THE AVAILABILITY OF AUTOMOTIVE LEAD-BASED BATTERIES FOR RECYCLING IN THE EU





EUROBAT ACEA JAMA JAPAN AUTOMOBILE MANUFACTURERS ASSOCIATION, INC. kama 한국자동차산업협회 Korea Automobile Manufacturers Association ila International Lead Association

A joint industry analysis of EU collection and recycling rates 2010-2012, prepared by information company IHS


IHS *is the leading information company with comprehensive content, insight and expertise in key areas shaping today's global landscape. Business and governments around the world use our products, services and solutions to make faster and more confident decisions.*

IHS *has been providing comprehensive information and expert independent analysis and insight to customers for more than fifty years - enabling them to make critical business decisions with speed and confidence.*

IHS *Consulting leverages an unmatched combination of* **IHS** *information, insight and expertise to transform data into knowledge and to help our customers navigate their greatest strategic and operational challenges. Our intellectual capital is deep, with the most respected and engaged experts across the globe, focused on a multitude of industries. All built on an operating model that utilises over 1,800 consultants, researchers and economists to advance cross-disciplinary collaboration and analysis.*

EUROBAT, the Association of European Automotive and Industrial Battery Manufacturers, acts as a unified voice in promoting the interests of the European automotive, industrial and special battery industries of all battery chemistries. With over forty members comprising over 90% of the automotive and industrial battery industry in Europe, EUROBAT also works with stakeholders to help develop a vision of future battery solutions to issues of public interest in areas including e-Mobility and renewable energy storage

---

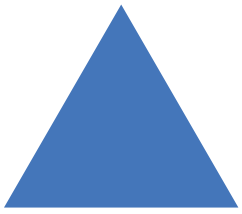
The European Automobile Manufacturers Association (ACEA), founded in 1991, represents the interests of the fifteen European car, truck and bus manufacturers at EU level. Its membership consists of the major international automobile companies, working together in an active association to ensure effective communication and negotiation with legislative, commercial, technical, consumer, environmental and other interests.

Japan Automobile Manufacturers Association (JAMA) is a non-profit industry association which comprises Japan's fourteen manufacturers of passenger cars, trucks, buses and motorcycles. JAMA works to support the sound development of Japan's automobile industry and to contribute to social and economic welfare.

Korea Automobile Manufacturers Association (KAMA) is a non-profit organization, representing the interests of automakers in Korea. KAMA is also dedicated to the sound growth of the automobile industry and the development of the national economy.

International Lead Association (ILA) is a membership body that supports companies involved in the mining, smelting, refining and recycling of lead. The ILA represents the producers of about three million tonnes of lead. ILA's work has a broad focus, covering all aspects of the industry's safe production, use and recycling of lead.

THE AVAILABILITY OF AUTOMOTIVE LEAD-BASED BATTERIES FOR RECYCLING IN THE EU



EUROBAT ACEA JAMA kama ila International Lead Association

Contents

Executive summary

The collection and recycling of automotive lead-based batteries is an efficient and cost-effective process that operates in a well-established infrastructure. The economics of lead battery recycling, where virtually all the materials are recovered and reused at the end of life in a straightforward production process, mean that very high rates of collection and recycling of lead-based batteries are realised.

THIS STUDY HAS ESTABLISHED THE COLLECTION AND RECYCLING RATE OF AUTOMOTIVE LEAD-BASED BATTERIES IN THE EU TO BE 99% OVER THE PERIOD 2010-2012.

2010/2012	IN THE EU
AUTOMOTIVE BATTERIES AVAILABLE FOR COLLECTION (TONNES)	1,110,730
AUTOMOTIVE BATTERIES COLLECTED (TONNES)	1,093,645
AUTOMOTIVE LEAD-BASED BATTERY COLLECTION AND RECYCLING RATE	**99%**

Average of 2010/2012

The results of this study prove that, with a recycling rate of 99%, automotive lead batteries are one of the few consumer products that already operate in a closed loop (i.e. where all used batteries are collected and the component parts are recycled ready for reuse). Previous studies have supported this assumption. However, until now, no robust analysis on the collection rate of automotive lead-based batteries in the EU has been carried out to confirm or deny it. We believe that these results will be used to inform a range of EU legislative discussions.

As part of the EU Batteries Directive, the European Commission calculates collection rates for portable batteries (there is no collection rate for automotive lead-based batteries) however, this methodology is inappropriate for automotive lead-based batteries. A new hypothesis has therefore been developed in this study in order to calculate an accurate figure for the collection and recycling rate of automotive lead-based batteries. This hypothesis has taken into account the longer life expectancy of automotive lead-based batteries and the fact that automotive batteries can be imported and exported within the EU. Extensive data has also been gathered from a range of sources including IHS/Polk parc data provided by consultants IHS/Polk, and from literature research, expert interviews and from EU national authorities and relevant industry associations, including EUROBAT, ILA, ACEA, JAMA and KAMA. Compared with 68% of aluminium soft drinks and beer cans[2], 72% of paper[3] and 70% of glass[4], achieving a rate of 99% makes lead-based batteries one of the most recycled consumer products in the EU.

We are confident that the methodology developed and adopted by the study, as well as its results, will make an important contribution to the debate and will facilitate the adoption of appropriate EU policies in the future.

[1] This means any battery or battery pack which is sealed, can be hand-carried by an average natural person without difficulty and is neither an automotive battery nor an industrial battery.

[2] European Aluminium Association 2013

[3] Confederation of European Paper Industries 2013

[4] European Container Glass Federation 2014

1 Previous recycling studies

The collection and recycling infrastructure associated with automotive lead batteries is often referred to as operating in a closed loop (i.e. where all used batteries are collected and the component parts are recycled ready for reuse). Previous studies on an EU level using various methodologies have supported this assumption. However, currently no robust analysis on an EU level has been undertaken to confirm this situation. This study aims to confirm or deny this assumption.

Previous studies in other countries have supported the assumption that the automotive lead-based battery industry is operating in a closed loop. For example, The National Recycling Rate Study[5], commissioned by Battery Council International, concluded that, for the years 2009-2013, the recycling rate of lead available from lead-based batteries in the United States is 99%.[6]

In the EU, as in the United States, it is likely that the industry also operates in a closed loop. In 2007 the Fraunhofer Institute reported a recycling rate of greater than 95%[7] for lead-based batteries. However, this report was based on German data, extrapolated to cover the whole of the EU. It could therefore be argued that no robust Europe-wide data and analysis exists to demonstrate that the industry works within a closed loop.

This research has therefore been conducted in order to provide conclusive analysis of the collection and recycling of used automotive lead-based batteries in the EU.

[5] National Recycling Rate Study, Battery Council International (2014)

[6] The national recycling rate was calculated by dividing the total pounds of battery lead recycled by the total pounds of battery lead available for recycling. The amount of lead available for recycling was based upon BCI surveys of battery manufacturers' average battery life, a battery becoming available at the expiration of its average operating life using, therefore, a methodology similar to the one developed in this report.

[7] *Nachhaltige rohstoffnahe Produktion*, Fraunhofer Institut für Chemische Technologie (2007)

2 Why robust data is needed

This study provides conclusive data on the recycling of lead batteries and will be used in a range of EU legislative discussions. It demonstrates that automotive lead-based batteries are one of the few products that already operate in a closed loop.

As explained in section 1, although it is widely acknowledged that the collection and recycling of automotive lead-based batteries operates, effectively, in a closed loop, there is no robust data that currently exists to prove the collection and recycling rate of lead-based batteries in the EU.

Moving towards a circular economy is at the heart of the resource efficiency agenda established under the Europe 2020 Strategy for smart, sustainable and inclusive growth. The European Commission has therefore been very active in promoting the use of sustainable materials and the importance of recycling. This report will help the lead battery and lead recycling industries highlight that automotive lead-based batteries are one of the few products that already operate in a closed loop.

The conclusions of this report will therefore be used in a range of legislative discussions and also to assist future research concerning not only the sustainability credentials of automotive lead-based batteries, but also the socio-economic benefits associated with their manufacture and use.

3 Overview of lead battery recycling

The collection and recycling of lead-based batteries is an efficient and cost-effective process that operates within an established infrastructure. The savings generated by automotive lead-based battery recycling, where virtually all the materials are recovered and reused in a straightforward production process, mean that there are very high rates of collection and recycling for lead-based automotive batteries.

3.1 HOW LEAD-BASED BATTERY RECYCLING WORKS

In the EU, used automotive lead-based batteries are typically returned to the point of sale, for example, vehicle workshops, vehicle dealerships, accessory shops, and DIY stores; or they are returned to recycling businesses or metal dealerships. In all cases they are then sent on to collection points. The batteries are picked up at collection points by specialised companies who transport and deliver the batteries to secondary smelting plants operating under strict environmental regulations.

Once the lead-based batteries arrive at a smelter for recycling, in general the battery is broken down into component parts, the majority of which can be recycled. The lead-acid battery is an excellent example of a product allowing an almost complete end-of-life recycling, with more than 93% of a lead-based battery available for recycling. The only component of the battery that cannot be recycled is the separators (these represent just 2% to 7% of the battery).

The components that can be recycled and re-used are as follows:

- The lead components (approximately 60% of the weight) are smelted and refined to be used to make new batteries.
- The battery casing, which is made of plastic (approximately 7% of the weight), is usually separated before the lead is recycled, depending on the method used, and is then reprocessed and re-used for batteries or for other products in the automobile industry, for example in bumpers, wheel arches and other parts.
- The spent electrolyte (diluted sulphuric acid, approximately 30% of the weight) is treated in a variety of ways. In some processes the spent electrolyte is separated and filtered to make it suitable for regenerating fresh acid for a variety

of applications. Other processes convert the spent electrolyte into calcium sulphate (gypsum) or sodium sulphate (soda), which can be used for various applications such as building products or detergents. Some processes neutralise the spent electrolyte and then dispose of it.

It is useful to note that even without the pressure from resource conservation and environmental protection, there is a significant incentive to collect and recycle used automotive lead-based batteries.

Recycling lead is relatively simple and cost effective and in most of the applications where lead is used, especially lead-based batteries, it is possible to recover it for use over and over again without any loss in quality. The lead-battery recycling process can be repeated indefinitely, meaning that new lead batteries are made with materials that have been recycled many times over. Furthermore, as all lead-based batteries have the same basic chemistry, this means that all types of lead battery can be processed easily by lead smelters. This is not the case with all automotive battery technologies[8] which are used for hybrid and electric vehicles and, owing to a range of factors such as the high recycling yield of lead batteries, the well-developed collection and recycling infrastructure and the intrinsic economic value of lead, we believe it is reasonable to assume that all batteries collected are recycled.

This means that the existing market for automotive lead-based batteries in the EU can be predominately met with recycled material and, because of this closed loop, the demand and requirement for primary lead reserves from mining is low. And even if the anticipated growth in demand for automotive batteries will need to be serviced by primary lead, this primary lead will itself then be available for recycling at end-of-life, and so will enter the closed-loop system.

[8] EUROBAT, ILA, ACEA, JAMA and KAMA, *A Review of Battery Technologies for Automotive Applications*, (2014)

4 Collection rate methodologies and approach of this report

As part of the EU Batteries Directive, the European Commission calculates collection rates for portable batteries, however, the methodology used is not appropriate for automotive batteries. A new hypothesis has therefore been developed in this study in order to calculate the collection and recycling rate of automotive lead-based batteries. This hypothesis has been created in order to take into account the long lifetime of automotive lead-based batteries and the fact that automotive lead-based batteries can be imported and exported within the EU.

4.1 CURRENT 'COLLECTION RATE' METHODOLOGY WITHIN THE BATTERIES DIRECTIVE

In the EU, within the EU Batteries Directive (2006/66/EC), a specific 'collection rate' formula is given for portable batteries; no collection rate is required for automotive lead-based batteries.

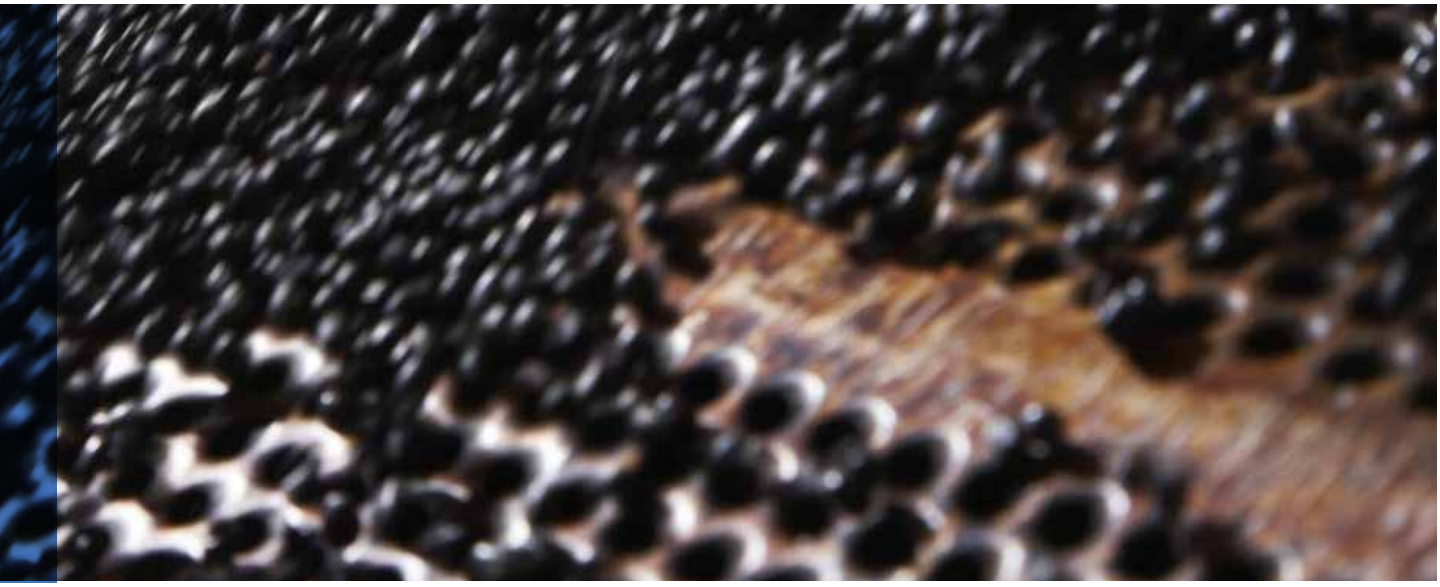
The collection rate is defined as: "The weight of batteries collected in the current year divided by the average of the sum of the weight of batteries placed on the market in the current and two preceding years. "In this context, batteries 'placed on the market' refers to the sales volumes of batteries that producers are obliged to report.

However, it is important to note that this methodology was set up for portable batteries and accumulators specifically; hence their use of an average of the three most recent years, corresponding to the lifecycle of portable batteries, which is around three years.

4.2 'COLLECTION RATE' METHODOLOGY CONCERNS

In effect, we believe that this 'collection rate' methodology is not suitable for automotive batteries, due to both their longer life expectancy and their greater potential to cross national borders within the EU. Using the collection-rate methodology for automotive batteries would produce less-than-reliable results.


BLS
BLS
UN 27 94
UN 27 94



This is because:

Automotive batteries have an average life expectancy of more than six years, significantly exceeding the three-year cycle considered in the formula for portable batteries in the Batteries Directive. Using a longer period for the denominator in the collection-rate formula ensures that any changes in new car registrations and in replacement battery sales occurring for economic or technological reasons are taken into account.

Batteries 'collected' can be placed on the market in one country and then collected at end-of-life in another country. This is due to automotive batteries often being exported/imported as part of a second-hand vehicle: for instance the rate of export of second-hand vehicles from Germany to Eastern European countries will impact the battery collection rate of the exporting as well as the importing countries. For the above reasons, we have chosen to implement a methodology that is better fitted to the specific characteristics of automotive batteries. This avoids the problems described above and leads to more robust results.

4.3 'AUTOMOTIVE LEAD-BASED BATTERY COLLECTION AND RECYCLING RATE' METHODOLOGY USED IN THIS REPORT

To address the concerns with the current collection-rate methodology described above, and to ensure an improved basis for establishing automotive lead-based battery collection rates, our tailored, more pertinent automotive lead-based battery collection and recycling rate methodology addresses both the number and weight of waste batteries that will be available for collection in a given year, taking advantage of two existing recognised data sources:

- Used automotive batteries recovered within the vehicle lifetime: Using IHS proprietary parc data by vehicle age, and then applying a formula for the battery's expected lifetime within the vehicle.

- Used automotive batteries recovered from end-of-life vehicles: Using EUROSTAT data on End-of-Life vehicles (ELV), by Member State where the battery is recovered during vehicle scrappage.

This gives a more accurate estimate of the quantity of used automotive lead-based batteries "available for collection and recycling" in the current year (units) by quantifying used batteries recovered within the vehicle's lifetime (i.e. batteries that come to the end of their life and are replaced in the vehicle) and used automotive batteries recovered from end-of-life vehicles (ELVs).

4.4 'AUTOMOTIVE LEAD-BASED BATTERY COLLECTION AND RECYCLING RATE' FORMULA

The automotive lead-based batteries available for collection and recycling in any one year can therefore be expressed as the sum of:

Batteries used in the current year on light vehicles[9] on the road, applying an appropriate life cycle for batteries to the volume and age of the actual light vehicle parc,

+

Batteries used in the current year on heavy vehicles[10] on the road, applying an appropriate life cycle for batteries to the volume and age of the actual heavy vehicle parc,

+

Batteries collected from end-of-life vehicles (ELV).
Using this methodology, each battery is tracked to the final place and time at which it becomes spent.[11]

Returning to our calculation, armed with units for each of our vehicle-size categories we can then apply an average weight of automotive battery for each size category, in order to arrive at a total annual automotive battery weight available for collection.

The automotive lead-based battery collection and recycling rate can then be calculated based upon the formula:

$$\frac{\text{Automotive battery weight collected in a given year (according to reports from national authorities)}}{\text{the estimate of the weight of automotive batteries available for collection in that year.}}$$

[9] 'Light Vehicles' are defined as vehicles of less than 3.5 tonnes.

[10] 'Heavy Vehicles' are vehicles of more than 3.5 tonnes.

[11] An interesting point to note is the fact that battery available for collection can also be defined as Year-N aftermarket (i.e. battery sold), plus Year-N battery removed from scrapped cars. In effect, batteries sold through the aftermarket are necessarily replacing an existing one, that is used, and is now ready for collection. Therefore, volumes of aftermarket sales country by country could help us to assess a credible number of batteries available for collection. Unfortunately, no robust data on volumes/types of aftermarket batteries sold per annum and by market are available for European countries.

5 Data gathering

This report has developed a new hypothesis to calculate the collection rate for automotive batteries. In order to calculate collection rates using this new hypothesis, extensive data has been gathered from a range of sources including: IHS/Polk parc data; literature research; expert interviews; EU national authorities; and, finally, from relevant industry associations. This allows the calculation of a more accurate figure for automotive lead-based battery collection and recycling rate by country and for the EU.

5.1 AUTOMOTIVE LEAD-BASED BATTERIES AVAILABLE FOR COLLECTION

To establish the number of automotive lead-based batteries available for collection, we applied battery replacement cycles and average weights to proprietary parc data provided by IHS/Polk.

IHS/Polk Car Parc gives a segmentation of the European vehicle parc in each EU member state for 15 years (our reference years were 2010, 2011 and 2012) split by age and by vehicle type. The parc is based upon a combination of effective or actual data sourced from official registers and ministries, complemented, where necessary, by calculated data based on new-registration data and official statistics.

IHS experts, using data from both industry and official sources, have developed accurate calculations of the automotive parc, individual scrappage rates and individual import/export flows. It is important to note that this approach is possible on a country-by-country basis.[12]

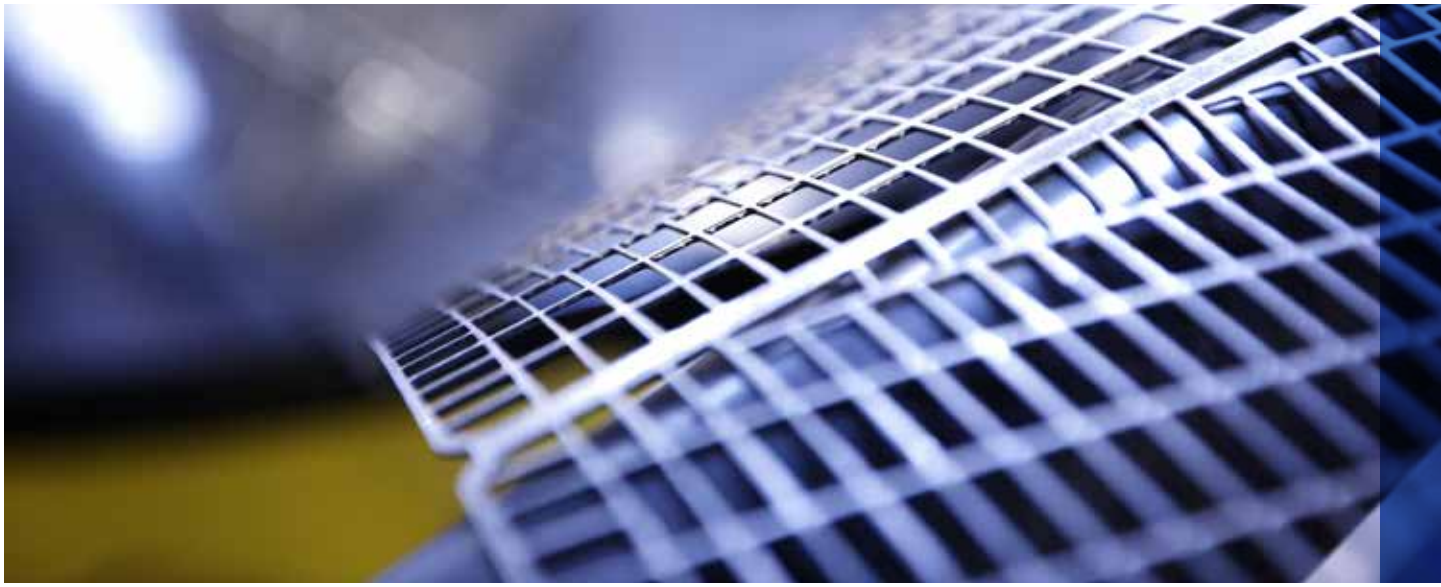
The main hypotheses used are:

1. **BATTERY REPLACEMENT CYCLE** - IHS researched, through industry literature and expert interviews, an average EU battery-replacement life cycle for Light Vehicles and Heavy Vehicles.

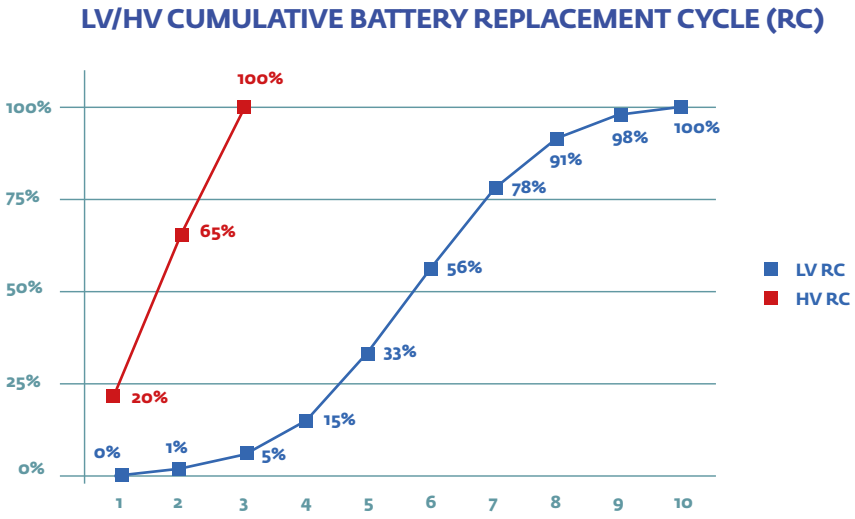
NB:

- **LV: *Light Vehicles*** *(vehicles of less than 3.5 tonnes) are split into Compact and Large, both having a similar battery life-cycle; the advantage of using this segmentation is to reflect a different average weight of batteries for these two groups.*

[12] NB: With the exception of Malta and Cyprus.



- **HV:** ***Heavy Vehicle*** *batteries, (vehicles of more than 3.5 tonnes) have a shorter battery life-cycle due to their higher utilisation and annual average mileage and their higher energy requirements caused by their greater weight and usage.*



LV and HV battery replacement cycle

Key points to note are:

- **Light Vehicle**s' replacement cycle
  1. Minimal battery replacement after three years
  2. More than 50% of batteries replaced by the sixth year
  3. 100% of batteries replaced whitin ten years

- **Heavy Vehicle**s' replacement cycle
  1. 20% of batteries replaced whitin the first year
  2. 65% of batteries replaced whitin the second year
  3. 100% of batteries replaced whitin three years

2. **AVERAGE WEIGHT OF AUTOMOTIVE BATTERY** - For this study, we used three vehicle-size categories (Compact Light, Large Light and Heavy), and applied for each of them an average weight of battery based on industry intelligence and expert inputs.

Having a model-based analysis gave the advantage of a more accurate estimate of the weight of batteries through the use of an average weight for the three representative segments of vehicles (see below).

The hypothesis used regarding battery use and weight is:

	COMPACT LIGHT VEHICLES	LARGE LIGHT VEHICLES	HEAVY VEHICLES
Average number of batteries by vehicle (units)	1	1	1,7
Average battery weight (Kg)	15	22,5	45

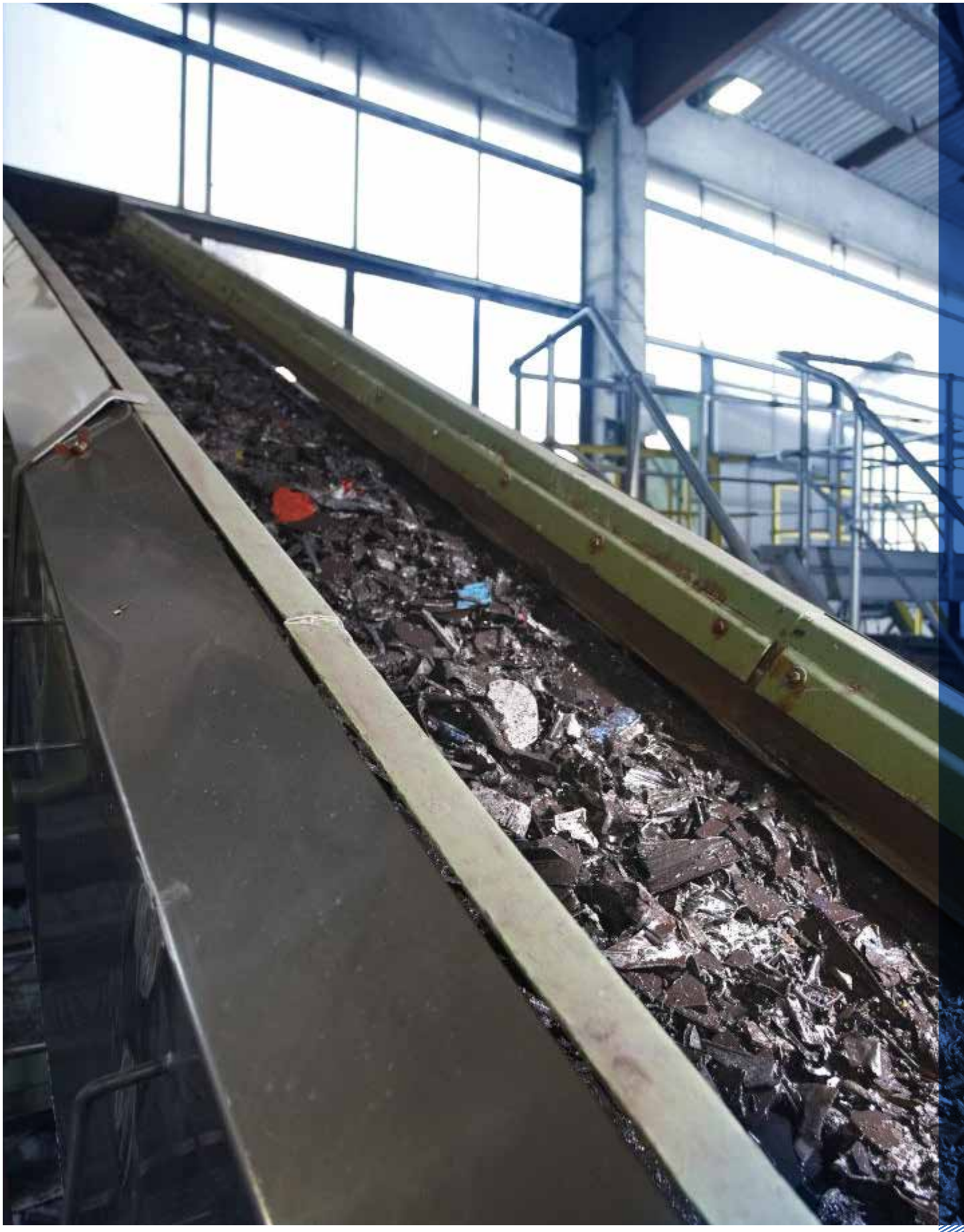
Here, it is important to note than Heavy Vehicles usually use more that one battery for their starter, lighting or ignition power requirements.

5.2 AUTOMOTIVE BATTERIES COLLECTED

To establish the number of automotive batteries collected, we used data provided by official, national authorities and by third-parties responsible for used-battery collection for the countries investigated.

In particular, the following organisations have been contacted:

COUNTRY	NATIONAL AUTHORITIES AND THIRD PARTIES RESPONSIBLE FOR USED BATTERY COLLECTION
France	ADEME, Environment and Energy Management Agency
Germany	UBA, Environmental Protection Agency
Italy	ISPRA, Institute for Environmental Protection and Research
Netherlands	ILT, Human Environment and Transport Inspectorate
Spain	SIGRAUTO, Association for the Environmental Treatment of End-of-Life Vehicles
Sweden	Environmental Protection Agency
United Kingdom	NPWD, National Packaging Waste Database



6 Results

Using the new methodology we can report an automotive lead-based battery collection and recycling rate for the EU over the period 2010/2012.

6.1 EU AUTOMOTIVE LEAD-BASED BATTERY COLLECTION AND RECYCLING RATE OVERVIEW

2010 - 2012	EU
Light vehicles	254,819,906
Batteries available for collection (Units)	54,099,093
Batteries available for collection (Tonnes)	945,123
Heavy vehicles	6,494,415
Batteries available for collection (Units)	3,680,168
Batteries available for collection (Tonnes)	165,608
Total Batteries available for collection (Units)	57,779,261
Total Batteries available for collection (Tonnes)	1,110,730
Automotive batteries collected (Tonnes)	1,145,043
Other applications / Misclassification	36,529
Automotive lead-based battery collection and recycling rate	**99%**

Key finding from the study

The EU automotive lead-based battery collection and recycling rate for the period 2010/2012 is 99%

1. **2010/2012 period** - The economics of lead-based battery recycling can be sensitive to the lead market price, which can fluctuate from year to year. Experts have raised concerns that possible temporary stocking of batteries could affect the yearly figure for batteries collected. This involves smelters temporarily storing lead-based batteries so as to ensure that they obtain the best possible price for their recycled lead. Consequently, it is appropriate to look at the data not on a year-on-year basis but over a longer period in order to mitigate the impact of battery hoarding from year to year. For this reason we have averaged annual results over three years.

2. **Light vehicles** - In order to make the results clearer, we have combined the volumes of Compact Light vehicles and Large Light vehicles into a single category 'Light vehicles'. As such, Light Vehicles are defined as vehicles of less than 3.5 tonnes; Heavy Vehicles are vehicles of more than 3.5 tonnes.

3. **Automotive lead-based batteries collected** - For each Member State, the estimated total weight of lead-based batteries available for collection was compared with data from national authorities on the weight of automotive batteries actually collected. Please note that the total weight of lead-based batteries includes all components (i.e. lead components, plastics and electrolyte).

4. **Other applications / Misclassification** - We have incorporated a 4.5% tolerance value, based on feedback from a survey of the EUROBAT and ILA membership, to account for other applications (lead-based batteries for motorcycles; lead-based batteries for marine, garden equipment and other applications; small industrial batteries) and misclassifications.

- **Lead-based batteries for motorcycles**: According to statistics from ACEM (the European Motorcycle Industry Association), there are approximately 66,000,000 motorcycles on European roads. Assuming that 20% of these will require battery replacement in a given year, we can conclude that more than 13,200,000 batteries are ready for collection each year. Here, with the assumption of an average weight of 4.5kg for motorcycle batteries, we can say that around 60,000 tonnes are available for collection each year.

- **Marine, garden equipment and other applications**: EUROBAT members and experts assume an average market share of 1% to 1.5% for this segment. Assuming a life expectancy of one year, and a comparable weight of 15kg, similar to that of automotive batteries, this results in an estimate of around 10,000 tonnes available for collection each year.

- **Small industrial batteries**: EUROBAT industrial battery statistics quantify that 2,133,000 standby batteries, with a capacity lower than 24Ah, were sold by its members in EU-28 Member States in 2013. These are all of similar size and dimensions to automotive batteries. For instance, batteries used for back-up applications such as in hospitals and telecommunications can be misclassified as other battery types when collected, due to their similar dimensions and packaging. In addition, there are several sizes of motive power battery which could be misclassified, although this is more difficult to isolate. No reliable data on the number of batteries available for collection in this segment is available so we have taken the sales figure as a best indicator. Assuming a comparable weight of 15kg, similar to automotive batteries, this results in an estimate of around 32,000 tonnes available for collection each year.

As all of these batteries are frequently misclassified, we have assumed that 50% actually end up in the collection stream for automotive batteries. We therefore arrive at the tolerance value of 4.5% for the three battery applications, listed above, which equates to around 50,000 tonnes.

It is important to note that very few automotive batteries are counted within industrial battery collection rates due to the specific automotive collection systems used.

5. **Automotive lead-based battery collection and recycling rate**: This study has established the collection and recycling rate of automotive lead-based batteries in the EU to be 99%. We believe the remaining 1% represents the statistical error of our approach and/or movement of stored batteries and batteries with longer lifetimes than estimated in this study rather than batteries being landfilled or incinerated.

6.2 EU AUTOMOTIVE LEAD-BASED BATTERY COLLECTION AND RECYCLING RATE BUILD-UP

2010 - 2012	SEVEN COUNTRIES	REST OF EU	EU
Light vehicles	186,352,145	68,467,760	254,819,906
Batteries available for collection (Units)	38,068,602	16,030,491	54,099,093
Batteries available for collection (Tonnes)	662,144	282,978	945,123
Heavy vehicles	3,896,683	2,597,732	6,494,415
Batteries available for collection (Unit)	2,208,120	1,472,048	3,680,168
Batteries available for collection (Tonnes)	99,365	66,242	165,608
Total Batteries available for collection (Unit)	40,276,722	17,502,539	57,779,261
Total Batteries available for collection (Tonnes)	761,510	349,221	1,110,730
Automotive batteries collected (Tonnes)	813,786	331,760	1,145,043
Other applications / Misclassification	36,529	14,892	51,398
Automotive lead-based battery collection and recycling rate	**102%**	**91%**	**99%**

1. **Seven countries** - The seven countries analysed individually are France, Germany, Italy, Netherlands, Spain, Sweden, and United Kingdom.

In order to arrive at the most accurate and cost effective EU data we decided on a bottom-up approach, working at member-state level for seven key markets. These seven markets represented a significant majority of the EU parc and had data availability on collected automotive batteries. They represent approximately 75% of the European market.

2. **Rest of EU** - These consist of the remaining EU countries analysed as a group (i.e. Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, Greece, Hungary, Ireland, Latvia, Lithuania, Luxembourg, Poland, Portugal, Romania, Slovakia, and Slovenia).

Cyprus and Malta are not taken into account due to the absence of a parc analysis.

3. **Automotive lead-based battery collection and recycling rate** - Data and feedback from the recycling industry suggest that there can be import and export of automotive batteries across Member State borders: it is reasonable to assume therefore that those countries with the majority of EU recycling resources will "import" used automotive batteries from other EU states.

In our research, those countries with multiple recycling facilities, and particularly those whose neighbouring countries have no recycling facilities (e.g. France and Germany), have higher automotive lead-based battery collection and recycling rates than expected, exceeding 100%. This suggests that there is a transfer of automotive batteries across Member State borders which is, in some instances. Although this does not affect our EU-level calculations, it does explain some of the variance in the automotive lead-based battery collection and recycling rates at Member State level. So, when looking at the rest of EU, we can assume that the group of seven countries we have focused on, which has the majority of EU recycling facilities, is likely to be collecting some of the batteries available for collection from the Rest-of-EU countries. Therefore it can be expected that collection rates in these seven countries will be boosted by batteries coming from the rest of the EU countries, and that the Rest-of-EU of countries will have a lower rate as a consequence.

7 Conclusion

In the absence of robust studies reporting the collection and recycling of automotive lead-based batteries in the EU, this study has focused on establishing an EU collection rate for these automotive batteries. More specifically it has sought to establish an appropriate methodology for calculating automotive lead-based batteries collection rates at an EU level and has applied this methodology to produce actual collection rates.

The study is based on the concept of an "automotive lead-based battery collection and recycling rate". It uses proprietary IHS/Polk parc data; vehicle end-of-life data from EUROSTAT; literature research; primary research through expert interviews, including those with representatives from the national authorities and sponsor associations EUROBAT, ILA, ACEA, JAMA and KAMA; and interviews with experts from the collection and recycling industry. This study has concluded that 99% of automotive lead-based batteries are collected and recycled in the EU.

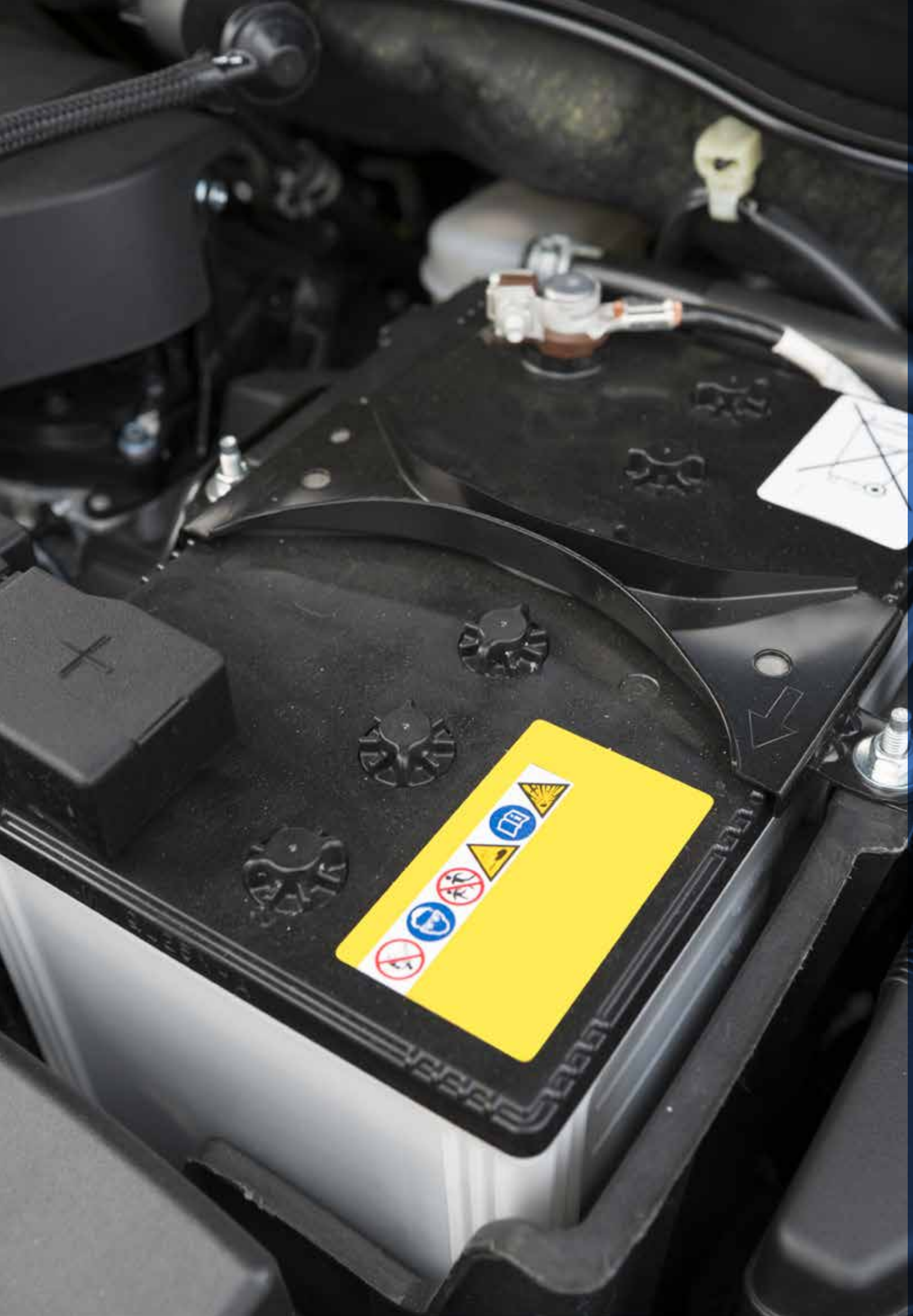
Compared with 68% of aluminium soft drinks and beer cans[15], 72% of paper[16] and 70% of glass[17], achieving a rate of 99% makes lead-based batteries one of the most recycled consumer products in the EU.

We are confident that the methodology developed and adopted by the study, as well as the study results, make an important contribution to the debate and that they will facilitate the adoption of appropriate EU policies in the future.

[15] European Aluminium Association 2013

[16] Confederation of European Paper Industries 2013

[17] European Container Glass Federation 2014



Points of contact

EUROBAT
Rene Schroeder
EU Affairs Manager
rschroeder@eurobat.org
+32 2 761 16 53

ILA
Dr Alistair Davidson
Technical Manager
davidson@ila-lead.org
+44 20 7833 8090

Bob Tolliday
Communications Manager
tolliday@ila-lead.org
+44 20 7833 8090

ACEA
Environmental Policy Director
Dr Tobias Bahr
tb@acea.be
+32 2 732 55 50

IHS
Dick Buttigieg
VP Consulting
Dick.Buttigieg@ihs.com
+44 20 3159 3457

Martin Seban
Senior Consultant
Martin.Seban@ihs.com
+33 1 76 76 3082

EUROBAT

ACEA

JAMA

kama

ila
International
Lead Association

This document provides a joint industry analysis of the current collection and recycling rate of lead-based batteries in automotive applications. The report proves that lead-based batteries are one of the few consumer products that already operates in a closed loop with a recycling rate of 99%.

The report focuses on seven key countries (France, Germany, Italy, Netherlands, Spain, Sweden, and United Kingdom) and establishes a methodology based on proprietary IHS/Polk parc data; vehicle end- of- life data from EUROSTAT; literature research; primary research through expert interviews, including those with representatives from the national authorities and sponsor associations, EUROBAT, ILA, ACEA, JAMA and KAMA.

EUROBAT ACEA JAMA kama ila International Lead Association

THE AVAILABILITY OF AUTOMOTIVE LEAD-BASED BATTERIES FOR RECYCLING IN THE EU

graphic & book design ALIAS2K.COM