NATIONAL

RECYCLING RATE STUDY

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BCI RECYCLING RATE STUDY

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I. INTRODUCTION

The National Recycling Rate Study, commissioned by the Battery Council International (BCI), is conducted annually and is designed to calculate the recycling rate of lead available from lead-acid batteries in the United States.[1] The first study was conducted in 1990. This most recent study completed finds the recycling rate for the years 1997 – 2001[2] to be 97.1%.

Part II of this report includes a review of the methodology used to determine the domestic recycling rate for battery lead during the years 1997 - 2001. Part III contains the data from which the recycling rate was calculated along with footnotes listing sources from which the data was obtained.

II. METHODOLOGY

The National Recycling Rate Study is conducted by the Market Research & Statistics Division of Smith, Bucklin & Associates, Inc., Chicago, Illinois. The national recycling rate (R) was calculated by dividing the total pounds of battery lead recycled (LR) by the total pounds of battery lead available for recycling (LA) in the United States. The calculation is as follows:

$R = (LR/LA) \times 100.$

A. Total Pounds of Lead Recycled from Batteries

To determine the total pounds of lead recycled from batteries, questionnaires were sent to all secondary lead smelters. The data gathered from the questionnaires indicates the total pounds of lead recycled from batteries at U.S. smelters. This total includes lead from whole batteries and lead from battery scrap.

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1/BCI is a not-for-profit trade association whose members are engaged in the production of lead storage batteries for automotive, marine, industrial, stationary, specialty, commercial and consumer uses. BCI's members also include entities engaged in the reclamation or recycling of used lead batteries. BCI represents 99% of the nation's domestic lead battery manufacturing capacity and 96% of the nation's lead battery recycling capacity.

2/Copies of previous National Recycling Rate Study reports can be obtained from BCI, 401 North Michigan Avenue, Chicago, Illinois 60611-4267.

A. Total Pounds of Lead Recycled from Batteries (continued)

All starting, lighting and ignition (SLI) and industrial batteries are included in this analysis. However, since the secondary lead smelters record the receipt of batteries by weight rather than by type, it is impossible to determine the recycling rate for each category of battery.[3]

B. Total Pounds of Battery Lead Available for Recycling

When calculating the total pounds of lead available for recycling, the following data was included in the equation: **1)** battery shipments, **2)** new battery exports, **3)** imports and exports of vehicles containing a battery, and **4)** imports and exports of scrap lead and used batteries.

1. Domestic Battery Shipments

Domestic battery shipment data for **SLI batteries** was obtained from BCI's statistical database,[4] The data is adjusted to exclude exported batteries that were classified as domestic shipments. Imported batteries that are shipped to U.S. destinations are reported to BCI and classified as domestic shipments. Since the SLI domestic shipment data is in units, an average lead weight was applied to each battery category to determine the total pounds of lead available for recycling from that category.

To determine the amount of lead available for recycling from industrial batteries, BCI surveys industrial battery manufacturers on the amount of lead used in the production of motive power batteries and stationary batteries shipped during the relevant years.

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3/When a smelter receives a truckload of batteries, it weighs the truck with and without the batteries to determine the net weight of the shipment. After determining the types of batteries received, the smelter multiplies the weight of the shipment by a pre-determined factor to identify the amount of battery lead received for recycling. These pre-determined factors are adjusted annually.

4/BCI collects data regarding shipments of SLI and industrial batteries on a monthly basis from its members.

BCI's database includes SLI battery shipment figures back to 1942.

Domestic Battery Shipments (continued)

In addition, average battery life must be taken into account when identifying the number of batteries available for recycling. For the purpose of this study, a battery becomes available at the expiration of its average operating life. The batteries included in the analysis, and their average operating lives, are:

Average Operating Life by Battery Type

	Number of Years		Number of Years
Passenger Car/Light Commercial	4	Motorcycle	2
Truck/Heavy Duty Commercial	3	Aircraft	2
Tractor	3	Military	6
Marine	3	Miscellaneous SLI[5]	3
General Utility	2	Motive Power	6
Golf Cart	3	Stationary	10

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5/This category represents specialty automotive batteries which are used in such applications as floor sweepers, trolley cars and mine cars.

2. Battery Exports

Data on exports of new batteries was obtained from the Department of Commerce (DOC).

3. Vehicle Imports and Exports

Data was collected on the imports and exports of vehicles known to contain batteries when shipped into or out of the United States. The imports and exports of passenger cars, trucks, and buses were obtained from the Automotive Aftermarket Industry Association. Imports and exports of motorcycles were collected from the Department of Commerce. All data was adjusted for each battery category's average life and assigned an average lead weight.

4. Scrap Lead and Used Battery Imports and Exports

Imports and exports of **lead waste and scrap** and **used batteries** were obtained from the Department of Commerce.

Lead Waste and Scrap:
Data reported by gross weight in the scrap lead category was multiplied by 90% to identify the amount of battery lead represented by the category.[6]

Used Batteries:
For the purpose of this analysis, the number of **used batteries** was multiplied by the average lead weight of a passenger car or light commercial battery during the years the batteries were assumed to be produced.[7] Used battery data reported by gross weight was multiplied by 58.6%, the estimated lead weight of an *undrained* passenger car or light commercial battery; or 73.6%, the estimated lead weight of a *drained* passenger car or light commercial battery. It is assumed that all batteries exported to and imported from Canada and Mexico were shipped *undrained*, and all batteries exported to and imported from all other countries were shipped *drained*, in accordance with Coast Guard regulations.[8]

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6/Source: Mr. William Woodbury, Lead Specialist, U.S. Bureau of Mines, (November 6, 1990).
Mr. David Larrabee, International Trade Specialist, U. S. Department of Commerce, (March 22, 1991).

7/The average lead weight for a passenger car and light commercial battery was calculated at 21.4 pounds for the 1997 - 2001 recycling rate.

8/The Department of Commerce typically reports the exports and imports of used batteries in units or by weight. The amount of lead contained in these batteries is then computed using the methods described above. However, in 1997, the Department of Commerce reported a category of exported used batteries in dollars. An estimate of the average price of junk batteries in 1997 was used to estimate the total pounds of lead contained in these batteries. The average price was divided into the reported dollar figure of exported batteries to determine the total pounds of used batteries that were exported. To determine the amount of lead in these batteries, the calculated weight of the used batteries was multiplied by 58.6%, the estimated lead weight of an *undrained* passenger car or light commercial battery; or 73.6%, the estimated lead weight of a *drained* passenger car or light commercial battery.

5. Notes

Average Lead Weight for Automotive Batteries

Major battery manufacturers are surveyed annually to identify the weight of lead contained in the various automotive battery categories produced each year. This data is used to estimate the total pounds of battery lead available for recycling during each year of the study.

Average Battery Life and Recycling Rate

As mentioned earlier, average battery life is taken into account when identifying the number of batteries available for recycling in a given year. However, these averages are estimates and some batteries may not enter the recycling stream during the estimated year (i.e., some after, some before). Thus, aggregating the data over a five-year period provides a more accurate picture of battery recycling activity in the U.S.

III. RECYCLING RATE WORKSHEET

The following pages contain the worksheet from which the recycling rate for the years 1997 - 2001 was calculated and footnotes listing sources from which relevant data were obtained.

BCI RECYCLING RATE: 1997 – 2001

AVERAGE BATTERY LIFE 1/	YEAR OF MFR. 2/	BATTERY TYPE AUTOMOTIVE: /9	DOMESTIC BATTERY SHIPMENTS	BATTERY EXPORTS - 3/	VEHICLE IMPORTS + 4/	VEHICLE EXPORTS - 5/	BATTERIES CONSUMED DOMESTICALLY = 6/	AVERAGE LEAD WEIGHT * 7/	LEAD IN BATTERIES CONSUMED DOMESTICALLY = 8/
4	'93 - '97	Pass Car & Light	350,733,090	2,284,184	20,441,058	4,921,800	363,968,164	21.4	7,804,170,056
3	'94 - '98	Truck & Heavy	37,160,633	20,015,601	3,383,011	1,550,291	18,977,752	37.3	707,638,885
3	'94 - '98	Tractor	2,942,949				2,942,949	32.7	96,300,442
3	'94 - '98	Marine	23,456,540				23,456,540	32.4	760,895,978
2	'95 - '99	General Utility	27,590,415				27,590,415	9.1	249,989,187
3	'94 - '98	Golf Cart	12,039,384				12,039,384	40.1	482,601,985
2	'95 - '99	Motorcycle	*****	3,108,562	1,553,406	502,798	*****	6.3	*****
2	'95 - '99	Aircraft	*****				*****	40.0	*****
6	'91 - '95	Military	*****				*****	41.9	*****
3	'94 - '98	Misc. & Others **10/**	*****				*****	25.0	*****
		TOTAL AUTOMOTIVE:					473,770,643	units	10,615,548,334
6	'91 - '95	**MOTIVE POWER: 11/**							994,506,169
10	'87 - '91	**STATIONARY: 12/**							495,963,888

TOTAL POUNDS OF LEAD IN BATTERIES CONSUMED DOMESTICALLY: 12,106,018,391 lbs.

LEAD RECYCLED FROM BATTERIES /13 : 10,539,951,476 lbs.

TOTAL LBS. LEAD IN BATTERIES CONSUMED DOMESTICALLY	BATTERY SCRAP LEAD IMPORTS + 14/	BATTERY SCRAP LEAD EXPORTS - 15/	BATTERY LEAD AVAILABLE IN U.S. FOR RECYCLING = 16/
12,106,018,391	+ 269,951,245	- 1,519,617,500	= **10,856,352,136 lbs.**

RECYCLING RATE 17/ = LEAD RECYCLED: 10,539,951,476 / LEAD AVAILABLE: = 10,856,352,136 = 97.1%

B. Footnotes

1/ Source: BCI Lead Content and Expected Life by Battery Type Survey (for automotive batteries). Collected for the years 1991 - 1999.

Note: The average life for industrial batteries was developed in consultation with industrial battery manufacturer experts.

2/ "Year of Manufacture" was computed by subtracting the average life of the battery from the year recycled.

3/ Source: Department of Commerce and adjusted for battery exports reported to BCI.

HTS # 8507.100030 (LEAD-ACID BATTERIES OF A KIND USED FOR STARTING PISTON ENGINES, NEW, 12 VOLTS, NOT EXCEEDING 6KG IN WEIGHT), 1995 - 1999 Export Data, Motorcycle Batteries
HTS # 8507.100050 (LEAD-ACID BATTERIES OF A KIND USED FOR STARTING PISTON ENGINES, NEW, 12 VOLTS), 1993 Export Data, Passenger Car Batteries
HTS # 8507.100060 (LEAD-ACID BATTERIES OF A KIND USED FOR STARTING PISTON ENGINES, NEW, 12 VOLTS, EXCEEDING 6KG IN WEIGHT), 1993 - 1997 Export Data, Passenger Car Batteries
HTS # 8507.100090 (LEAD-ACID BATTERIES OF A KIND USED FOR STARTING PISTON ENGINES, NEW, OTHER THAN 12 VOLT), 1994 - 1998 Export Data , Truck and Heavy Duty Commercial Batteries
HTS # 8507.200030 (LEAD ACID STORAGE BATTERIES, NEW, NESOI, 6 VOLTS), 1995 – 1999 Export Data, Motorcycle Batteries
HTS # 8507.200040 (LEAD ACID STORAGE BATTERIES, NESOI, NEW, 12 VOLTS), 1993 – 1997 Export Data, Passenger Car Batteries
HTS # 8507.200060 (LEAD ACID STORAGE BATTERIES, NEW, NESOI, 36 VOLTS), 1991 – 1995 Export Data, Motive Power Batteries estimated at 1800 pounds per battery

Note: Department of Commerce does not separate battery imports by product type.

4/ Source: Automotive Aftermarket Industry Association (1993 - 1997 data for Passenger Car Imports, 1994 - 1998 data for Truck and Bus Imports).

Source: Department of Commerce, 1995 - 1999 Import Data (for Motorcycle Imports).

HTS # 8711.100000 (MOTORCYCLES [INCL MOPEDS], PIST, ENG, CYL, NOT, EXC 50 CC)
HTS # 8711.200030 (MOTORCYCLES EXCEEDING 50 CC, NOT EXCEEDING 90 CC)
HTS # 8711.200060 (MOTORCYCLES EXCEEDING 90 CC, NOT EXCEEDING 190CC)
HTS # 8711.200090 (MOTORCYCLES EXCEEDING 190 CC, BUT NOT EXCEEDING 250)
HTS # 8711.300030 (MOTORCYCLES EXCEEDING 250 CC, BUT NOT EXCEEDING 290)
HTS # 8711.300060 (MOTORCYCLES EXCEEDING 290 CC, NOT EXCEEDING 490 CC)
HTS # 8711.300090 (MOTORCYCLES EXCEEDING 490 CC, NOT EXCEEDING 500 CC)
HTS # 8711.403000 (MOTORCYCLES EXCEEDING 500 CC, NOT EXCEEDING 700 CC)
HTS # 8711.406030 (MOTORCYCLES EXCEEDING 700 CC NOT EXCEEDING 790 CC)
HTS # 8711.406060 (MOTORCYCLES EXCEEDING 790 CC NOT EXCEEDING 800 CC)
HTS # 8711.500030 (MOTORCYCLES EXCEEDING 800 CC NOT EXCEEDING 970 CC)
HTS # 8711.500060 (MOTORCYCLES EXCEEDING 970 CC)
HTS # 8711.900000 (MOTORCYCLES [INCLUDING MOPEDS], NESOI)

B. Footnotes (continued)

5/ Source: Automotive Aftermarket Industry Association (1993 - 1997 data for Passenger Car Exports, 1994 - 1998 data for Truck and Bus Exports).

Source: Department of Commerce, 1995 - 1999 Export Data (for Motorcycle Exports).
HTS # 8711.100000 (MOTORCYCLES [INCL MOPEDS], PIST, ENG, CYL, NOT, EXC 50 CC)
HTS # 8711.200000 (MOTORCYCLES [INCL MOPEDS], CYCL, EXC 50 CC, NT 250 CC)
HTS # 8711.300000 (MOTORCYCLES [INCL MOPEDS], CYCL, EXC 250 CC, NT 500 CC)
HTS # 8711.400000 (MOTORCYCLES, CYCL, EXC 500, NT 800 CC)
HTS # 8711.500000 (MOTORCYCLES, CYCL, EXCD 800 CC)
HTS # 8711.900000 (MOTORCYCLES [INCL MOPEDS], NESOI)

Note: Vehicle imports/exports are included for those vehicles known to contain a battery when shipped.
Virtually 100% of cars and trucks contain a battery when they are imported/exported (otherwise they would be unable to move them)-per Ray Kubis, Johnson Controls Battery Group, Inc. (1989).
Most motorcycles contain a battery when imported/exported - per Motorcycle Industry Council (January 1991).
Generally, forklifts do not contain a battery when imported/exported - per Clyde Elium, East Penn Mfg. Co., Inc. (January 21, 1991).

6/ Batteries Consumed Domestically is found by taking domestic battery shipments, subtracting battery exports, adding vehicle imports and subtracting vehicle exports.

7/ Source: BCI Lead Content and Expected Life by Battery Type Survey (for automotive batteries). Collected for the years 1991 - 1999.

Prior to the 1994 recycling rate, the average lead weight of passenger car and light commercial batteries was developed in consultation with Delco-Remy, East Penn Manufacturing Company, Exide Corporation and Johnson Controls, Inc.

8/ Lead in Batteries Consumed Domestically is found by multiplying the Batteries Consumed Domestically (in units) by the Average Lead Weight for each product category.

The Lead Consumed in Motive Power and Stationary Batteries was collected in pounds and did not need to be converted from units.

9/ Source: BCI Monthly Shipment Report.

10/ Actual shipments of motorcycle, aircraft, military and all other batteries are confidential. However, the data has been included in the calculations.

Miscellaneous and All Other batteries generally include specialty automotive batteries; i.e., floor sweeping, trolley car and mine car batteries.

B. Footnotes (continued)

11/ Industrial Battery Manufacturer Survey, Motive Power Batteries. Collected for the years 1991 - 1995.
Participants:
Battery Builders, Inc.
Bulldog Battery Corporation
C&D Technologies, Inc.
Crown Battery Manufacturing Company
Douglas Battery Manufacturing Company
East Penn Manufacturing Company, Inc.
Industrial Battery Engineering
EnerSys, Inc.
GNB Industrial Power, Division of Exide Technologies
Hawker Powersource, Inc.
Pilot Batteries, Inc.
Powerflow System, Inc.
State Battery Company, Inc.
Trojan Battery Company

12/ Industrial Battery Manufacturer Survey, Standby (Stationary) Batteries. Collected for the years 1987 - 1991.
Participants:
Powercom Division - C&D Technologies, Inc.
Dynasty Division - C&D Technologies, Inc.
EnerSys, Inc.
GNB Industrial Power, Division of Exide Technologies
Hawker Energy Products, Inc.
State Battery Company, Inc.
Teledyne Battery Products

13/ Secondary Lead Smelter Survey. Collected for the years 1997 - 2001.
Participants:
The Doe Run Company
East Penn Manufacturing Company, Inc.
Exide Corporation
General Smelting & Refining
GNB, Division of Exide Corporation
Gopher Smelting & Refining Company
Gulf Coast Lead Company
Refined Metals Corporation
RSR Corporation
Sanders Lead Company

B. Footnotes (continued)

14/ Source: Department of Commerce, 1997 - 2001 Import Data.

HTS # 7802.000030	(LEAD WASTE AND SCRAP FROM LEAD-ACID BATTERIES)
HTS # 7802.000060	(LEAD WASTE AND SCRAP NOT FROM LEAD-ACID BATTERIES)
HTS # 8507.204000	(LEAD ACID STORAGE BATTERIES, USED, AS THE PRIMARY SOURCE OF ELECTRICAL POWER)
HTS # 8548.100540	(SPENT PRMRY CELLS & BATTRS, RECRY OF LED, LEAD-ACID)
HTS # 8548.100580	(OTH SPNT PRMRY CLLS & BTTRS, RECRY OF LD, OTH LD-ACD)
HTS # 8548.101500	(SPENT PRIMARY CELLS, PRIMARY BATTERIES AND ELETRIC STORAGE BATT, OTHER THAN RECOVERY LEAD)
HTS # 8548.102500	(WASTE & SCRAP OF PRIMARY CELLS, BATTERIES & ELECTRIC STORAGE BATT FOR RECOVERY LEAD, NESOI)
HTS # 8548.102540	(SPENT PRIMARY CELLS, PRIMARY BATTERIES AND ELETRIC STORAGE BATT; FOR RECOVERY OF LEAD)
HTS # 8548.102580	(OTHER SPENT PRIMARY CELLS, PRIMARY BATT. AND ELETRIC STORAGE BATT. FOR RECOVERY OF LEAD)
HTS # 8548.103500	(WASTE & SCRAP OF PRIMARY CELLS, PRIMARY BATTERIES & ELECTRIC STORAGE BATTERIES, NESOI)

15/ Source: Department of Commerce, 1997 - 2001 Export Data.

HTS # 7802.000030	(LEAD WASTE AND SCRAP FROM LEAD-ACID BATTERIES)
HTS # 7802.000060	(LEAD WASTE AND SCRAP OTHER THAN FROM LEAD-ACID BATTERIES)
HTS # 8548.100540	(SPENT LEAD-ACID STORAGE BATTERIES, OF A KIND USED FOR STARTING ENGINES)
HTS # 8548.100580	(SPENT PRIMARY BATTERIES & SPENT ELETRICAL STORAGE BATTERIES, NESOI, FOR RECOVERY OF LEAD)
HTS # 8548.101000	(WASTE AND SCRAP OF BATTERIES FOR RECOVERY OF LEAD)
HTS # 8548.101500	(SPENT PRIMARY CELLS, PRIMARY BATT. & ELECTRIC STORAGE BATT., NESOI, OTHER THAN RECOVERY LEAD)
HTS # 8548.102500	(WASTE & SCRAP OF PRIMARY CELLS, PRIMARY BATT. & ELECTRIC STORAGE BATT. FOR RECOV ERY OF LEAD)
HTS # 8548.103500	(WASTE & SCRAP OF PRIMARY CELLS, PRIMARY BATT. & ELECTRIC STORAGE BATT. OTHERTHAN RECOV ERY)

16/ Battery Lead Available in the U.S. for Recycling is found by taking the Total Pounds of Lead in Batteries Consumed Domestically, plus the Battery Scrap Lead Imports and subtracting the Battery Scrap Lead Exports.

17/ The Recycling Rate for the years 1997 - 2001 is found by dividing the total pounds of Lead Recycled from Batteries by the total pounds of Battery Lead Available in the U.S. for Recycling.