# Waste Stream

## Name

Used lead-acid batteries (ULABs). ([[1]](#endnote-2))

## Waste description

ULABs are a well-defined type of hazardous waste and there is detailed knowledge about their composition. Batteries used in cars typically weigh between 10 kg and 30 kg, while those used in trucks can weigh up to 70 kg. Moreover, they may be used as traction batteries for electric vehicles and for industrial purposes. The electrolyte—a dilute solution of sulfuric acid—content is about 15–25 wt% and the lead content is about 65–75 wt%. The lead is in the form of plates (grids and paste) of pure lead or lead alloys covered with a layer of lead oxide and lead sulfate. In conventional batteries, there is a constant wear of the plates (during normal operation) which causes a sediment or “mud” to build-up in the bottom of the case ([[2]](#endnote-3)).

## Information on waste / non-waste classification

National provisions concerning the definition of waste may differ and, therefore, the same material may be regarded as waste in one country but as non-waste in another country. Determining whether a substance or object is or not a waste may not always be straightforward; however, it is ultimately the mandate of the national competent authority on waste to decide when an item is to be defined as waste or non-waste. Further work on clarifying this matter under the Basel Convention is in progress ([[3]](#endnote-4)).

The European Union Network for the Implementation and Enforcement of Environmental Law (IMPEL) recommends that where the holder of lead acid batteries claims that the batteries are second-hand goods (i.e. not classified as waste), he should be able to provide the following evidence to back up his claim: (a) a copy of the invoice and contract relating to the sale and/or transfer of ownership of the batteries which states that the goods are for direct re-use and fully functional; (b) evidence of evaluation/testing in the form of a copy of the records on every item; (c) a declaration made by the owner that none of the batteries are waste; (d) the batteries should be properly packed to protect them during transport; (e) regulations concerning the international carriage of dangerous goods must be complied with. Also, the batteries must be in good condition and functional, which means that all caps are in place, the batteries are free of cracks and show no signs of leakage, the batteries are not too old (normal lifetime is about five years), and the terminals are protected with plastic lids during transport. ([[4]](#endnote-5))

## Classification under the Basel Convention (Annexes I, II, III, VIII and/or IX)

ULABs belong to category Y31­—lead; lead compounds—in Annex I, and are further classified as A1160 in Annex VIII—waste lead-acid batteries, whole or crushed. Drained sulfuric acid electrolyte should be classified under the Y34 category, “acidic solutions or acids in solid form”; used lead-acid batteries can also be classified as Y34 if the acid was not drained. Used lead-acid batteries are likely to possess hazard characteristics H6.1, H8, H11, H12 and H13 in Annex III. The primary immediate hazard from battery electrolyte is corrosivity (H8).

## Basel Convention guidelines and other guidelines/instruments

General:

* SBC Technical Guidelines for the Environmentally Sound Management of Waste Lead-Acid Batteries (2003) – Available at http://www.basel.int/Implementation/TechnicalMatters/DevelopmentofTechnicalGuidelines/AdoptedTechnicalGuidelines/tabid/2376/Default.aspx
* SBC Training Manual for the Preparation of National Used Lead Acid Batteries Environmentally Sound Management Plans in the Context of the Implementation of the Basel Convention (2004) – Available at http://www.basel.int/TheConvention/Publications/TrainingManuals/tabid/2363/Default.aspx
* Commission for Environmental Cooperation (CEC) Practices and Options for Environmentally Sound Management of Spent Lead-acid Batteries within North America (2007) – Available at http://www3.cec.org/islandora/en/item/2323-practices-and-options-environmentally-sound-management-spent-lead-acid-batteries

Secondary lead smelting:

* SBC Technical Guidelines on the Environmentally Sound Recycling/Reclamation of Metals and Metal Compounds (R4) (2004) – Available at http://www.basel.int/Implementation/TechnicalMatters/DevelopmentofTechnicalGuidelines/AdoptedTechnicalGuidelines/tabid/2376/Default.aspx
* UNEP Guidelines on Best Available Techniques and Provisional Guidance on Best Environmental Practices Relevant to Article 5 and Annex C of the Stockholm Convention on Persistent Organic Pollutants: Thermal Processes in the Metallurgical Industry not Mentioned in Annex C, Part II (2008) – Available at http://chm.pops.int/Implementation/BATBEP/BATBEPGuidelinesArticle5/tabid/187/Default.aspx
* European IPPC Bureau Reference Document on Best Available Techniques for the Waste Treatments Industries (2006) – Available at http://eippcb.jrc.ec.europa.eu/reference/ (currently under review)
* European IPPC Bureau Reference Document on Best Available Techniques for the Non-ferrous Metals Industries, Final Draft (2014) – Available at http://eippcb.jrc.ec.europa.eu/reference/

# Waste Management

## General handling

Appropriate personal protective equipment (PPE), including chemical goggles, acid-resistant apron, and rubber or plastic acid-resistant gloves, should be worn and Materials Safety Data Sheet (MSDS) should be readily available to all workers who seek additional information about potential hazards and the appropriate corrective action in the event of an accident.

ULABs must be stacked in an upright orientation with all the vent and inspection caps firmly in place so that acid is not spilled.

ULABs should be stored, handled and transported in accordance with national hazardous waste, dangerous goods and workplace health and safety legislation. Where there is no adequate legislation, the Basel Convention Technical Guidelines should be consulted.

## Collection

* Simplified reverse-distribution system (reverse logistics): ULABs are returned by consumers to retailers, where they are stored until transported to the waste facility. It is better suited to circumstances where the facility is relatively close to the collection points.
* Collectors’ system: This system relies on the premise that retailers, after the collection of ULABs, will use a specialised collectors’ network that will deliver the ULABs to the waste management facility. Different from the simplified reverse-distribution system, the role played by the collectors ensures that the transportation costs will not be absorbed completely by the retailers. Due to the higher number of operators in this system, its implementation allows for a wider geographic area to be served.
* Manufacturer-supported return system: The manufacturers are responsible for planning and implementing the logistics of returning the ULABs so that they can be delivered to the waste management facility or returned to the manufacturer. The collectors and those responsible for the transportation are linked to the manufacturers. Thus, despite the fact that the manufacturers are not directly involved with the collection and transportation of the ULABs, it remains their responsibility to provide the necessary means to accomplish these steps in a manner consistent with environmentally sound management.
* Reverse-distribution system: ULABs are returned by consumers to retailers, picked up by wholesalers or battery manufacturers (when delivering new batteries), and finally taken to a secondary lead smelter for recycling.

## Storage

Storage of ULABs at collection points should only be regarded as an interim measure, in order to permit time for the collection of sufficient volumes of ULABs for cost effective transportation to the recycling facility. Collection points should not store large amounts of ULABs or for a long time, as this increases the risk of accidental spills or leakage of electrolyte and should be avoided. It is recommended that collection points storing ULABs for a period greater than 180 days or in quantities greater than 1000 kg should be licensed and regulated as hazardous waste storage facilities.

Batteries should not be drained of electrolyte at collection points. Battery draining is a potentially hazardous activity that demands, not only special tools, containers and safety equipment, but also trained personnel (and in most instances an effluent treatment plant). Since these requirements may often be lacking, which increases the risk of an accident dramatically, the drainage at collection points should be avoided. Processing ULABs for recovery by draining the electrolyte should be considered an activity that requires a hazardous waste disposal permit.

ULABs should be ideally stored inside acid-resistant containers that may also be sealed and used as the transport container, to minimize the risk of accidental spillage. However, if this is not the case, undamaged batteries should be placed on a wooden or plastic pallet and care should be taken to prevent the terminals from short-circuiting as described below under “packaging and labelling”.

The following measures should be adopted: (a) the storage area should be sheltered from rain and other water sources, be equipped with an effluent collection system or sump to capture any spillage of electrolyte, and be located away from heat sources; (b) the storage area should have an impermeable surface with a curb or berm to control spills; (c) the storage place should have an exhaust ventilation system, or a fast air recirculation system, in order to avoid hazardous gas accumulation; (d) the storage area should have restricted access and be identified as a hazardous waste storage site.

ULAB collectors should ensure that they sell or send their batteries to facilities that are properly licensed, are in full compliance with regulatory requirements and have an environmental management system (EMS) in place.

## Packaging and labelling

Batteries should be stacked not more than 3 layers high on pallets in good condition and of heavy duty construction—hardwood or plastic pallets are preferred. To ensure the safe transport of ULABs, batteries should be of similar size by layer with largest and heaviest on the bottom layer; lower height batteries can be stacked in the inner rows on each layer. Battery terminals should be oriented in such a manner as to prevent short circuits. A piece of electrical tape can be placed over each terminal to avoid terminal contact.

Large (sealed) used standby power batteries should only be stacked up to a maximum of 2 layers. Forklift battery cells and large flooded standby power should not be stacked higher than one layer. It is recommended that pallet weights should not exceed 1500 kg ([[5]](#endnote-6)).

To prevent the batteries from sliding off, a layer of cardboard should be placed on the pallet before stacking the first layer of ULABs. To minimise the potential for short circuit and to prevent protruding battery terminals from one layer puncturing the bottom of battery cases in the layer above (and causing the leakage of electrolyte), a layer of thick corrugated cardboard should be placed between each layer of ULABs, as well as on the top layer. The use of thick cardboard is preferable to particleboard or fibreboard because small spills can be absorbed and are visible. The ULABs should be secured to the pallet, to prevent them from falling off, with clear stretch wrap. The pallet should be wrapped as many times as necessary to stabilize the load, and strapped under tension with plastic tape.

ULABs that are damaged and have the potential for leakage should either be transported in salvage drums/packaging, or repaired and/or packaged in such a manner that leakage of electrolyte is not likely to occur under conditions normally incident to transportation; drainage of electrolyte as a mean to eliminate the potential for leakage during transportation should be avoided. Damaged ULABs that are free of electrolyte (not visibly leaking when offered for transportation) may be placed in securely closed heavy-duty polyethylene bag and placed onto a pallet with undamaged ULABs.

Pallets and containers should be identified with labels marked “Corrosive” using the appropriate symbol, the relevant United Nations number and proper shipping name: UN2794, battery, wet, filled with acid; or UN2800, battery, wet, non-spillable. Electrolyte that has leaked from a damaged ULAB must be classed, packaged and described as appropriate for the liquid: UN2796, battery fluid, acid.

## Transportation

Transport of ULABs should conform to national legislation on the transport of dangerous or hazardous goods; where there are no such regulations, responsible authorities should refer to the latest revised edition of the United Nations Recommendations on the Transport of Dangerous Goods, Model Regulations ([[6]](#endnote-7)).

ULABs should be handled with appropriate care when being transported. The main risk associated with battery transport is the electrolyte, which may leak from the batteries, even if appropriately transported in an upright position. Only qualified, authorized and licensed transport companies should be used; the transporter must make certain that the batteries are loaded so as to prevent movement, damage (to the vehicle or ULABs), leakage, or short circuits during transit.

Transport vehicles should be properly marked with placards identifying the fact that corrosive and hazardous products are being transported. PPE should be provided for the transport personnel, who should be trained in its emergency use. Transport vehicles should be outfitted with the equipment necessary to neutralize any simple electrolyte spillage or leakage problems (for example, acid neutralizer or absorbent, nitrile gloves, polyethylene apron, shoe covers, safety goggles, scoops, disposal bags and ties, and labels), and the transport personnel trained on how to use it. All releases should be immediately contained.

Hazardous waste manifests or consignment notes must accompany each shipment of ULABs in accordance with national laws, until it reaches its final destination. On completion of a shipment, the receiving facility returns a signed copy of the manifest to the generator, confirming that the waste has been received by the designated facility. If the waste regulatory authority is sufficiently well established, it may be possible to pre-notify the agency about a planned offsite transport and disposal of hazardous healthcare waste and to obtain the agency’s approval.

Emergency response information—Emergency Response Intervention Cards (ERICards) ([[7]](#endnote-8)), Emergency Response Guides ([[8]](#endnote-9))—should accompany shipments of hazardous waste to provide guidance on initial actions in response to a transport accident.

# Disposal Operations (Annex IV, Sections A and B)

## Best available techniques (BAT) and best environmental practices (BEP)

Facilities that handle ULABs should meet all basic requirements to ensure the environmentally sound management (ESM) of wastes and commit to continual improvement in their operations. A facility should have the following, which should meet the approval of the relevant authorities: (a) appropriate design and location; (b) an environmental and social impact assessment, where appropriate; (c) sufficient measures in place to safeguard occupational health and safety, including an appropriate and adequate training programme for its personnel; (d) sufficient measures in place to protect the environment; (e) an applicable EMS in place, if feasible and appropriate; (f) an adequate and transparent monitoring, recording, reporting and evaluation programme; (g) an adequate emergency plan and response mechanism; (h) an adequate plan for closure and aftercare. ([[9]](#endnote-10))

ULABs are the main source of feedstock for secondary lead production. Under the Basel Convention this constitutes an operation “which may lead to resource recovery, recycling, reclamation, direct reuse or alternative uses” under categories R3 (“recycling/reclamation of organic substances which are not used as solvents”), R4 (“recycling/reclamation of metals and metal compounds”) and R5 (“recycling/reclamation of other inorganic materials”) of part B of Annex IV. Secondary lead operations include scrap pre-treatment (battery breaking, crushing, and sweating), smelting and refining. For countries with no secondary smelters, there is no way to avoid exporting ULABs for ESM.

In order to prevent or reduce diffuse emissions from battery crushing, screening and classifying operations, BAT is to use enclosed equipment with a gas extraction system; to reduce dust emissions BAT is to use a bag filter or wet scrubber. To prevent the contamination of the soil and groundwater from battery storage and preparation, BAT is to use acid-resistant flooring with a spill collection system to reduce the risk of leakage into the environment. In order to reuse or recover the sulfuric acid collected from the battery recovery process, depending on the local conditions and of the impurities present in the acid, BAT is to use one or a combination of the following techniques: pickling agent; as raw material in a chemical plant; regeneration of the acid by cracking; production of gypsum; and/or production of sodium sulphate.

Processes considered as BAT for the prevention or minimization of the formation and subsequent release of unintentional POPs include (1) the blast furnace (with good process control), (2) the ISASMELT/Ausmelt furnace, (3) the top-blown rotary furnace, (4) the electric furnace and (5) the rotary furnace ([[10]](#endnote-11)). Possible measures to reduce or eliminate the generation and release of unintentional POPs include: (1) battery breaking prior to charging into the furnace and the removal of plastics and other non-leaded materials (whole battery feed or incomplete separation should be avoided); and (2) the use of process control systems to maintain process stability and operate at parameter levels that will contribute to the minimization of PCDD/PCDF generation (in the absence of continuous PCDD/PCDF monitoring, other variables such as temperature, residence time, gas components and fume collection damper controls should be continuously monitored and maintained to establish optimum operating conditions for the reduction of PCDD/PCDF). Other measures that may assist in controlling emissions of unintentional POPs include: (1) implementation of fume and off-gas collection in all stages of the smelting process—BAT for gas and fume treatment systems are those that include cooling with heat recovery if practical before cleaning—; (2) removal of dusts and metal compounds generated from the smelting process using high-efficiency dust removal system; (3) use of afterburners at temperatures over 950°C followed by rapid quenching of hot gases to temperatures below 250°C; and (4) use of activated carbon treatment for PCDD/PCDF removal from smelter off-gases. PCDD/PCDF performance levels associated with BAT for secondary lead smelters are below 0.1 ng I-TEQ/Nm3 (at operating oxygen concentrations) ([[11]](#endnote-12)).

# Sustainable Materials Management (SMM)

## Extended Producer Responsibility (EPR)

* European Union: Under Directive 2006/66/EC Member States are required to ensure that producers, or third parties, set up schemes to collect automotive batteries from end-users or from an accessible collection point in their vicinity, where collection is not carried out as part of an end-of-life vehicle programme. Furthermore, where the batteries have originated from private, non-commercial vehicles, the schemes may not involve any charge to end-users when discarding ULABs, nor any obligation to buy a new battery. Member States are also required to ensure that producers of industrial batteries, or third parties, do not refuse to take back used industrial batteries from end-users, regardless of chemical composition and origin.
* United States: Lead-acid batteries are subject to mandatory deposit systems in several states— Arizona, Arkansas, Connecticut, Idaho, Maine, Minnesota, New York, South Carolina and Washington—and voluntary deposit systems in most other areas. Many of the states have used model legislation developed by the Battery Council International (BCI), which recommends that retailers charge a US$10 fee (deposit) on all batteries sold, with the fee waived or returned if the customer brings back a used battery within 30–45 days of purchase.
* Canada: The “lead-acid battery product category” is managed in British Columbia in accordance with the stewardship plans approved under the Recycling Regulation. Province-wide lead-acid battery Stewardship Plans have been developed by the Canadian Battery Association ([[12]](#endnote-13)) (CBA) and Interstate Battery System of Canada[[13]](#endnote-14) (IBSC). All costs are borne by CBA and IBSC, and ULABs are accepted for free at participating retailers. To compete with independent recyclers CBA members may implement a business-to-business programme (at the wholesale level) involving a core charge (deposit) to encourage the return of ULABs from the retailer to the manufacturer. Typically these core charges are CAD$10 per automotive battery with greater amounts for larger sizes.

## Financing systems

* Deposit/Refund Schemes: ULAB recovery can be incentivised with collection schemes based on a financial incentive, such as a refundable levy on new lead acid batteries, which is repaid to the customer when the ULAB is returned to the retailer. These financial incentives can be used in a number of ways, but should be sufficient to drive the consumer to return the ULAB into the formal and licensed sectors and prevent the ULAB from finding its way into the informal and unlicensed recyclers.
* Purchase Discount Schemes: Purchase discount schemes operate in a similar way to the deposit/refund schemes, but instead of the consumer paying a deposit the first time a new battery is purchased, the consumer will only pay the retail price. However, when the battery is at the end of its useful life and the ULAB returned to the retailer, a discount will be given on the price of a new battery and the ULAB will be retained by the retailer and sent to a licensed recycler. These schemes are invariably run by the secondary lead recyclers and the battery manufacturers. The industry bears all the costs and sets up the necessary recovery infrastructure to make the scheme work, but the costs are such that the schemes are only viable in countries with domestic recyclers and battery manufacturers. ([[14]](#endnote-15))

## Incentives and disincentives

* European Union: Under Directive 2006/66/EC Member States shall prohibit the disposal in landfills or by incineration of waste industrial and automotive batteries and accumulators.
* United States: Some states have prohibited the disposal of ULABs in solid waste landfills or incinerators. For example, New Hampshire (New Hampshire Revised Statutes Annotated, Section 149-M:27), New Mexico (New Mexico Administrative Code, Section 20.9.2.10), and Massachusetts (Code of Massachusetts Regulations, Section 19.017).

# Legislation

## Existing national, regional and international legislations

* European Union: Directive 2006/66/EC of the European Parliament and of the Council, of 6 September 2006, on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC. Available at http://ec.europa.eu/environment/waste/batteries/
* India (Ministry of Environment and Forests): Batteries (Management and Handling) Rules, 2001, and Batteries (Management and Handling) Amendment Rules, 2010. Available at http://www.moef.nic.in/hazardous\_substances\_management
* British Columbia, Canada: Recycling Regulation of the Environmental Management Act (B.C. Reg. 449/2004) as amended by B.C. Reg. 296/2009. Available at http://www.bclaws.ca/Recon/document/ID/freeside/449\_2004

# Capacity and Feasibility

ULABs are a mix of lead, lead alloys, lead compounds, dilute sulfuric acid (which will sometimes be in the form of a gel), polypropylene, polyester, acrylonitrile butadiene styrene (ABS) and PVC, and all these materials will be in differing proportions. Each material has the potential to impact differently on the environment and human health, depending on how the ULABs are recovered and recycled. Battery drainage, breaking and separation into different components can take place at a bulker or scrap dealer, however, more commonly today, these steps are carried out at the lead reduction facilities ([[15]](#endnote-16)).

The International Lead and Zinc Study Group (ILZSG), founded in 1959 by the United Nations, compiles a World Directory of Primary and Secondary Lead Plants. The latest Directory (2011) lists a total of 270 primary and secondary lead smelters (spread over 66 countries). ILZSG also publishes an online database. ([[16]](#endnote-17))

Information on disposal and recovery facilities authorized, permitted or registered to operate in the territories of the Parties to the Basel Convention, is provided in the Online Reporting Database of the Basel Convention, which contains data transmitted by Parties pursuant to Article 13 (3) of the Convention. The database is accessible through the Basel Convention website on: http://www.basel.int/Countries/NationalReporting/ReportingDatabase/tabid/1494/Default.aspx.

# Permitting

Waste facilities should be licensed/authorised/permitted. If there is no licensed smelter and the scrap exporter is the conduit for effective recovery, then the exporter should not only be licensed and achieve high standards of environmental protection in any storage facility (which could be quite long time depending on the battery demand), but also should present a detailed set of operating procedures describing its activities and those of its partners in other countries in order to facilitate governmental actions in the regional scenario.

# Enforcement

The ESM of wastes requires a regulatory and enforcement infrastructure that ensures compliance with legal instruments and standards. Consideration should be given to a national (and sometimes a regional) policy that includes provisions to allow prompt, adequate and effective enforcement actions to be undertaken, including sanctions and penalties that will serve as a deterrent to non-compliance.

Measures should be in place to ensure adequate monitoring, inspection and enforcement of ULAB imports and exports subject to the requirements of the Basel Convention, by agents of the State and cooperation with enforcement agencies in other States (to prevent illegal traffic).

Adequate penalties and sanctions for illegal traffic should discourage such movements in the future.

# Certification and Auditing Systems

It is recommended that licensed waste management facilities should be subject to annual inspections by the appropriate government agencies and/or audits by a recognised independent auditor. The objective of the inspection and/or auditing procedure would be to: check conformance of the facility with all basic requirements to ensure the ESM of wastes, with relevant environmental regulations, and, if applicable, current EMS systems. Verifying compliance with existing laws and regulations is embodied in the European Community Eco-Management and Audit Scheme (EMAS). Under ISO 14001, a facility is required to know whether or not it is in compliance with applicable laws and regulations; without that knowledge, the facility would be considered out of conformance with that ISO standard. The inspection and/or audit should also assess the performance of the facility with respect to environment, health and safety objectives. ([[17]](#endnote-18))

In the United States, the Recycling Industry Operating Standard (“RIOS”), created by the Institute of Scrap Recycling Industries (ISRI), is a management system integrating environmental, quality, and health and safety standards. This is an ISO-compatible management system that allows for third party audits, registration by certifying bodies, and certification. In Germany, facilities may be certified as “Entsorgungsfachbetrieb” (specialised waste management companies) according to the requirements set out in the Ordinance on Specialised Waste Management Companies (EfbV). ([[18]](#endnote-19))

# Transboundary Movements

Governments should put in place legal requirements to implement and enforce the provisions of relevant international and/or regional instruments in relation to the transboundary movement of ULABs (pre-notification, prior informed consent, etc.), including the Basel Convention.

Transboundary movements of ULABs for management in another country cannot be assured to result in ESM by evaluating receiving facilities alone. Elements such as those for effective legal systems, government oversight and other infrastructure to protect the occupational health and safety of workers, communities and the environment, should also be considered. Transboundary movements of ULABs should not be considered to be legal where there is a reason to believe the waste in question will not be managed according to ESM.

Notifications received by the Secretariat of the Basel Convention from Parties—pursuant to Article 13 of the Convention—on decisions to prohibit or restrict the import/export of hazardous or other wastes are published on the website of the Secretariat ([[19]](#endnote-20)).

1. Sometimes referred to as spent lead-acid batteries. [↑](#endnote-ref-2)
2. In valve-regulated batteries the loosened mass particles are fixed between the plates and cannot fall to the bottom of the case. [↑](#endnote-ref-3)
3. For further information, refer to the development of “Technical Guidelines on Transboundary Movements of E-waste and Used Electrical and Electronic Equipment, in Particular Regarding the Distinction Between Waste and Non-waste Under the Basel Convention” (http://www.basel.int/Implementation/TechnicalMatters/DevelopmentofTechnicalGuidelines/Ewaste/tabid/2377/Default.aspx), the development of Guidance to Provide Further Legal Clarity in Relation to “Used and End-of-life Goods” (http://www.basel.int/Implementation/LegalMatters/CountryLedInitiative/OutcomeofCOP10/Providingfurtherlegalclarity/tabid/2673/Default.aspx), and the development of a Glossary of Terms to provide additional legal clarity with respect to certain terms used in the Convention (http://www.basel.int/Implementation/LegalMatters/LegalClarity/tabid/3621/Default.aspx). [↑](#endnote-ref-4)
4. European Union Network for the Implementation and Enforcement of Environmental Law (IMPEL). 2012. Waste Sites Manual. Identification and control of “upstream” storage and treatment facilities used for problematic waste exports. Available at http://impel.eu/projects/waste-sites-phase-2/ [↑](#endnote-ref-5)
5. Australian Battery Recycling Initiative (ABRI). 2013. Packaging Standard for Used Lead Acid Batteries (ULAB). Available at http://www.batteryrecycling.org.au/resources/abri-publications [↑](#endnote-ref-6)
6. For further information, refer to http://www.unece.org/trans/danger/danger.html [↑](#endnote-ref-7)
7. For further information, refer to http://www.ericards.net/ [↑](#endnote-ref-8)
8. For further information, refer to http://www.tc.gc.ca/eng/canutec/guide-menu-227.htm or http://phmsa.dot.gov/hazmat/library [↑](#endnote-ref-9)
9. Secretariat of the Basel Convention. 2013. Framework for the Environmentally Sound Management of Hazardous Wastes and Other Wastes. Available at http://www.basel.int/Implementation/CountryLedInitiative/EnvironmentallySoundManagement/ESMFramework/tabid/3616/Default.aspx [↑](#endnote-ref-10)
10. United Nations Environment Programme (UNEP). 2008. Guidelines on Best Available Techniques and Provisional Guidance on Best Environmental Practices Relevant to Article 5 and Annex C of the Stockholm Convention on Persistent Organic Pollutants: Thermal Processes in the Metallurgical Industry not Mentioned in Annex C, Part II. Expert Group on Best Available Techniques and Best Environmental Practices. Geneva: UNEP. [↑](#endnote-ref-11)
11. United Nations Environment Programme (UNEP). 2008. Guidelines on Best Available Techniques and Provisional Guidance on Best Environmental Practices Relevant to Article 5 and Annex C of the Stockholm Convention on Persistent Organic Pollutants: Thermal Processes in the Metallurgical Industry not Mentioned in Annex C, Part II. Expert Group on Best Available Techniques and Best Environmental Practices. Geneva: UNEP. [↑](#endnote-ref-12)
12. Canadian Battery Association (CBA). 2011. The Canadian Battery Association’s British Columbia Stewardship Plan for Lead-Acid Batteries. Available at http://www2.gov.bc.ca/gov/topic.page?id=8BFD7790000043658C123DD6D81BB6A6 [↑](#endnote-ref-13)
13. Interstate Battery System of Canada, Inc. (IBSC). 2011. British Columbia Product Stewardship Plan. Available at http://www2.gov.bc.ca/gov/topic.page?id=8BFD7790000043658C123DD6D81BB6A6 [↑](#endnote-ref-14)
14. Secretariat of the Basel Convention. 2004. Training Manual for the preparation of national used lead acid batteries environmentally sound management plans in the context of the implementation of the Basel Convention. Basel Convention Series SBC No.2004/5. Available at http://www.basel.int/Portals/4/Basel%20Convention/docs/meetings/sbc/workdoc/tm-ulab/tm\_ulab.pdf [↑](#endnote-ref-15)
15. Commission for Environmental Cooperation (CEC) of North America. 2007. Practices and Options for Environmentally Sound Management of Spent Lead-acid Batteries within North America. Available at http://www3.cec.org/islandora/en/item/2323-practices-and-options-environmentally-sound-management-spent-lead-acid-batteries [↑](#endnote-ref-16)
16. For further information, refer to http://www.ilzsg.org/generic/pages/list.aspx?table=document&ff\_aa\_document\_type=B&from=13 [↑](#endnote-ref-17)
17. Organisation for Economic Co-operation and Development (OECD). 2007. Guidance Manual on Environmentally Sound Management of Waste. Available at http://www.oecd.org/env/waste/39559085.pdf [↑](#endnote-ref-18)
18. German Ordinance on Specialised Waste Management Companies (Entsorgungsfachbetriebeverordnung - EfbV), of September 1996. Available at http://www.bmub.bund.de/fileadmin/bmu-import/files/pdfs/allgemein/application/pdf/wastemanage.pdf [↑](#endnote-ref-19)
19. For further information, refer to http://www.basel.int/Countries/ImportExportRestrictions/tabid/1481/Default.aspx [↑](#endnote-ref-20)