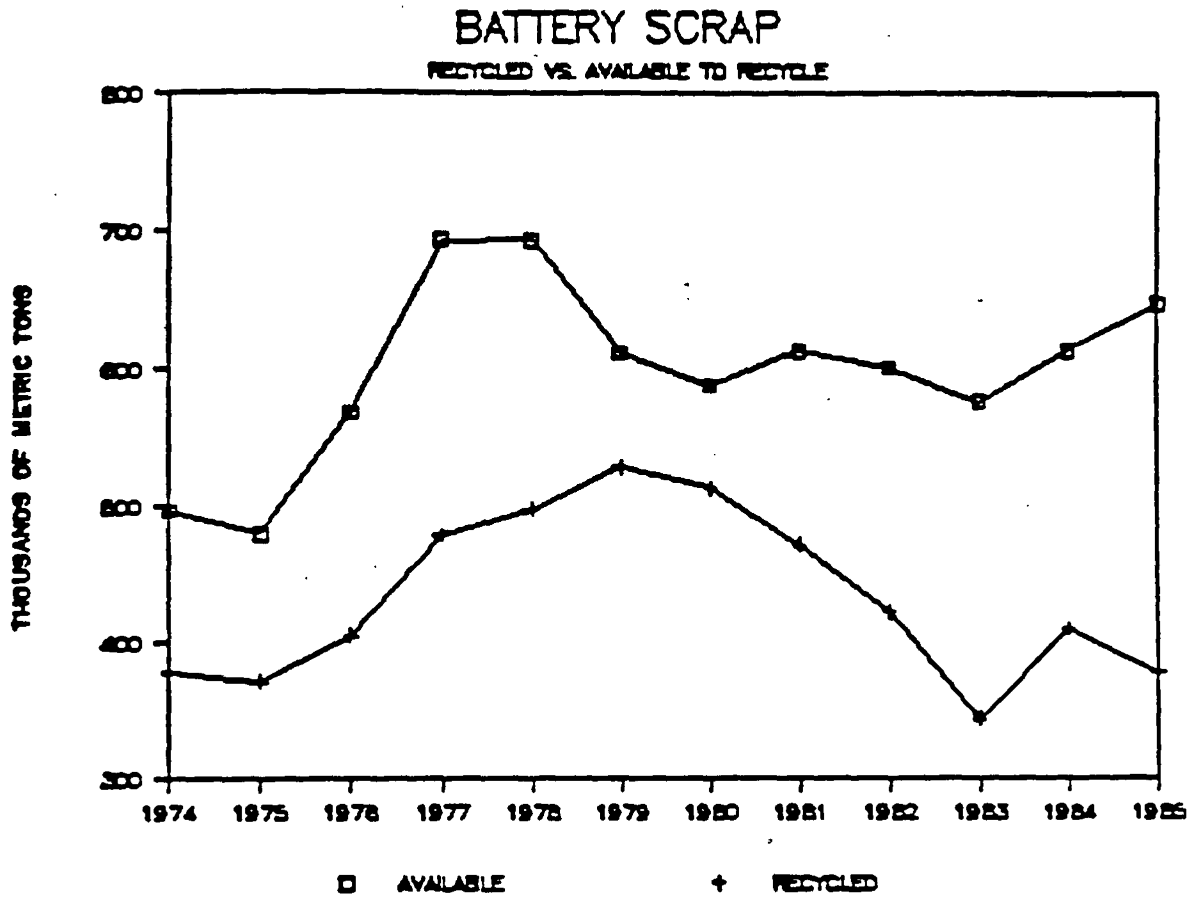
BATTERY RECYCLING RATES VS. LEAD PRICES



BATTERY RECYCLING RATES VS. LEAD PRICES

	(% RECYCLED)	LEAD PRICE (1985 real-cents/lb)
1974	76.1	49.1
1975	77.5	43
1976	71.5	43.7
1977	69.0	54.5
1978	71.7	55.6
1979	86.3	78
1980	87.3	55.5
1981	77.1	43.2
1982	70.4	28.4
1983	59.9	23.4
1984	66.9	26.4
1985	58.5	19.1

FIGURE 7



BATTERY LEAD SCRAP

	AVAILABLE TO RECYCLE	ACTUALLY RECYCLED
	(000 metric	tons)
1974	496.2	377.5
1975	479.0	371.1
1976	565.8	404.3
1977	691.8	477.4
1978	692.8	496.8
1979	610.5	526.7
1980	586.1	511.7
1981	611.5	471.2
1982	598.9	421.5
1983	574.0	343.8
1984	611.6	409.2
1985	646.0	377.7

Battery Recycling Chain

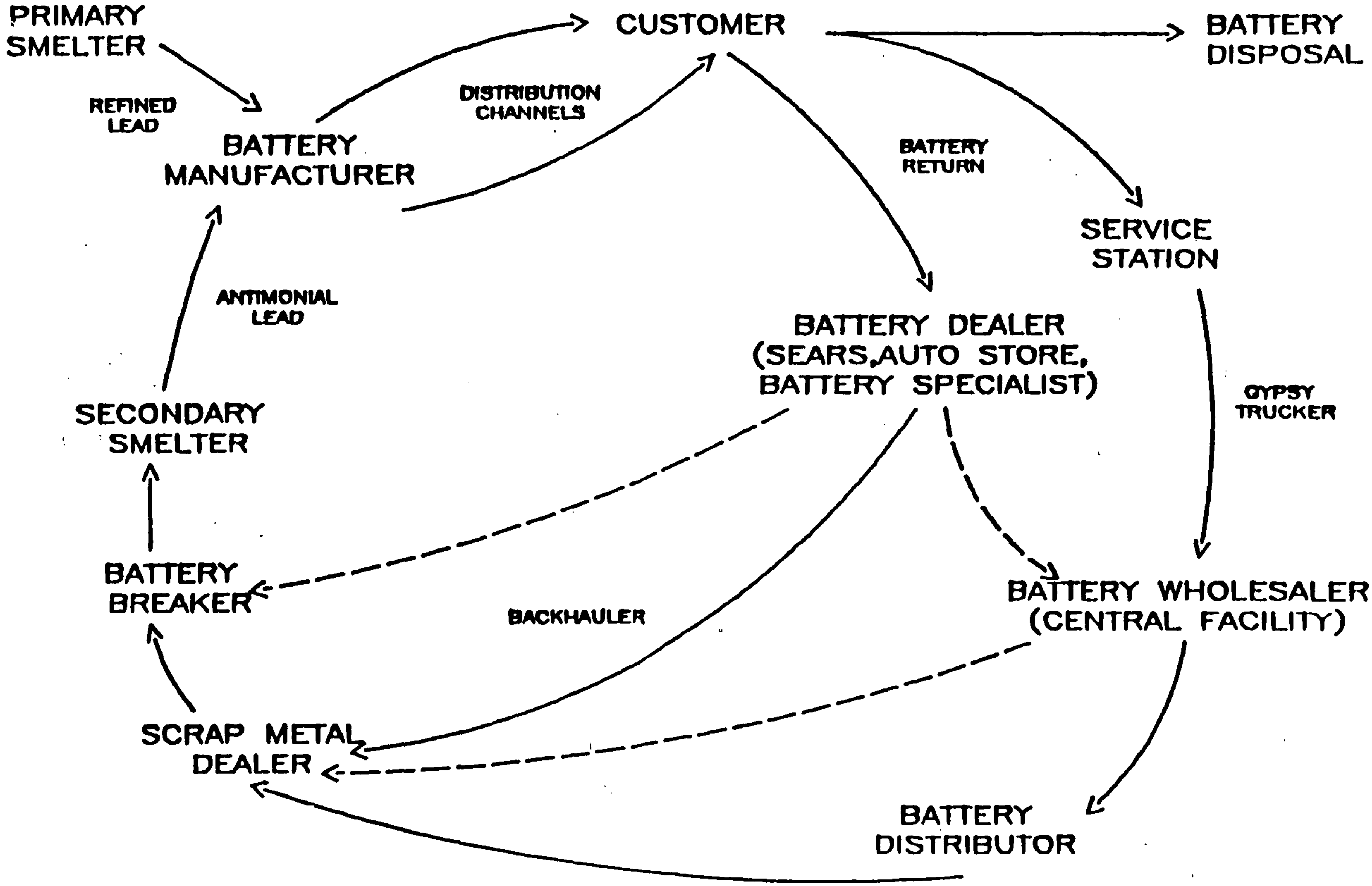
In order to explain the decreasing trend in battery recycling, one must consider the costs associated with each stage in the transportation chain. The four major distribution channels for selling new batteries to customers are battery specialists (over 30 percent — e.g., Delco), mass merchandisers-discount and department stores (23 percent — e.g., Sears), parts distributors (17 percent), and mass merchandisers-auto chains (8 percent). When a battery dies, the consumer typically returns the used battery to a service station, battery dealer, or mass merchandiser for a discount on the purchase of the replacement battery. In the past, this discount has been as high as four to five dollars per battery but has more recently been zero to one dollar per battery (typically 25 cents), with the exception of some mass merchandisers that continue to value a trade-in at five dollars. (These merchandisers have chosen to absorb the trade-in discount by shrinking battery sales profits.) As illustrated in the flow diagram in Figure 10, the returned battery is then stockpiled and often sold to a wholesaler when the stockpile is sufficiently large or lead prices are sufficiently high. The wholesaler may then sell it to distributors and scrap metal dealers before it returns to the battery breaker (to crush and separate the lead from other battery components) and secondary lead smelter for recycling.

Most secondary smelters have their own in-house battery breaking equipment. However, some battery breakers have also operated independently. It is often the case that the mass merchandiser has a contract with the battery distributor to backhaul a certain number of batteries for each shipment of new batteries. This delivery truck then travels between the manufacturing warehouse, the battery retailer, and the battery breaker or secondary smelter. The secondary smelter often has a long-term contract with major scrap customers and charges tolling costs at approximately 10 to 12 cents a pound to resmelt the scrap lead. The delivery truck transports the recycled lead raw product to the battery manufacturer and repeats the cycle. The time required for batteries to come full cycle is estimated to be four to five years.

The typical costs at each stage of the chain are estimated by Lead Industries Association (LIA) sources as follows:

2¢/lb.	for spent battery (22 lbs. lead per battery on average)
1¢/lb.	additional payment by wholesaler
2¢/lb.	delivery to battery breaker
2¢/lb.	battery breaking
11¢/lb.	tolling fee by secondary smelter
2¢/lb.	transport from central facility
20¢/lb.	total cost of lead delivered to market

FIGURE 10
BATTERY RECYCLING CHAIN



It is important to note that some of the above costs such as delivery and transport costs are quite variable. Thus the 20 cents per pound represents a single point estimate around which total recycling costs ranging between 15 to 25 cents per pound are distributed.

By January 1986, producer prices of common lead were 18 to 20 cents a pound. The marginal cost of primary production is also somewhere between 18 and 20 cents a pound. Secondary producers have even higher costs of production. However, secondary producers may fare somewhat better because the end product of secondary smelters from recycled battery scrap is often a superior grade alloy called "antimonial lead" (or "hard lead"). Antimonial lead sold for 20 to 24 cents a pound in 1985.

Even at these prices, there is clearly little or no cushion for profit. When lead prices decline, the profits of higher cost producers are further eroded. As a result of the current decline in lead prices, whereas in the past, a customer who returned a battery received a credit toward the purchase of a new battery, in 1985 and 1986 some customers must pay a battery disposal fee of approximately 50 cents. Otherwise the battery does not get recycled and exits from the recycling chain.

A survey of secondary lead smelters conducted in March 1986 by the Secondary Lead Smelters Association (SLSA) supports the fact that the economics of lead recycling have deteriorated. One lead smelter cited an offer of 200 batteries free of charge which it had received from a local major discount store. The smelter turned down the offer because the labor costs for loading and transporting the free batteries would eat up any profit gained from recycling.

Health and Environmental Regulation of Lead

The economics of the secondary lead industry have been further dampened by stringent and costly environmental regulations enacted since the late 1970s. The standards that apply to spent batteries are ambient air quality standards for lead, OSHA standards for lead in the work place, water quality standards for smelters and battery plants, and recent RCRA regulations for the storage and the handling of hazardous waste.

In 1978, the ambient air quality standards for lead were set at 1.5 micrograms/cubic meter. This meant that battery manufacturers and primary and secondary lead smelters could not exceed this level at the fenceline when averaged per quarter. The capital improvements required to meet this lead standard alone were recently estimated by lead industry experts at the Bureau of Mines to cost 4 cents a pound of lead produced and must be met by 1988.* Additionally, an even lower ambient air quality standard of 0.5 micrograms of lead per cubic meter has recently been proposed.

In March 1983, as part of the final phase of a 1979 OSHA standard, an in-plant maximum permissible exposure limit for lead of 50 micrograms/cubic meter was established. Primary lead smelters must meet this standard by 1991; battery plants and secondary smelters must meet the standards by 1986. These OSHA regulations also set a blood lead limit of 50 micrograms of lead/100 grams of blood to apply to all employees in the lead industry.

In addition to providing temporary medical removal protection (MRP) benefits for those employees whose blood levels rose above certain levels (experts believe as many as 30 percent of the workers in the industry at any time could be on MRP**), the OSHA regulations required that companies in the lead industry set up monthly surveillance programs, regular physicals, respirators, uniforms, etc., to administer and monitor the regulations. Industry sources estimate that those OSHA regulations add 20 to 40 dollars a ton (1 to 2 cents a pound) to production costs depending on the size of the operation.+

The third regulatory issue faced by the lead and battery industries stems from the Clean Water Act of 1977. By March 1984, water effluent limits for primary and secondary lead smelters were set at an annual average of 80 parts-per-million; battery plants faced a standard of 120 parts-per-million. Few if any secondary smelters are currently able to meet these standards. Wastewater treatment costs to meet there standards range from $0.75 million to $3 million per plant or about 0.5 cents per pound of lead.++

The final and most recent regulations affecting the battery industry are the November 1984 and January 1985 RCRA regulations which now classify spent lead-acid batteries (or parts of spent batteries) as well as certain lead mine and smelter effluents as hazardous wastes, thus adding difficulty to battery recycling efforts. These regulations impose costly

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* "Lead." Mineral Facts and Problems, 1985 edition, Bureau of Mines, p. 14.

** Ibid.

\+ Secondary Lead Smelters Association (SLSA).

++ Ibid.

restrictions on owners and operators of facilities that store spent batteries before reclaiming them. The Small Quantity Generators provision of RCRA says that anyone generating more than 100 kg (220 lbs) of hazardous waste per month (less than six spent batteries) must comply with RCRA regulations that handle transportation and disposal of hazardous waste. However, spent batteries have so far been exempt from the SQC transportation clause that would have required spent batteries to be manifested. The SQC disposal requirements which do apply dictate that spent batteries from a SQC must be stored and disposed of at an approved hazardous waste facility. On-site storage of less than 180 days remains unregulated.

Since some secondary smelters store lead-acid batteries on site, they become land disposal facilities and therefore need a RCRA permit or interim status in order to operate. A secondary smelter that handles spend lead-acid batteries must meet the following RCRA requirements: be issued a Part B application which allows them to process the hazardous material, install a groundwater monitoring system, and obtain non-sudden liability insurance for $3 million per occurrence and $6 million in total. Sourçes close to the lead industry estimate that a Part B application costs between $30,000 and $50,000, depending on the size of the smelter, and a groundwater monitoring system costs approximately $30,000.* Due to RCRA alone, the costs to an owner or operator to continue to handle spent batteries are on the order of $100-$200,000 per plant. These costs can be prohibitive especially for independent battery breakers.

By themselves, these costs can be substantial. However, for many secondary smelters, the primary issue is not cost but the inability to maintain operations due to the unavailability of liability insurance. Many secondary smelters store batteries on-site prior to processing and thus require RCRA permits at land disposal operations. These facilities were required by the Hazardous and Solid Waste Amendments of 1984 (HSWA) in order to submit Part B permit applications and to certify compliance with groundwater monitoring and financial responsibility requirement by November 8, 1985, or else their interim status would terminate. Because most secondary smelters could not obtain liability insurance or indicate the financial strength to provide financial assurance, they were not able to comply with the HSWA requirements and have thus lost interim status to operate their land disposal operations. Stringent enforcement of the HSWA interim status provisions would therefore force the the closure of a number of smelters that have otherwise managed to remain economically viable.

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* Secondary Lead Smelters Association (SLSA).

In summary, it is clear that the costs faced by battery breakers, lead smelters, battery manufacturers, and storage facilities to comply with health and environmental regulations for lead alone are becoming significant. The estimates above show that NAAQS and OSHA regulations for lead cost 5 cents per pound at a minimum. In addition, RCRA regulations for spent battery and processing facilities require an up-front investment of several hundred thousand dollars or up to 1 cent per pound of lead produced. As discussed in the next section, these compliance costs have had and will continue to have a dramatic effect on the battery reprocessing industry.

Impacts on Secondary Smelters and Battery Breakers

The progress of regulation relating to the handling of lead waste as well as the overall poor economics performance of the entire lead industry mean that many secondary smelters are now unable to invest in environmental equipment in order to comply with the regulations while still maintaining their ability to collect adequate raw material (old scrap) and ultimately sell it for a profit. In 1985, there were approximately 23 secondary lead smelters in the U.S., down from approximately 80 only two years earlier.* Many of these secondary lead smelters in the industry are being or have recently been forced to drop out because of price constraints and the increased costs of complying with environmental regulations. Table 1 shows that a total of 571,000 metric tons of furnace capacity in secondary smelters has closed since 1981; this is a significant portion of the total furnace capacity of less than 900,000 tons at the end of 1984.** Thus secondary lead smelting capacity has shrunk by 37 percent in the four-year period 1981-1984. And since early 1984, eight additional smelters have closed. Additionally, industry sources estimate that as many as 70 percent of the currently operating smelters are operating without the necessary environmental permits. They could be forced to close after the grace period expires.

Similarly, many independent battery breakers have gone out of business; there now remain less than five operating breakers in the entire U.S., down from approximately 300 in the late 1970s.+ One industry expert believes that the first 150 breakers dropped out gradually under pressure to meet OSHA regulations. RCRA regulations caused another 70 smelters to close fairly soon after the regulations were enacted. By the

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* "Lead." Mineral Facts and Problems, 1985 edition, Bureau of Mines, p. 3.

** "Lead." Bureau of Mines Minerals Yearbook, 1984, p. 5.

\+ NARI Metals Report, 30 October 1985.

TABLE 1

U.S. Secondary Lead Smelter and Remelter Closures

Company Name	Location of Smelter	Capacity (metric tons)	Date of Closure
Bergsoe-Boliden	Muncie, IN	(20,000)	
Bergsoe-Metal Corp.	St. Helens, OR	(27,000)	May-85
	Seattle, WA	(20,000)	Jul-84
Chloride	Florence, MS	(12,000)	Nov-82
Federated Metals	Newark, NJ	(10,000)	Oct-84
	Whiting, IN	(10,000)	Feb-83
	Houston, TX	(10,000)	
General Battery Corp.	Heflin, LA	(13,000)	Mar-82
General Smelting	Nashville, TN	(10,000)	
GNB Batteries	Omaha, NE	(25,000)	
	Savannah, IL	(55,000)	
Houston Lead Co.	Houston, TX	(15,000)	Aug-81
Hyman Viener & Sons	Richmond, VA	(12,000)	
Inco US, Inc.	Jacksonville, FL	(15,000)	
Inland Metals Refining	Chicago, IL	(3,000)	
Murmur Corp.	Dallas, TX	(60,000)	
National Smelting & Refining	Atlanta, GA	(25,000)	Mar-84
	Pedricktown, GA	(60,000)	Jan-84

TABLE 1. (cont.)

Company Name	Location of Smelter	Capacity (metric tons)	Date of Closure
Roth Bros. Smelting	E. Syracuse, NY	(5,000)	
Sanders Lead	Cedartown, GA	(10,000)	
Southwest Metals	San Bernadino, CA	(10,000)	
Taracorp. Inc.	McCook, Il	(14,000)	
	St. Louis Park, MN	(18,000)	
	Granite City, IL	(25,000)	
Tonolli North America	Nesquehoning, PA	(45,000)	Jan-85
USS Lead Refinery Inc.	E. Chicago, IL	(22,000)	Dec-85
Willard Lead Co.	Charlotte, NC	(20,000)	
	TOTAL CLOSURES:	(571,000)	

SOURCE: National Association of Recycling Industries (NARI) beginning of 1983, there were less than 50 battery breakers in the U.S.; by 1984 there were less than 25 still operating.

The numerous recent closures in the industry have led to substantial reductions in the nation's ability to recycle batteries. A battery industry expert noted that in the state of Texas alone, approximately 5 million batteries are available for recycling per year, yet because of the fact that by 1985, there did not exist any battery breaker in Texas, only 1 million batteries at best were recycled after having been transported long distances for resmelting. Closure of smelters and battery breakers even further narrows the geographic distribution of recycling facilities and increases the overall transportation costs of supplying the remaining smelters with the raw material required. As one survey respondent noted, "at current junk pricing, junks [spent batteries] cannot be shipped very far and have any value over freight costs." Thus it has been observed that large junk battery shippers by 1986 generated 60 to 80 percent less volume than in 1984.

Those smelters that do remain have generally been able to do so because of their overall strategy of vertical integration. That is, these companies not only produce their own batteries but also break and resmelt the secondary lead from spent batteries. Table 2 distinguishes between those major battery manufacturers that smelt their own lead and those that do not.

Note that current legislation essentially exempts those persons who generate, transport, or collect spent batteries or persons who store spent batteries but do not reclaim them from RCRA regulations. These exemptions apply to components of the battery chain such as backhaulers, battery dealers or distributors, service stations, or scrap metal dealers. However, according to the survey of secondary lead smelters, scrap metal dealers and service stations have ceased handling spent batteries because the simple economics of the situation leave no room for profitability. One respondent cited that in the case of South Texas, by early 1986, over 50 percent of the scrap dealers were no longer receiving or buying scrap batteries due to depressed lead prices and even fear of upcoming government regulations that would affect their spent battery collection efforts and potentially their liability for the potential damages caused by improper battery disposal.

It is clear then that economic incentives that existed up to six years ago for recycling batteries have diminished. At the 1986 price levels for lead, scrap metal dealers are not adequately rewarded to provide as sufficient a financial incentive to collect lead scrap as before. Thus consumers and battery wholesalers often find it easier to simply dispose of spent batteries (illegally) rather than find someone (and maybe <u>pay</u> someone) to take them off their hands. This explains the ballooning

Table 2

MAJOR STORAGE BATTERY COMPANIES

Vertically Integrated	Not Vertically Integrated
General Battery	Globe Union (Johnson Controls)
Chloride	Delco
GNB	
East Penn	

quantities of spent batteries that are unaccounted for (either disposed of in landfills, permanently stockpiled, or otherwise exiting the recycling chain). With no upturn in sight for lead demand or lead prices, battery recycling rates will continue to decline. Faced with increasing numbers of batteries exiting from the recycling chain, we must carefully examine the possible health and environmental effects of improper disposal of lead-acid batteries.

HEALTH AND ENVIRONMENTAL IMPACTS

Scientific View

To determine the potential health and/or environmental hazards associated with improper lead-acid battery disposal, a number of chemists and soil scientists were queried. The general consensus is that there does exist a mechanism by which lead can form an aqueous component which can then leach through the soil into nearby groundwater.

According to experts, lead is more soluble than most heavy metals and is in fact highly soluble in organic compounds such as acetic and citric acid. This is a fact already well known to the EPA. At present, the solution agent used to perform Extraction Procedure (EP) toxicity tests for lead is acetic acid. The significance of acetic acid for this analysis is that it is very prevalent in household garbage disposed in municipal landfills. Lead from battery plates, posts and grids when mixed with co-disposed acetic acid can form lead acetates. There remains some uncertainty about the extent to which these compounds will migrate through the soil; some believe that the lead acetate will "complex" with soils, especially clay, which prevents further movement. However, there is clearly some possibility that lead will migrate through the landfill in the form of lead acetate and move into adjacent regions entering aquifers used for drinking water.

Scientists believe that the degree of leaching and the hazard that lead leachates pose depends upon many features of the landfill, including how the lead source (batteries) is distributed in the landfill. It is, however, rare for compounds such as lead acetates to migrate long distances.

The scientific implication is that a mechanism for lead migration is present in areas with high concentrations of acetic acid. Therefore, we would expect a greater potential for off-site health and environmental impacts due to lead at municipal landfills rather than at industrial dumps where the organic compounds might not be present.

In addition to lead, batteries contain significant amounts of sulfuric acid. While sulfuric acid is a highly toxic material, it is very often neutralized by the natural buffering agents in soil. Therefore, the release of small quantities of sulfuric acid is less of a concern than the migration of lead compounds.

Empirical Evidence

The extent to which lead compounds have contaminated groundwater sources is difficult to document. The reason is that there are limited data available. A search for site-specific evidence was therefore centered on the EPA's NPL sites since most documentation and testing would have occurred at these sites.

Based on a survey conducted by Putnam, Hayes & Bartlett of U.S. secondary lead smelters, there is general agreement that the batteries are finding their way in increasing numbers to dumpsters and city garbage trucks for hauling to municipal landfills. There are even reports that some landfills, for example, due to the increasing presence of batteries in landfills, are considering purchasing battery breaking equipment to handle the spent batteries they receive. Other incinerators report increasing problems with heavy metals in scrubber waste water. One survey respondent noted that in a Texas town with a population of 10,000, an estimated five to 10 batteries were being buried in household garbage daily.

In addition to causing problems with incinerator operations, lead-acid batteries have also been causing problems with automobile shredding equipment. Since per-pound payment for the weight of a junked automobile is now higher than that of the average battery, spent batteries have recently been found hidden inside crushed vehicles.* Unfortunately, shredders have found unacceptable lead levels in the nonmetallic residue from the shredding process bound for landfills. Additionally, the high lead content in metal scrap changes the properties of the scrap and carries a potential problem for steelmaking operations relying on this scrap.

The environmental impacts of the increased presence of batteries in landfills may not yet be measurable. From a total of 786 sites on the NPL, 55 of them noted the presence of lead (from any source) in the list of significant contaminants. However, thus far the primary sources of lead contamination were supposed to be fly ash and paint sludge, materials whose lead content is in a different form to test the scientific hypothesis posed above regarding the formation of lead acetates.

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* American Metals Market, 21 November 1985, p. 1.

In fact, out of more than 25 NPL landfill sites studied in some detail, only one had notable (i.e., above background) concentrations of lead in nearby groundwater. At the Gems landfill in New Jersey, a facility primarily for municipal wastes, concentrations of lead in various samples were as follows:

Leachate	300-400 ppm
Surface water	12-41 ppb
Groundwater	11-73 ppb
(groundwater background	10 ppb)

To keep these numbers in perspective, recall that the drinking water standard for lead is 50 ppm. The sources of lead contamination at the GEMS site are unknown; however, it seems clear that lead in some form leached through the landfill to contaminate nearby groundwater supplies.

CONCLUSIONS

Based on the analysis undertaken for this study, we conclude that the current economic conditions of the secondary lead industry coupled with increasingly stringent environmental regulations are causing a decline in lead-acid battery recycling rates from typical levels of 80 percent to current levels below 60 percent. This translates into approximately 120,000 additional metric tons of lead that exited from the battery recycling chain in 1985 and entered the environment.

Since lead demand is likely to remain flat in the future and lead supply will continue to be ample, it is unlikely that lead prices will increase significantly from their current low levels. Therefore, assuming no growth or further decline in lead demand or lead prices, and extrapolating the 60 percent recycling rate over the next 10 years, between 1985 and 1995, nearly 120 million additional batteries containing about 2.6 billion pounds of lead will enter the environment due to the 20 percent decline in battery recycling rates. If environmental regulations cause further closures in the secondary lead industry, the number of batteries exiting the recycling chain will only increase.

Based on a survey of secondary lead smelters and anecdotal evidence collected from sources close to the battery industry, spent batteries have been found to be entering the environment in increasing numbers by means of disposal at municipal landfills and incinerators. The increasing presence of batteries is causing operational problems in some facilities, such as contamination of incinerator ash with hazardous metals. At municipal landfills, substantial numbers of disposed batteries pose a hazard or threat of lead contamination.

Scientists concur that a mechanism does exist at a landfill for lead to form a compound and leach through the soil to contaminate nearby groundwater. However, the empirical evidence that we have obtained regarding the extent of the lead contamination problem is inconclusive. We have not found widespread contamination of groundwater by lead at landfills on the National Priorities list. However, the decline in recycling rates is relatively recent. Therefore, we cannot yet expect to find much empirical evidence; rather, we would expect to see lead contamination posing a larger contamination problem in the future.

Based on these conclusions, and on a study of the lead industry in general, we believe that continued economic trends combined with existing or more stringent environmental regulations will exacerbate the problem of lead-acid battery recycling. The current market provides no financial incentives to increase recycling rates which may decline even further and ultimately have a significant impact on human health and the environment.

RECOMMENDATIONS

Based on the preliminary findings of this study, we recommend that the EPA examine in more detail the link between improper disposal of lead-acid batteries and health and environmental impacts of lead contamination in soils and groundwater. This effort should be undertaken both empirically (i.e., searching for sites where lead contamination from batteries or other sources is a problem) and theoretically (i.e., reviewing scientific implications of the possible mechanisms for the formation and migration of lead compounds).

If the health and environmental risks due to improper disposal of lead-acid batteries pose or threaten to pose a significant problem, then the EPA should explore options that address critical steps in the lead-acid battery recycling process. Unlike most hazardous wastes, there exists a recycling chain for lead-acid batteries that in the past has operated with remarkable efficiency in response to market forces. The current market economics and regulatory climate have reduced the efficiency of this recycling mechanism. It may be the case, however, that if the recycling chain were compensated for the environmental benefits provided in addition to the value of the lead recovered, recycling rates would return to previous levels, and a potential environmental problem in the form of massive amounts of improperly disposed batteries could be eliminated. In this case, the EPA may want to consider regulatory or market-based schemes that would take advantage of and enhance the efficiency of the existing recycling network. For example, the EPA may want to reconsider certain RCRA regulations that apply to the collection, handling, and processing of lead-acid batteries to determine whether relaxation of certain provisions may maintain public health and welfare while removing barriers to recycling. Similarly, the EPA may want to consider the merits of market-based incentives such as deposit mechanisms that generate funds, which can be added to the value of a used battery to encourage recycling.

To complement or supplant efforts to encourage recycling, the EPA may also want to evaluate the feasibility of regulatory, market-based, or information programs that require or encourage the separation and proper handling of batteries at the point of disposal. Such programs may encourage landfill or incinerator operators to separate, collect, and return batteries to the recycling chain.

Appendix 1

GUIDE TO THE CALCULATION OF BATTERY RECYCLING RATES

The five major steps involved to calculate the battery recycling rate are:

1. The average lead content per motor vehicle battery is estimated as follows:

   (Total lead consumed for batteries - lead consumed for industrial batteries)/Total battery shipments),

   where total battery shipments includes original equipment (OE), replacement, and export shipments. To account for inventory fluctuations, a two-year moving average of lead content per battery is used to smooth the profile over time.

2. Assume that the actual recoverable lead per battery is 90 percent of the lead content due to losses in the recovery process.

3. The total motor vehicle batteries available to recover are:

   Truck deregistrations + auto deregistrations + # of replacement batteries.

   If 90 percent of automobile registrations are car registrations (based on historical trends), then:

   Truck battery lead content = 1.2 * average battery lead content;

   Auto battery lead content = average battery lead content/1.02.

   Therefore, motor vehicle batteries <u>available</u> for recycling =

   (truck deregistrations + .1 * replacement batteries) * truck battery weight [3 years earlier] + (car deregistrations + 9 * replacement batteries) * car battery weight [3 years earlier],

   where the average life of a battery is estimated at three years.

4. To get actual lead recovered from motor vehicle batteries:

Amount of lead recovered from scrap batteries - .8 * lead consumed in industrial batteries [6 years earlier] + .75 * lead consumed for battery exports,

where we assume 80 percent of industrial batteries are recycled, and the lifetime of these batteries is six years, and 75 percent of all batteries exported are ultimately recycled in the destination country.

5. Battery recycling rate = battery lead scrap actually recovered/available for recovery.

APPENDIX I (cont): CALCULATION OF BATTERY RECYCLING RATES FOR 1974 - 1985

		1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
BATTERIES REPLACED (millions)		44.4	42.6	49.2	54.6	56.4	53.7	50.1	53.6	54.2	56.1	59.3	58.7
PLUS:													
VEHICLE DEREGISTRATIONS													
CARS (millions)		5.9	5.6	7.2	8.8	7.9	8.6	8.9	7.2	6.7	6.8	7.1	8.8
TRUCKS (millions)		0.8	0.9	1.3	1.8	1.7	1.5	1.5	1.4	1.5	1.8	2.0	2.5
BATTERIES AVAILABLE FOR RECOVERY (millions)		51.1	49.1	57.7	65.2	66.0	63.8	60.5	62.2	62.4	64.7	68.4	70.0
MULTIPLIED BY:													
AVERAGE RECOVERABLE LEAD PER BATTERY (3 year delay) (pounds)		21.4	21.5	21.6	23.3	23.1	21.1	21.3	21.7	21.1	19.5	19.7	20.3
TOTAL RECOVERABLE LEAD FROM SPENT BATTERIES (000 metric tons)		496.0	478.8	565.3	689.1	691.6	610.6	584.5	612.2	597.2	572.3	611.2	644.6
LEAD RECOVERED FROM SCRAP BATTERIES (000 metric tons)		379.6	378.7	418.6	468.7	469.6	495.6	480.6	481.4	439.2	371.5	443.1	406.7
LESS:													
LEAD RECOVERED FROM INDUSTRIAL BATTERIES (6 year delay) (000 metric tons)	80%	42.4	41.7	46.2	49.4	46.7	58.6	58.7	54.7	56.5	65.9	67.8	74.0
PLUS:													
LEAD RECOVERED IN BATTERY SCRAP EXPORTS (000 metric tons)	75%	40.4	34.0	31.9	58.1	74.0	89.8	89.7	44.6	38.9	38.2	33.8	44.9
TOTAL LEAD ACTUALLY RECOVERED FROM SPENT BATTERIES (000 metric tons)		377.6	371.0	404.3	477.5	496.8	526.7	511.6	471.2	421.6	343.8	409.2	377.6
RECYCLING RATE (%)		76.1%	77.5%	71.5%	69.3%	71.8%	86.3%	87.5%	77.0%	70.6%	60.1%	66.9%	58.6%

SCRAP IRON & STEEL PRICES

Consumer Buying Prices

Special Markets

Additional Grades

Stainless Steel Scrap

AMM Weekly Scrap Composites

Export Yard Buying Prices

Broker Buying Prices

Metal Market Weekly Steel Scrap Price Composite

Appendix B

NONFERROUS SCRAP

Copper

[illegible]

Aluminum

[illegible]

Lead

[illegible]

Zinc

[illegible]

Nickel

[illegible]

Tin

[illegible]

Additional Prices

BOSTON

[illegible]

BUFFALO

[illegible]

CHICAGO

[illegible]

DETROIT

[illegible]

LOS ANGELES

[illegible]

NEW YORK

[illegible]

PHILADELPHIA

[illegible]

SAN FRANCISCO

[illegible]

MONTREAL

[illegible]

TORONTO

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July 10, 1986

Mr. Bob Wilbur
B C I
1101 Connecticut Ave, Suite 700
Washington, D.C. 20036

SUBJECT: CURRENT UPDATE - DISTRIBUTION TO SLSA MEMBERSHIP AND OTHER INTERESTED PARTIES

Dear Mr. Wilbur:

Attached you will find copies of two recent articles, one issued on July 2nd, 1986 by American Metals Market and the second one by Metals Week, dated July 7, 1986 all pertaining to the recent spent lead acid battery studies.

The articles are of course self-explanatory. For example, an EPA policy staffer has stated "we haven't been able to generate any interest in the problems along the agency's chain of command where follow-up work could be authorized. One official of the office of EPA Policy Planning and Evaluation made the astounding statement that "the research so far shows no solid evidence of health risks from the finding that more batteries are entering landfills as the battery-recycling industry shrinks! They further comment that "what drives the agency are health risks." (EPA's own consulting firm contradicts this conclusion.) An EPA policy staffer was also quoted as saying "there's no future study planned." From this person's view point, I find the EPA conclusions as incomprehensible!

On March 8, 1984, EPA promulgated Effluent Guidelines for Nonferrous metals manufacturers of which Secondary Lead Smelting (Battery recycling) was a sub-category. In the pre-amble of those regulations, EPA stated that the raw, untreated waste waters from all operating secondary lead smelters contained 80 tons per year of toxic pollutants. If we conservatively assume that lead constitutes 70% of the total toxics, that equates to 56 tons per year of lead in untreated waste water. The promulgated BAT/PSES regulations require treatment of those waste waters to reduce discharge of toxics to 1.67 tons per year (1.17 tons per year lead). The Secondary Lead Smelter Association Inc. (SLSA) filed a law suit against EPA contending those levels were unachievable using EPA's model technology. SLSA entered into ernest settlement negotiations with EPA and proposed effluent limitations equating to a discharge level of approximately 3.0 tons per year of toxics (2.1 tons per year of lead). EPA refused to negotiate with SLSA on this matter and instead chose litigation in Federal District Court over the difference ... 0.93 tons per year of lead!

It is totally incomprehensible to me why the EPA would fight so hard over 0.93 tons per year of lead on this issue which will cost the secondary lead industry millions of dollars to attempt to comply with, if at all possible, and then take the attitude that 200,000 tons per year of lead being improperly disposed of (as shown by their own study) is insignificant and causing no harm - or in the words of the EPA "shows no solid evidence of health risk".

Telex: 297036 GNB MEND

In other words, the EPA does apparently consider 56 tons of lead discharged into the environment is a health hazard requiring millions of dollars for the secondary lead industry to correct while at the same time considering 200,000 short tons of lead and millions of gallons of acid improperly disposed of in the environment as a result of not being reclaimed as constituting "no solid evidence of health risks."

On the bright side, you will see from the article that the Department of Commerce disagrees with the EPA conclusions and plans to start a study of their own. It is my understanding that there is somewhat of an adversary relationship between EPA and the Department of Commerce. You will note from the article that Commerce says "EPA is looking at health effects. That's a small part of what we want to get at." Current plans call for a Commerce study to begin this autumn and to be completed by mid 1987. Please also note that Commerce is "very interested...in the possibility that remedies - such as the imposition of cash deposits on battery purchases - are needed in light of threats to the public health or the recycling industry's health."

From this writer's viewpoint, the matter of cash deposits on battery purchases is a very sensitive issue. Although primaries or secondaries may or may not be greatly concerned about cash deposits, I have noted that the battery manufacturers in general, have some concern as to how this might effect the battery market. It is unlikely that any battery manufacturer would like to be known as the author of a cash deposit program with their customers. Please note that many retailers are now advertising with the stipulation that "no trade-in required." Retail stores are becoming less interested in dealing with junks due to lack of economic incentives. In addition, we are finding that the re-cycling business is growing rapidly. In this business, entrepreneurs are culling junk batteries, cleaning them up, charging and re-testing and then selling them on the open market at extremely low prices. This results in loss of lead and battery sales to smelters and battery manufacturers. There is some question in my mind as to product liability ramifications regarding such transactions.

I am also enclosing an article from the July 8th issue of American Metals Market pertaining to the B & O Railroad agreement to clean up a lead battery scrap site. Please note that scrap battery dealers are to be held responsible if they shipped any batteries to a specific location as far back as 40 years ago! Actions such as this will further deter scrap dealers from being interested in collecting junk batteries.

Also, please find copies of a four page article from the "Phoenix Quarterly" published by the Institute of Scrap, Iron & Steel, Inc. which deals extensively with our paper entitled "Impending Crisis?" and the EPA authorized study made by Putnam, Hayes & Bartlett. BCI will be publishing an article on this same subject in late July.

Consequently, as of this writing, we have one agency (EPA) who says this matter is of no great concern even though EPA's own consulting firm's statistics show otherwise, while at the same time the Department of Commerce says they are very interested in this project!

Mike Sappington of Lake Engineering is preparing a letter now to various agency individuals (including the Department of Commerce) pointing out the incongruity of EPA's conclusion and will be sending SLSA members copies of his correspondence. You will recall that at the last SLSA meeting held in Philadelphia the "Impending Crisis" paper was discussed in depth and it was decided that an SLSA committee should be formed to make specific technical guideline recommendations to the EPA. Mike Sappington was appointed chairman of this project and is organizing this committee now. You will be hearing from him in the near future.

I have engaged the services on behalf of GNB of Mr. Gary H. Baise - Attorney at Law with the firm of Beveridge & Diamond, Washington, D.C. to represent GNB in matters pertaining to environmental issues. Mr. Baise is a former Deputy Administrator of the EPA serving under Mr. William Ruckleshaus, former Administrator of the EPA. Mr. Baise will assist GNB in communicating the inequities of the present situation on both, federal and state levels.

Sincerely,

James G. Palmer
Executive Vice President
Supply & Distribution Group

Encl

AMM Wed. July 2, 1986

FROM: J Palmer

Battery Studies Are Picked Up By Commerce

By BILL SCHMITT

NEW YORK—The Commerce Department will carry on where the Environmental Protection Agency is leaving off as the federal unit spearheading studies of the unrecycled battery problem, sources say.

Commerce is developing plans to begin this year its own research into the declining rate of lead battery recycling, Robert

(Continued on page 8)

Commerce Gets Battery Studies

(Continued from page 2)

C. Reiley, director of the agency's Office of Metals and Commodities, said Monday.

"We're very interested," he said, in the possibility that remedies—such as the imposition of cash deposits on battery purchases—are needed in light of threats to the public health or the recycling industry's health.

The idea of battery deposits is "a good idea," Reiley said. "We think that we could support that," but it has to be studied more closely, through more government research.

Reiley's remarks came in response to indications that the EPA, which recently sponsored a preliminary study on the recycling decline (AMM, June 10), will not move ahead with follow-up research because no significant health effects from the trend can be found.

"There's no future study planned," said the EPA policy staffer who coordinated the initial research.

"We haven't been able to generate any interest" in the problem along the agency's "chain of command" where follow-up work could be authorized, acknowledged Glen Anderson in the EPA Office of Policy, Planning and Evaluation.

He said that the research so far shows no solid evidence of health risks from the finding that more batteries are entering landfills as the battery-recycling industry shrinks. Staffers consulted last week regarding the study showed little interest, Anderson said, because "what drives this agency are health risks."

Reiley at Commerce responded, "EPA is looking at health effects. That's a small part of what we want to get at." The agency's Basic Industries Sector is interested in studying whether and how to create policies aiding the recycling industry, he said.

"We plan to do it," Reiley said of the study, "but we're being a little cautious because of Gramm-Rudman and some staffing problems we have right now."

Current plans call for the study to begin this autumn and to be completed by mid-1987, Reiley said.

METALS WEEK

July 7, 1986

LEAD AND ZINC

New North American zinc price hike met with skepticism

The latest wave of zinc price increases to 44¢ per lb may be premature in the view of some analysts, but there is general agreement the 41¢ level will remain firm at least through August. The new hikes came in anticipation of the July 11 US Mint tender, and on the heels of a June 26 contract rejection by Noranda's striking Valleyfield, Que., zinc refinery workers.

The strike vote bolstered LME prices, which moved back above the 37¢ mark (£533) for spot HG. On June 30 St. Joe and Jersey Miniere moved up 3¢ to 44¢ per lb for HG. Hudson Bay went up 4.5¢ to 42.5¢ for HG, and raised its domestic HG tag 6.5¢ to 58.5¢ (Canadian). Cominco followed to 44¢ and 60.5¢ (Canadian) for HG on July 2, buoyed in part by the LME, and surprising some analysts who thought the major Canadian producers would hold their position at 41¢.

"There was a lot of poor business and marketing done last year for 1986," said one analyst, "and now they're trying to recoup." Although the new price increases were "forcing the issue," he said the market will definitely be tight for August.

One producer predicted settlements at the Broken Hill Mines in Australia or Valleyfield would have little effect on current price levels. "If the present status quo continues, even if Noranda comes back, 41¢ will be maintained," he said, noting, "Things are basically in balance." Despite the normal summer slowdown, he added, "I think third-quarter demand from the steel industry, particularly in coated products, looks very good."

NEW PRODUCER US ZINC PRICES

(US ¢ per lb)

US Producers:	HG	PW	SHG	Controlled lead	CGG
Asarco	41.00	41.50	41.50	41.50	41.75
Huron Valley Steel	41.00	41.00	41.60	NA	41.75
St. Joe Resources	44.C0	44.00	NA	44.75	44.75
Jersey Miniere	44.00	44.75	44.50	44.75	44.75
Canadian Producers:					
Cominco	44.00	NA	44.50	44.50	44.75
Hudson Bay	42.50	43.00	43.00	43.00	43.25
Noranda	41.00	41.50	41.50	41.50	41.75
Falconbridge	41.00	41.60	41.00	41.50	41.75

NA—not available

The US Mint tender for 7,642,000 lb of SHG this week will be carefully watched, though most producers say they expect the winning bid will go to a dealer. The tender should solidify the August price, and provide some momentum for September sales. And even if some strikes do occur in the US steel industry, most analysts said a widespread stoppage was unlikely.

Finally, Noranda declared *force majeure* for zinc shipments from the Valleyfield refinery on June 16. The company is, however, selling and tolling concentrates.

Lead prices predicted stable through 1986; BHAS announces July shutdown for Port Pirie

Analysts are expressing "cautious optimism" lead prices will remain firm through the end of the year, even if a settlement is reached in the six-week labor dispute at Broken Hill Mines.

June monthly averages are on page 8.

With BHAS's Port Pirie, Australia lead smelter slated to close on July 25 for at least a month because of depleted stocks, downward pressure on the LME price is now expected to be slight in the event of a settlement.

Asarco, eyeing the softened LME price, lowered its quote by 0.25¢ to 22.25¢ per lb on July 1. Though the price difference between the LME and the US market was as high as 5.5¢, one industry analyst said if the gap attracted metal from Europe, its effect would be shortlived. "As soon as material starts coming from Europe, it will firm up that market," he noted.

The real story in lead is inventories. Producers hope there will be a healthy reduction in stocks through the end of the year. Already, the once bloated inventories are returning to supply and demand balance; US stocks, which stood at 116,699 tons at the end of May, are expected to fall below 100,000 tons by the end of June, and below 80,000 tons by the end of July. North American producers report they are receiving some calls for metal from Europe and the Far East because of the Broken Hill strike.

Given these conditions, one analyst expressed confidence the price will hold in the 22¢- to 24¢-per-lb range through the end of the year. If inventories reach a less cumbersome level, and supply and demand are stable, he said, "I don't think the price will go below 20¢, even next year."

At Broken Hill, mine owners AM&S and North Broken Hill Holdings were to respond on July 4 to a union compromise proposal calling for 19 work shifts per week, up from 15 shifts before the strike began on May 26. The owners want 21 shifts.

Finally, USW negotiators will meet with Homestake representatives on July 8 to discuss the terms of a new contract for 215 mine and mill workers at the Buick, MO, lead operation. No talks are planned for 200 idle smelter workers. The smelter will be down at least through the end of the year, one source said.

Elsewhere in lead and zinc...

Boliden will operate the Black Angel Mine in Greenland for at least two years, a stipulation required by Danish authorities in the deal worked out between Cominco and Boliden two weeks ago. "We are confident there are ore bodies for at least two years, and we are crossing our fingers for more," a Boliden spokesman said. If the sale is approved by Vestgron Mines' stockholders on July 8, ownership will be transferred to Boliden during the week of July 14.

The EPA has no plans to study the environmental impact of spent batteries on municipal landfills. "It's not a real big issue," an EPA spokesman said. "There may someday be a problem, but it's a long-term problem." A recent agency report recommended a follow-up study after it found 40% of all spent batteries are escaping the secondary lead recycling chain because of low lead prices. Meanwhile, the Commerce Dept.'s Office of Metals and Commodities plans its own study of the secondary lead industry, which should be under way by the end of the year. "It's becoming a hazardous waste management industry, rather than a lead recycling industry," an OMC spokesman said. The report will suggest policy solutions.

LATE NEWS

- Amax is expected to be awarded tungsten [illegible] GSA's July 3 tender. Amax bid on one lot (202) containing 1,763.159 stu of WO_3 at $42.769 per stu. Bomar bid on three lots: (202) 1,763.159 stu of WO_3; (203) 3,249.264 stu; and (204) 646.346 stu at $28.50, $30, and $30 per stu, respectively. The material should be awarded this week.

American Metal Market

VOL. 94. NO. 131 $1.50

B&O in Agreement to Cleanup Of Lead Battery Scrap Site

By EDWARD WORDEN

NEW YORK—The Baltimore & Ohio Railroad has agreed to a voluntary cleanup of lead-contaminated railyards in Troy, Ohio, as part of a federal Superfund case, but will continue to hold scrap dealers responsible if they shipped any batteries to nearby United Scrap Lead Co. as far back as 40 years ago.

United, a now-defunct recycler of vehicle and industrial batteries, shipped lead from the B&O yard from 1946 to 1980. Empty battery casings were shredded and left in an on-site fill area. After the recycler's property was put on the National Priorities List (Superfund) in 1984 state environmental officials sought federal testing of the railyards, too.

Levels as high as 386,000 parts per million were found on railroad property. The B&O initially applied a dust controller and erected fencing around highly contaminated areas.

The federal Environmental Protection Agency (EPA) reached an agreement with B&O officials but not with owners of the now-defunct scrap company. The former site of the battery recycling operation, located near the railroad property, is on the National Priorities List for Superfund action.

As possible suppliers of batteries to United, scrap dealers throughout Ohio and Kentucky have been notified by the railroad that they might face liability for a portion of cleanup costs. Some 175 letters signed by James L. O'Connell, a Cincinnati attorney retained by B&O, were sent in recent months.

"I've turned the letter over to my attorney," one scrap dealer said. "We haven't done business with United for at least 15 years."

The consent order, which was approved by federal and state EPA officials, is in lieu of a federal cleanup that had been estimated at $1 million or more, a federal EPA spokesman said. The proposed action by B&O, other sources said, will require roughly half that amount.

The railroad company agreed to remove soil containing more than 500 parts of lead per million parts of soil. According to the EPA the level represents a margin of safety, since levels up to 1,000 parts per million are permitted by the federal Agency for Toxic Substances and Disease Registry.

Approximately two months will be required to take away an estimated 4,000 cubic yards of contaminated soil, according to the EPA.

"Levels as high as 386,000 parts per million were found on railroad property," the EPA spokesman said. "We also sampled the surrounding residen-

(Continued on page 8)

B&O Agrees to Clean Scrap Battery Site

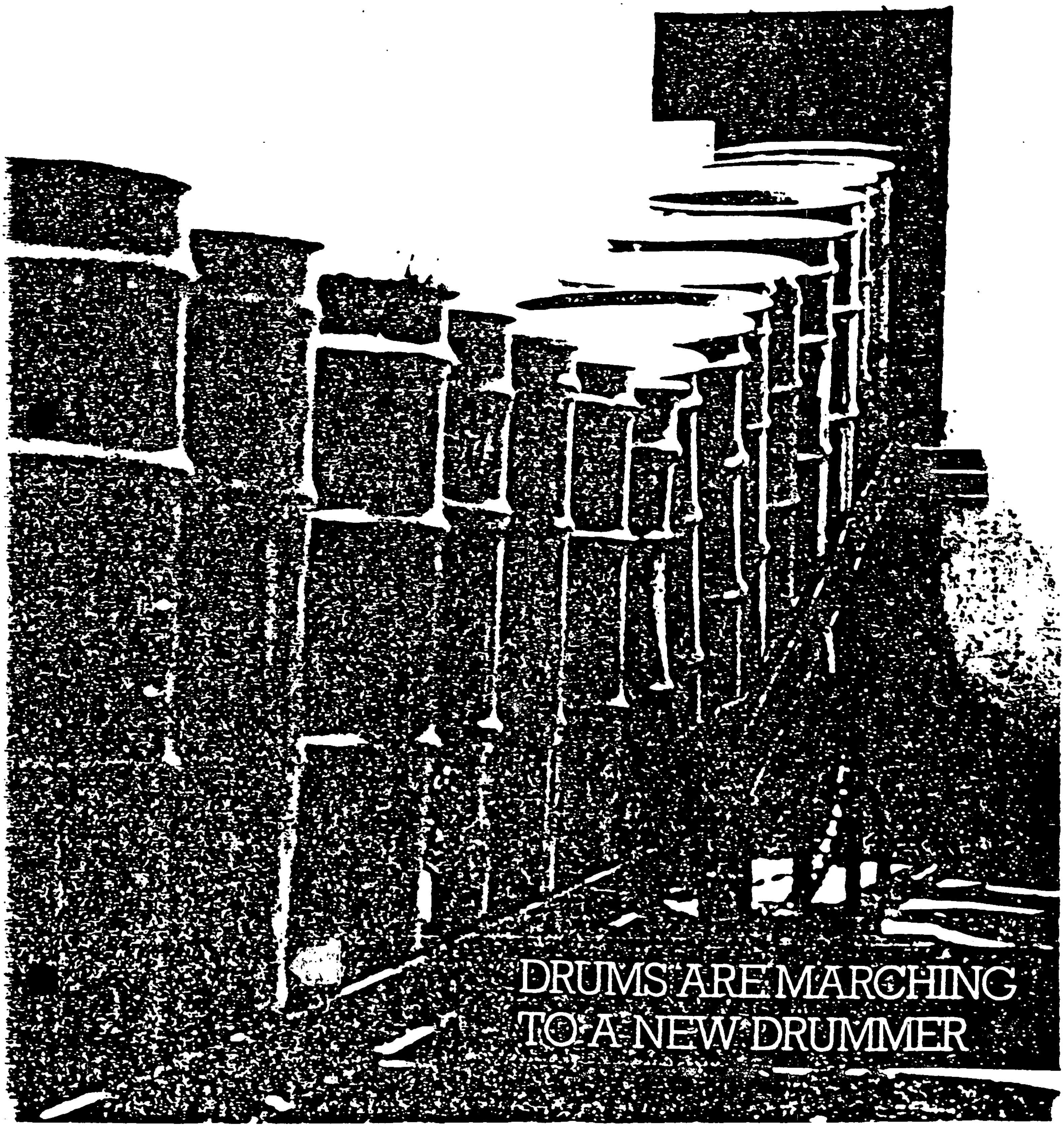
(Continued from first page)

tial area but no levels of concern were found. The railroad company applied a dust controller and fenced the highly contaminated areas in October to limit access to the soil."

Owners of United have retained counsel but have been unavailable for comment.

Phoenix Quarterly

INSTITUTE OF SCRAP IRON AND STEEL, INC. VOL. 18 NO. 2 SUMMER 1986



DRUMS ARE MARCHING TO A NEW DRUMMER

In This Issue

Volume Eighteen, Number Two, Summer 1986

Phoenix Quarterly

Like the phoenix of old, scrap iron and steel, having outlived their usefulness in one life, are purified and revitalized in the furnace of their own destruction and returned to the economy as new steel. This cycle of reclamation, which conserves our precious natural resources, is the modern counterpart of the phoenix arising from the ashes of its own funeral pyre to symbolize, in ancient times, the perpetuity of life.

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Dead Batteries— A Negative Charge to the Environment?

A product with one of the highest recycling rates in the country, if not the highest, now finds itself on a downhill slide, scorned as hazardous.

In 1979 and 1980, nearly 90 percent of the spent lead-acid automobile batteries discarded in the United States were reclaimed by secondary lead smelters—nearly 600,000 net tons of lead scrap. However, by 1985, the battery recycling rate plummeted to just over 58 percent. Of the 712,000 tons of battery scrap available to recycle last year, only 416,000 tons were actually recycled.

Since 1980, battery scrap available for recycling has increased by 10 percent, while battery scrap actually recycled has decreased by 26 percent. This decline in the recycling rate over the past six years represents from 132,000 to 198,000 additional tons of lead that are leaving the battery recycling chain annually. At 20 pounds of recoverable lead per battery, it is estimated that an additional 13 to 20 million batteries were not recycled in 1985 alone.

The big question, and a growing concern, is, what's happening to those batteries and the secondary lead smelters that recover the lead scrap from spent batteries?

The U.S. Environmental Protection Agency thought the problem serious enough to commission a study entitled "The Impacts of Lead Industry Economics on Battery Recycling." Just prior to the EPA study, "An Impending Crisis?" was released by GNB, Inc. and Lake Engineering and Development, Inc. describing the secondary lead smelting industries evaluation of the situation.

A great deal of similar information is contained in both reports, including consensus on two basic problems confronting the secondary lead industry:

1. Low market prices for an oversupply of lead.
2. Increasingly stringent environmental regulations.

Both studies also conclude that increasing numbers of batteries are being disposed of in municipal landfills and incinerators that are not prepared to handle hazardous materials.

James G. Palmer and Michael Sappington, authors of "An Impending Crisis?," report instances where "truckload quantities of lead-acid batteries are being disposed of in municipal sanitary landfills." This, they say, is "the opposite of the intent of the various environmental regulations.

What is difficult to sort out is how much of the secondary lead industries' problem can be attributed to an abundance of lead at historically low prices and what can be attributed to government regulation. The former is certainly easier to quantify.

U.S. lead prices have nose-dived from over 55 cents a pound in 1980 to 19 cents in 1985. (Between 1977 and 1980, lead prices averaged 61 cents a pound, hitting a high of 78 cents a pound in 1979.) That 19 cents approximates the cost of producing primary lead at the seven mines in Missouri that account for 80 to 90 percent of total U.S. mine production.

Historically, the production of secondary lead from old and new scrap has exceeded production of primary lead. (More than 75 percent of the old scrap comes from recycled auto batteries.) However, secondary lead production has declined in recent years from its peak of 885,000 tons in 1979 to 591,000 tons in 1985. With no increases in lead prices in sight, Putnam, Hayes & Bartlett (PH&B), which prepared the EPA study, finds no reason to expect that secondary production will increase from current levels; it may even decline further.

The Cambridge, Massachusetts, consulting firm also found that "the economics of the secondary lead industry have been further dampened by stringent and costly environmental regulations enacted since the late 1970's." Those that apply to spent batteries are ambient air-quality standards for lead, Occupational Safety and Health Administration (OSHA) standards for lead in the work place, water-quality standards for smelters and battery plants, and recent Resource Conservation and Recovery Act (RCRA) regulations for the storage and handling of hazardous waste. The costs of RCRA alone to a secondary smelter that handles batteries are between $100,000 and $200,000 per plant.

Price and regulation have taken their toll on the industry. Palmer and Sappington report that in 1981 the secondary lead industry in the U.S. had the capacity to recycle some 1.2 million tons of lead contained primarily in scrap batteries. That capability has shrunk to just over 700,000 tons today, of which only about 66 percent is operational. The 60 operational smelters in the U.S. in 1982 have dwindled to 24.

Their point is, the shrinkage in the industry will not stop the annual generation of 70,000,000 spent lead-acid batteries, which represent 70 million gallons of highly corrosive, lead-containing sulfuric acid and approximately 1.25 billion pounds of toxic lead. They warn that if the declining trend in battery recycling is not reversed, "by 1990 it is possible that over three billion pounds of spent lead-acid batteries will have been improperly disposed of in the environment during the decade of the 1980's."

Palmer and Sappington point out that market analysts predict lead will remain in abundant supply and prices will remain below levels necessary to support the collection chain for the foreseeable future. The authors explain that low lead prices dictate low scrap prices.

"Currently, a spent lead-acid battery is worth around $1.00 delivered to a smelter. At this low level, and after subtracting freight costs to get the battery to the smelter, there is little economic incentive for the collection chain to operate.

"For example, if a spent battery is only worth 25 cents to the local service station, it is easier to place the battery in the trash rather than to save it for pickup. Suppose the entrepreneur who collects batteries from service stations in his pickup truck delivery to a collection center pays the service station the 25 cents for the battery. His truck holds 100 batteries which he can sell to the collection center for 50 cents each. The $25 he nets on his load hardly pays for the fuel for his truck, much less his labor and other expenses.

"Additionally, should that entrepreneur be required to obtain environmental permits to transport the spent batteries, such a requirement could be the 'final blow' to any incentive to collect batteries.

"Since worldwide lead prices quoted by the London Metal Exchange are based on an abundant supply versus demand, the secondary lead smelter cannot pass forward its increasing environmental compliance costs. Consequently, they must be passed backward to the scrap batteries, which acts as a disincentive to the collection chain. Under current conditions, we [Palmer and Sappington] estimate nearly 35 percent of the spent batteries being generated in the U.S. are not now being collected and returned to smelters. As the smelters' environmental compliance costs increase, further downward pressure on the scrap prices will certainly exacerbate this problem."

EPA's study points out that when a battery dies, the consumer typically returns the used battery to a service station, battery dealer, or mass merchandiser for a discount on the purchase of a replacement battery. In the past, this discount has been as high as $4.00 to $5.00 per battery, but more recently has been zero to $1.00 per battery (typically 25 cents), with the exception of some mass merchandisers that continue to value a trade-in at $5.00.

PH&B found that "as a result of the current decline in lead prices, whereas in the past a customer who returned a battery received a credit towards the purchase of a new battery, in 1985 and 1986 some customers must pay a battery disposal fee of approximately 50 cents; otherwise the battery does not get recycled and leaves the recycling chain."

It is clear to PH&B "that economic incentives that existed up to six years ago for recycling batteries have diminished. At the 1986 price levels for lead, scrap metal dealers are not adequately rewarded to provide as sufficient a financial incentive to collect lead scrap as before. Thus, consumers and battery wholesalers often find it easier to simply dispose of spent batteries (illegally) rather than find someone (and maybe pay someone) to take them off their hands.

"This explains the ballooning quantities of spent batteries that are unaccounted for (either disposed of in landfills, permanently stockpiled, or otherwise exiting the recycling chain). With no upturn in sight for lead demand or lead prices, battery recycling rates will continue to decline. Faced with increasing numbers of batteries exiting from the recycling chain, we must carefully examine the possible health and environmental effects of improper disposal of lead-acid batteries."

Based on a survey of secondary lead smelters conducted by PH&B, "there is general agreement that the batteries are finding their way in increasing numbers to dumpsters and city garbage trucks for hauling to municipal landfills. There are even reports that some landfills, for example, due to the increasing presence of batteries in landfills, are considering purchasing battery breaking equipment to handle the spent batteries they receive. Incinerators report increasing prob-

lems with heavy metals in scrubber waste water. One survey respondent noted that in a Texas town with a population of 10,000, an estimated 5 to 10 batteries were being buried in household garbage daily."

Citing a specific situation and the probable results, Palmer and Sappington explain that the only secondary lead smelter in the northwestern U.S. announced in March 1986 that it will cease operation and close by July 1, 1986, due to its inability to obtain environmental impairment liability insurance required under RCRA regulations.

"The states of Oregon, Washington, Idaho, and Montana are expected to generate approximately 2,500,000 spent lead-acid automobile batteries this year. The nearest secondary lead smelters are in Los Angeles, California—over 1,000 miles away. Freight costs to transport the spent batteries to Los Angeles are greater than the market price the Los Angeles plants pay for their raw material. Some of the spent batteries may be exported to smelters in the Far East, but the most likely scenario is that the northwestern U.S. could very soon have a serious disposal problem with junk batteries."

In another regional example, PH&B found that in the state of Texas alone, approximately five million batteries are available for recycling per year, yet because of the fact that by 1985 there did not exist any battery breaker in Texas, only one million batteries at best were recycled after having been transported long distances for smelting.

One smelter, responding to a March 1986 survey by the Secondary Lead Smelters Association, cited an offer from a local major discount store of 200 batteries free of charge. The smelter turned down the offer because the labor costs for loading and transporting the free batteries would eat up any profit gained from recycling.

The study for EPA found that "large spent battery shippers by 1986 generated 60 to 80 percent less volume than in 1984."

Palmer and Sappington have determined that if the 70 million spent auto batteries generated annually in the U.S. (1985 rate) from replacement sales and junk autos, are allowed to be disposed of in sanitary landfills near the major metropolitan areas, where the highest concentration of spent batteries occur, "ground water contamination and other environmental impairments are not only very likely, but highly probable."

Although attempts have been going on for decades to find a replacement, the general consensus is that there is no viable substitute for the lead-acid battery. When asked the consequences of a ban, one top official of a major U.S. battery manufacturer replied, "You'll have to install a hand crank on all new cars." Asked about the future—10 or 15 years from now—he replied, "I assure you, the lead-acid battery will be the starting/lighting/ignition system well into the 21st century."

What then is the solution?

According to Palmer and Sappington, "EPA has spent 20 years regulating the removal of lead from gasoline so as to eliminate release to the environment of an estimated 250,000 tons of lead per year. The problem we are now facing with unrecycled lead-acid batteries is of nearly the same magnitude and could become even greater if current trends are not reversed."

They suggest economic incentives as a way to attack the problem "to ensure that the vast majority of all scrap lead-acid batteries enter the collection chain for delivery to secondary lead smelters for reclamation rather than being disposed of in the environment" and "to offset or compensate for the smelters' continually rising environmental compliance problems."

In a recent letter to the U.S. Department of Commerce, the Secondary Lead Smelters Association emphasized that "regulation which discourages recycling, even in the name of environmental control, may cause rather than alleviate environmental harm in the long run."

As an example of this point, SLSA said under "EPA's new definition of solid waste, effective July 5, 1986, secondary lead smelters must obtain and comply with RCRA permitting requirements for storage facilities for lead-acid batteries which are stored for recycling each year. The unintended effect of this regulation will be to discourage secondary smelters from accepting spent automobile batteries for recycling (if not to force the closure of the few remaining secondary smelters)."

PH&B concludes its study for EPA's Office of Policy Analysis expressing the belief that "continued economic trends combined with existing or more stringent environmental regulations will exacerbate the problem of lead-acid battery recycling. The current market provides no financial incentives to increase recycling rates which may decline even further and ultimately have a significant impact on human health and the environment."

The consulting firm recommended that EPA "examine in more detail the link between improper disposal of lead-acid batteries and health and environmental impacts of lead contamination in soils and groundwater."

If there is a problem, the next recommendation is for EPA to "explore options that address critical steps in the lead-acid battery process."

PH&B elaborates: "Unlike most hazardous wastes, there exists a recycling chain for lead-acid batteries that in the past has operated with remarkable efficiency in response to market forces. The current market economics and regulatory climate have reduced the efficiency of this recycling mechanism.

"It may be the case, however, that if the recycling chain were compensated for the environmental benefits provided in addition to the value of the lead recovered, recycling rates would return to previous levels, and a potential environmental problem in the form of massive amounts of improperly disposed batteries could be eliminated. In this case, EPA may want to consider regulatory or market-based schemes that would take advantage of and enhance the efficiency of the existing recycling network.

"For example, EPA may want to consider the merits of market-based incentives such as deposit mechanisms that generate funds, which can be added to the value of a used battery to encourage recycling."

Palmer and Sappington think the government needs to take a closer

look at who is doing what to whom and why: "It is critical that Congress establish means to accomplish cross regulatory coordination and review of related programs in order to keep specific programs from defeating the overall effectiveness of a system. 'Catch 22' situations will not help the environment, and elimination of lead recycling capability surely is not in the national interest."

This problem is yet another example of why the "Design for Recycling" program, being sponsored by the Institute of Scrap Iron and Steel, is important to the nation. What a product is made with will have a tremendous bearing on its future recyclability. And if that product must be made with hazardous material, as is the case presently with lead-acid batteries, then society must be prepared to confront the recycling/disposal problem and deal with it intelligently.

However, it would seem more rational to consider the various implications, consequences, and costs at the outset. In this way, the outcome and cost of using a hazardous material can be identified and accounted for. The cost to maintain the environment either through recycling or disposal can be established and included in the overall cost of the product—no environmental surprises at the end of the product's life.

For a copy of the EPA study write:
Kenneth Wise
Putnam, Hayes & Bartlett, Inc.
124 Mt. Auburn Street
Cambridge, MA 02[illegible]

PRODUCTION OF LEAD
(000 of net tons)

	Primary	Secondary
1975	637.4	659.4
1976	654 3	7[illegible]
1977	606.3	83[illegible]
1978	624 3	849 8
1979	635.4	884 8
1980	605.3	735 6
1981	547.2	708 5
1982	566.1	631 3
1983	569.2	555 1
1984	430.9	631 3
1985	551.2	591 3

Putnam, Hayes & Bartlett, Inc
Source: U.S. Industrial Outlook 1985, pp. 20–4, and U.S. Statistical Abstracts 1985, p. 712.

BATTERY RECYCLING RATES VS. LEAD PRICES

	(% RECYCLED)	LEAD PRICE (cents/lb)*
1974	76.1	49 1
1975	77.5	43 0
1976	71.5	43.7
1977	69.0	54 5
1978	71.7	55.6
1979	86.3	78.0
1980	87.3	55.5
1981	77.1	43 2
1982	70.4	28 4
1983	59.9	23 4
1984	66 9	26 4
1985	58.5	19 1

*calculated on real 1985 dollars
Putnam, Hayes & Bartlett, Inc

BATTERY LEAD SCRAP
(000 of net tons)

	AVAILABLE TO RECYCLE	ACTUALLY RECYCLED
1974	547 0	416 1
1975	528 0	409 1
1976	623.7	445 7
1977	762.6	526.2
1978	763 7	547 6
1979	673 0	580 6
1980	646 1	564 1
1981	674 1	519 4
1982	660.2	464 6
1983	632.7	379 0
1984	674 2	451 1
1985	712.1	416 3

Putnam, Hayes & Bartlett, Inc

GENERAL BATTERY CORPORATION
INTER-ORGANIZATION CORRESPONDENCE

TO: BCI Board of Directors
BCI - Air, Water and Hazardous Waste Committee

11/6/86

FROM: John Bitler, Chairman
BCI - Air, Water and Hazardous Waste Committee

SUBJECT: REPORT TO BOARD OF DIRECTORS (SUPPLEMENT)

RECYCLING OF SPENT BATTERIES

This position received after initial summary was prepared.

Additional comments received November 6th.

"Our company favors a governmental regulation or taxation (i.e. Excise Tax) to generate a fund to support recycling with a financial incentive. It is felt that a refund to the consumer for return of a spent battery at time of purchase of the replacement battery is a more effective method. (Details on how the initial financing of the refund was not disclosed).

JAB/bb

GENERAL BATTERY CORPORATION
INTER-ORGANIZATION CORRESPONDENCE

TO: BCI Board of Directors
BCI - Air, Water and Hazardous Waste Committee

11/6/86

FROM: John Bitler, Chairman
BCI - Air, Water and Hazardous Waste Committee

SUBJECT: REPORT TO BOARD OF DIRECTORS

BATTERY MANUFACTURING EFFLUENT LIMITATIONS GUIDELINES

The revisions to the allowances obtained by this Committee were finally made official by publication in the Federal Register Vol 51, No. 167 dated Thursday, August 28, 1986 p.30814.

RECYCLING OF SPENT BATTERIES

The Committee feels very strongly that we need to advise the consumer and encourage the return of spent batteries into the recycling chain as some of our members are instituting a program of awareness of the problem. Some of the members feel strongly that we, the battery industry, should make this effort for encouraging recycling in order to keep governmental regulations out of this cause.

One method we propose is a notice of some type of advise the user that a spent battery has a value for conservation of natural resources, but a greater negative impact on the environment if not properly recycled. This we can implement simply and quickly with a label, standardized by the industry with the BCI logo similar to the attached sketch. For consideration, we obtained a price for three different sizes of acid proof plaques of which our industry uses. Cost application and location will differ by each manufacturer. Another option is to imprint or mold the case to have a permanent message. Following is a summary of some comments we received from Committee members:

"...our people like the idea of having our industry take the initiative in battery recycling."

"Our sales people have a problem with adding another label to batteries."

"We would need universal customer approval..."

"Concur with this idea as it is the manufacturer that is cited as the 'deep pockets' when a suit is filed for a site cleanup."

"...possibly incorporate an 800 telephone number for consumer to use to find out how to recycle."

"...label should suggest ways to recycle the battery:

Give the battery to the retailer
Look in the Yellow Pages under scrap dealers
Drop off with local service station mechanic"

"Greatest visibility is on the top if possible to incorporate with other messages."

"...reduce fear by using something less alarming such as 'Trade-In' rather then 'Don't Pollute'."

"...identify more closely with other consumer recycling programs. This will mean a change of graphics to those that exist on soda cans, class bottles and the like. (Triangular pattern of arrows trailing each other)."