WASTE LEAD-ACID BATTERIES

This fact sheet is part of a series of fact sheets to support the implementation of the environmentally sound management of hazardous wastes and other wastes, as required under the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal.

The fact sheet provides information on the environmentally sound management of waste lead-acid batteries, also sometimes referred to as "spent lead-acid batteries" or "used lead-acid batteries". It is primarily intended for use by collectors of waste lead-acid batteries, transporters and operators of facilities that store, recycle or otherwise dispose waste lead-acid batteries.

This fact sheet should be read in conjunction with the **Technical Guidelines for the Environmentally Sound Management of Waste Lead-acid Batteries,** previously developed under the Basel Convention[(1)].

Classification

The classification of waste lead-acid batteries according to Annexes I, III, VIII and IX of the Basel Convention is presented in Table 1.

Collection and storage at collection points

Waste lead-acid batteries should be collected with proper care, in order to avoid adverse health effects and environmental contamination.

Batteries should be stored whole at collection points and should not be drained, dismantled or broken to remove lead plates or electrolyte. Draining should be handled at licensed, permitted or authorised dismantlers or smelters, who have proper procedures in place to collect and manage the acid.

The storage area should be located away from heat sources, be sheltered and well ventilated, and have an impermeable surface with sufficient curbing/bunding, including a collection sump, to contain any spills. The storage area should also have restricted access and be identified with the appropriate corrosive warning sign[(1)].

Source: http://www.ppesrl.eu/

Figure 1. Collection container

Waste lead-acid batteries should be stored inside acid-resistant containers or placed on pallets. Where possible the collection container should be used as the transport container to minimize the risk of accidental spillage[(1)].Waste lead-acid batteries should be stacked in an upright orientation with all the vent and inspection caps firmly in place. If caps are missing, they should be replaced; if replacement is not possible, vent holes should be sealed with foam. To prevent short circuits, terminals should be protected with tape or other insulating material (e.g. cardboard, waffleboard).

Spill control equipment should be available to

Waste categories	Y-code of Annex I	H-code of Annex 3	A-code of Annex VIII (or B-code of Annex IX if applicable):	UN Shipping name, number, class
Waste lead-acid batteries	Y31,Y34	H8, H11, H12, H13	A1160	Waste Battery, Wet, Filled with Acid, UN2794, Class 8 -or- Waste Battery, Wet, Non-spillable, UN2800, Class 8
Waste lead-acid batteries, drained	Y31	H11, H12, H13	A1160	Environmentally Hazardous Substances, Solid, N.O.S., UN3077, Class 9
Waste battery electrolyte	Y34	H8	A4090	Waste Battery Fluid, Acid, UN2796, Class 8

H8=Corrosives; H11=Toxic (delayed or chronic); H12=Ecotoxic; H13=Capable, by any means, after disposal of yielding another material which possesses any of the hazardous characteristics listed in Annex III

Table 1. Classification of waste lead-acid batteries

neutralise any electrolyte release, including, at a minimum, neutralizer (e.g. soda ash, sodium bicarbonate or lime), absorbent (e.g., sand, inert material or vermiculite), shovel or scoop, and polyethylene disposal bags. Personnel should wear **appropriate personal protective equipment (PPE)**, including acid-resistant clothing, safety footwear, gloves, face and eye protection. Safety data sheets should be readily available to all workers.

Waste lead-acid batteries should be stored at **collection points** solely for the purpose of accumulating a sufficient quantity for cost effective transportation to the recycling facility. Collection points should not store a large number of waste lead-acid batteries, or for long periods of time, as this increases the risk of accidental spills or leakage of electrolyte[1]. The collection point may be required to be **licensed or permitted** as a hazardous waste storage facility under national law.

Collectors should not sell their batteries to unlicensed lead smelters[1].

Packaging

Prior to packaging, waste lead-acid batteries should be inspected for damage; this should be done while wearing the appropriate PPE (i.e. acid-resistant clothing or plastic apron, safety footwear, gloves, eye protection).

Depending on the type of waste lead-acid batteries, different packaging requirements apply[2,3,4,5]. Batteries (except for non-spillable stationary cells) should be kept upright at all times, and batteries with terminals on the side must be stacked so the posts are facing away from each other. Waste lead-acid batteries should generally be stacked up to a height not more than 1.5 times the load width[6]. Automotive and small sealed standby (stationary) batteries should be stacked not more than 3 layers high on pallets[2,3], with the largest on the bottom. Large sealed standby batteries should only be stacked up to a maximum of 2 layers[2]. Forklift (motive) battery cells and large flooded standby batteries should not be stacked higher than one layer[2,4,5].The weight capacity of the pallet must be adequate for the load[2]; it should be constructed with a minimum of three bottom runners[6]. Thick corrugated cardboard should be placed on pallets and between each layer of waste lead-acid batteries (as well as on the top layer) to prevent them from sliding off, to minimise the potential for short circuit and to prevent protruding battery terminals from puncturing other battery cases. Waste lead-acid batteries should be secured to the pallet 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 on all four sides. Waste lead acid batteries should not be packaged with waste non-lead-acid batteries.

Waste lead-acid batteries that are damaged and have the potential for leakage should either be transported in compatible (e.g. polyethylene) salvage drums/packaging, or repaired and/or packaged in such a manner that leakage of electrolyte is not likely to occur under normal conditions of transportation. Drainage of electrolyte as a means to eliminate the potential for leakage during transportation should be avoided. Damaged batteries that are not visibly leaking may be packaged separately in heavy weight polyethylene plastic bags (minimum 0.15 mm thick), closed securely with an adjustable plastic tie and placed in the middle of the top layer of stacked batteries[6].

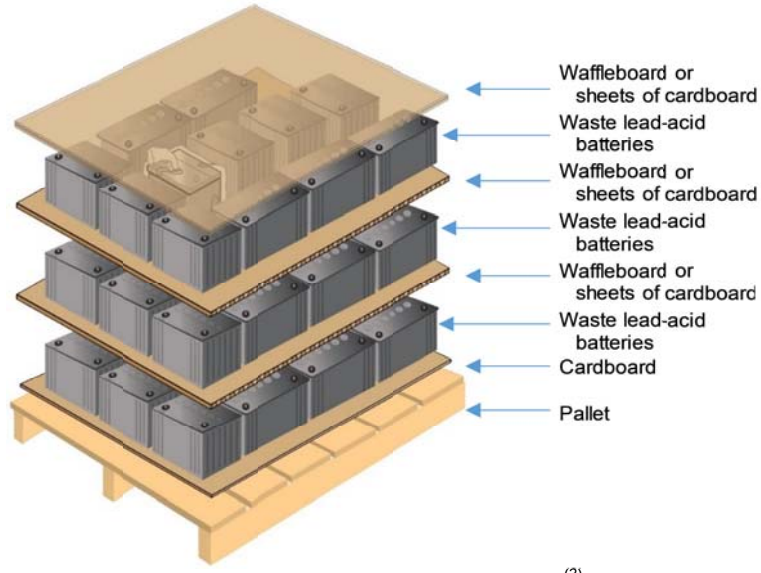

Figure 2. Stacking Waste Lead-Acid Batteries on Pallets[3]

Transport

Transport should be carried out by a licensed,

Source: http://batterycouncil.org/?Transportation

Figure 3. Damaged batteries that are not visibly leaking electrolyte must be put in heavyweight polyethylene plastic bags

permitted or otherwise authorised carrier, according to the applicable laws and regulations. The United Nations Recommendations on the Transport of Dangerous Goods, Model Regulations[7] contains provisions for the packing, marking, labelling and placarding of dangerous goods, which may be considered in cases where there is no specific legislation. Transport vehicles should have visible Class 8 (corrosive) placards identifying the contents.

Source: http://batterycouncil.org/?Transportation

Figure 5. Securing pallets to prevent shifting of the load during transport

When transporting waste lead-acid batteries, routes should be chosen so as to minimise the impact of a potential spill[6]; routes should avoid heavily populated or congested areas, and sensitive environmental areas.

Containers and pallets must be properly blocked, braced, or otherwise secured in the trailer to prevent shifting of the load during transport.

Emergency response information (e.g. European

Source: http://batterycouncil.org/?Transportation

Figure 4. Batteries secured to the pallet with stretch wrap

Chemical Industry Council's ERICards) and hazardous waste tracking documents, as required by national law, should accompany each shipment of waste batteries. National legislation may require that such documents be retained for a certain period. Vehicles should be outfitted with the equipment necessary to neutralize small spillages (e.g. acid neutralizer or absorbent, nitrile gloves, polyethylene apron, shoe covers, safety goggles, scoops, disposal bags and ties, and labels). Transporters should be trained in emergency procedures; in the event of a spill, the transporters should contain the release and notify local emergency authorities.

Transboundary Movement

Transboundary movements of waste lead-acid batteries are subject to the Basel Convention control procedure and should be reduced to a minimum consistent with environmentally sound and efficient management and conducted in a manner which will protect human health and the environment. In addition, waste lead-acid batteries may be subject to additional restrictions and control procedures in certain countries.

Environmentally Sound Waste Management

Waste lead-acid batteries should only be recycled in facilities that are properly licensed, permitted or authorised, and that practise environmentally sound management (ESM). A facility-wide Environmental Health and Safety Management System should be implemented[6].

Non-lead-acid batteries should be identified and segregated to ensure they do not enter the smelter[1,6].

To **prevent contamination of soil and groundwater** from battery storage, crushing, screening and classifying operations, acid-resistant flooring with a spill collection system should be used. To **prevent or**

reduce diffuse emissions from battery crushing, screening, and classifying operations, enclosed equipment with a gas extraction system should be used.

To **recover the sulfuric acid**, one or a combination of the following techniques should be used: as pickling agent or raw material in a chemical plant, regeneration by cracking, production of gypsum and/or sodium sulphate.

At the recycling facility the acidic spent electrolyte is generally neutralized (pH adjusted), often with magnesium hydroxide ($Mg(OH)_2$), to precipitate out contaminants in the form of a filter cake. The pH adjustment reaction is exothermic (produces heat) and therefore the best practice is for this process to occur in fiberglass tanks, rather than polyethylene tanks. This neutralization process produces a sulfate filter cake, which, depending on the results of leachate testing carried out at a certified laboratory, is either landfilled as a non-hazardous waste or is sent for further treatment as a hazardous waste.

Materials that cannot be recycled should be properly disposed of in accordance with the waste management hierarchy (e.g. prioritise incineration with energy recovery over landfilling).

Work practices to minimise workers' and the surrounding community's exposure to lead should be applied, including the following: do not smoke; segregate work and eating areas; keep eating area clean; wash hands before eating; shower daily at the end of the workday, before going home; change workwear (change out of work clothes before going home); change and launder workwear daily; check and clean respirators daily; wear respirators; wear work clothes; install mechanical controls to reduce employee exposure to lead dust in air; keep homes, vehicles, and personal property clean[6].

Extended Producer Responsibility

There are a number of countries that have implemented extended producer responsibility (EPR) schemes covering waste lead-acid batteries. See the reference section for examples of existing EPR schemes[9]. All waste should be managed according to ESM practices, whether or not it falls under an EPR scheme.

Capacity and Feasibility

The International Lead and Zinc Study Group publishes an online mine and smelter database, the latest of which lists a total of 275 primary and secondary lead smelters (spread over 66 countries)[10]. Additional information on facilities authorized, permitted or registered to operate in the territories of the Parties to the Basel Convention can be found in the Convention's online reporting database[11].

Certification and Auditing Systems

Environmental management systems (EMS) can help organisations identify and manage their environmental impacts as well as compliance with environmental legislation. Collectors and recyclers can become certified (e.g. using ISO, EMAS or industry standards) by demonstrating to an accredited, independent third-party auditor that they meet specific standards to safely manage waste lead-acid batteries. An organization can, however, achieve the same benefits from an EMS whether or not it pursues certification. Non-standardised systems can in principle be equally effective if properly designed and implemented. General guidelines and recommendations to help small and medium-sized businesses develop an EMS have been published by the European Environment Agency[12], the U.S. Environmental Protection Agency[13], and the Bureau of International Recycling[14], among others.

References

(1) Technical Guidelines for the Environmentally Sound Management of Waste Lead-acid Batteries (2003). http://www.basel.int/Implementation/Publications/TechnicalGuidelines/tabid/2362/Default.aspx

(2) Australian Battery Recycling Initiative (2013) Packaging Standard for Used Lead Acid Batteries (ULAB). http://www.batteryrecycling.org.au/wp-content/uploads/2013/11/ULAB-packaging-standard-2013-final2.pdf

(3) Battery Council International (2010) Stacking and Wrapping Used Batteries on Pallets. http://batterycouncil.org/?Transportation

(4) Battery Council International (2010) Packaging and Securing Used Stationary Batteries/Cells. http://batterycouncil.org/?Transportation

(5) Battery Council International (2010) Packaging and Securing Used Motive Batteries/Cells. http://batterycouncil.org/?Transportation

(6) Commission for Environmental Cooperation (2016) Environmentally Sound Management of Spent Lead-acid Batteries in North America. http://www3.cec.org/islandora/en/item/11665-environmentally-sound-management-spent-lead-acid-batteries-in-north-america

(7) United Nations Recommendations on the Transport of Dangerous Goods, Model Regulations. http://www.unece.org/?id=3598

(8) 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. http://chm.pops.int/Implementation/BATBEP/BATBEPGuidelinesArticle5/tabid/187/Default.aspx

(9) For further information on extended producer responsibility see:

- Canadian Battery Association, http://www.canadianbatteryassociation.ca
- Australian Battery Recycling Initiative, http://www.batteryrecycling.org.au/home
- BlyBatteriRetur, http://blybatteriretur.se/english/
- OECD, http://www.oecd.org/env/tools-evaluation/extendedproducerresponsibility.htm

(10) International Lead and Zinc Study Group. Mine and Lead Smelter Database. http://www.ilzsg.org/

(11) Online Reporting Database, Basel Convention. http://www.basel.int/Countries/NationalReporting/ReportingDatabase/tabid/1494/Default.aspx

(12) European Environment Agency (1998) Environmental Management Tools for SMEs: A Handbook. http://www.eea.europa.eu/publications/GH-14-98-065-EN-C

(13) U.S. Environmental Protection Agency Environmental Management Systems (EMS) https://www.epa.gov/ems

(14) Bureau of International Recycling (2006) Tools for Environmentally Sound Management for an ISO compliant Environmental Management System that includes OECD Core Performance Elements for the World's Recycling Industries http://www.bir.org/publications/esm-tools/