

RESPONSIBLE RECYCLING OF ENERGY STORAGE BATTERIES



These guidelines provide an overview of the issues that need to be considered by manufacturers, distributors, installers, consumers, collectors and recyclers of used energy storage batteries. Each of these groups share responsibility for the safe and environmentally responsible management of used batteries.

BENEFITS OF RECYCLING

Recycling batteries at the end of their life has a number of benefits:

- It enables the recovery and reuse of materials including lead, iron, plastics, aluminium, copper, lithium, cobalt and electrolyte
- It diverts toxic and hazardous materials from landfill
- It ensures that batteries are managed safely
- There may be a financial return (depending on the battery type).



CHOOSING A RECYCLABLE BATTERY

Recyclability is one of the issues that you will want to consider when you purchase an energy storage battery system. Think about their potential for a second life through reuse, remanufacturing or recycling. The recyclability of a particular battery technology depends on two criteria:

1. **Its material components**, i.e. whether the individual components can be separated and recycled into new materials that have a commercial value.
2. **Recycling infrastructure**, i.e. the availability of:
 - collection and drop-off services for the battery type
 - companies that will either reprocess them within Australia or export them for recycling.

More information on the main battery types is provided below and on ABRI's website: www.batteryrecycling.org.au.

GENERAL GUIDELINES FOR STORING AND HANDLING USED BATTERIES

Most commonly used batteries are classified as a hazardous waste and/or a dangerous good at the end of their life. They must be managed carefully to avoid any environmental damage and to protect the health and safety of your workers and the general community. Some basic guidance is provided below.

- Most used batteries still hold a residual charge when they reach the end of their life. They should be decommissioned and removed by licensed personnel. Do not cut cables without taking adequate precautions. Always assume the batteries in situ carry a lethal charge.
- To avoid the potential for electric shock or short circuit, do not place metal objects on top of batteries and insulate terminals to prevent short circuit.

- Check for damaged or leaking batteries. These need to be wrapped and handled with extra care. Seek advice from the manufacturer or collector/recycler.
- Wear protective clothing when handling used batteries. Take appropriate action if a spill occurs because some substances in the batteries may be toxic or corrosive.
- Identify the label on the battery to determine its chemistry type. If there is no identifying label check with the manufacturer or distributor. Different classes of dangerous goods must not be mixed together during storage or transport (e.g. lead acid batteries are a Class 8 product and lithium-ion are a Class 9).
- Keep batteries away from potential sparks or flames. Store them in a cool, dry, well-ventilated area.
- Organisations that store or handle used batteries must undertake due diligence on their environmental and workplace health and safety obligations. Ensure that you have appropriate management systems in place and that staff receive adequate training.
- Used lead acid, nickel cadmium and lithium-ion batteries must be transported in accordance with the Australian Dangerous Goods Code

There is additional information to help you on ABRI's website: www.batteryrecycling.org.au.

CHOOSING THE RIGHT RECYCLER

At the end of the batteries' life you will need to choose a responsible company to collect, transport and/or recycle them. Some of the questions that you need to consider are:

1. Does the company have a license to collect, transport and recycle or dispose of the battery, and/or have development consent for the activity? Most batteries require a license to transport hazardous waste within Australia and can only be exported with a permit from the Australian Government.
2. Does the company have third party accreditation or are they a member of an industry body? ABRI members must comply with a Code of Conduct for responsible recycling.
3. Has the company advised what happens to the batteries they collect? Ask them to provide you with a recycling certificate that nominates the method and destination for recycling.

See Planet Ark's checklist: *Choosing the right recycler* for more information (<http://businessrecycling.com.au/research/resources.cfm>).

MANAGING USED LEAD ACID BATTERIES



Identifying a lead acid battery: Look for the 'Pb' (lead) symbol with the 'crossed out wheeled bin'.

Recyclability: Used lead acid batteries (ULAB) are recyclable and have a commercial value. Close to 100% of the materials can be recycled and there is a well-established infrastructure for collection and recycling.

Find a responsible recycler: ULAB are recycled within Australia or exported for recycling overseas. See www.batteryrecycling.org.au/recycling/automotive-batteries.

Legal requirements: ULAB are a controlled waste. A waste storage licence and a waste transport licence are required in most jurisdictions. Interstate transport of batteries must be tracked, and some jurisdictions require intrastate tracking as well. Batteries must be transported in accordance with the Australian Dangerous Goods Code (ADG). The export of ULAB requires a permit from the Australian Government. See <http://www.batteryrecycling.org.au/recycling/regulations>.

Health and safety: Follow manufacturers' guidelines for safe handling and storage. ABRI has published a series of information sheets at www.batteryrecycling.org.au/recycling/automotive-batteries.

Packaging: ABRI has published a voluntary packaging standard at <http://www.batteryrecycling.org.au/wp-content/uploads/2013/11/ULAB-packaging-standard-2013-final2.pdf>



Figure 1: Lead acid batteries are classified as a Class 8 Dangerous Good



Figure 2: Solar storage batteries (photo GNB Industrial Power)

MANAGING USED LITHIUM ION (LI-ION) BATTERIES



Identifying a lithium-ion battery: Many Li-ion batteries look similar to lead acid batteries, and they are not always labelled with a chemistry symbol. Some may have the above symbol.

There are many different types of Li-ion battery. Some of the most common are Lithium nickel manganese cobalt oxide (also known as NMC), Lithium iron phosphate (also known as Li-ferrous, LFP or LiFePO₄), Lithium manganese oxide (also known as Li manganese, LMO or Spinel), and Lithium titanate. There are many other Li-ion chemistries under development as well.

Recyclability: Most Li-ion batteries are recyclable, although recycling technologies are still being developed. Recycling efficiency varies depending on the processes used. In addition to metals recovery, some of the materials may be sold for road construction or fertiliser. Li-ion batteries are being collected in Australia and exported for recycling.

Find a recycler: Companies that have an export permit or are applying for a permit to export Li-ion batteries are listed at <http://www.batteryrecycling.org.au/recycling/lithium-ion-batteries>.

Legal requirements: Li-ion batteries are classified as a dangerous good (Class 9). Batteries must be packaged and transported in accordance with the Australian Dangerous Goods Code (ADG). The export of Li-ion batteries requires a permit from the Australian Government.

Health and safety: Follow manufacturers' guidelines for safe handling and storage.

Packaging: The Australian Dangerous Goods Code (version 7.4) includes special provisions and packaging instructions for used and damaged Li-ion batteries.

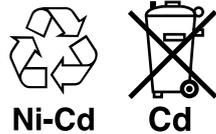


Figure 2: Li-ion batteries are classified as a Class 9 Dangerous Good

MANAGING USED NICKEL CADMIUM BATTERIES

Identifying a NiCd battery:

Look for one of the following symbols.



Recyclability: Used Ni-Cd batteries are recyclable, with a diversion rate from landfill of over 95%.

Find a responsible recycler: Used wet cell (vented) Ni-Cd batteries are either recycled within Australia or exported for recycling overseas.

See <http://www.batteryrecycling.org.au/recycling/nickel-cadmium-batteries>.

Legal requirements: Ni-Cd batteries are a controlled waste. A waste storage licence and a waste transport licence are required in most jurisdictions. Interstate transport must be tracked, and some jurisdictions require intrastate tracking as well. Batteries must be packaged and transported in accordance with the Australian Dangerous Goods Code (ADG). The export of used batteries requires a permit from the Australian Government.

Health and safety: Follow manufacturers' guidelines for safe handling and storage.



Figure 3: Nickel cadmium batteries (photo MRI)

MANAGING OTHER BATTERY TYPES

Other energy storage batteries include:

- Flow batteries (zinc bromine or vanadium redox)
- Sodium-ion batteries
- Aqueous hybrid batteries.

These are new technologies so there may not be an established recycling system.

Find a recycler: Consult with your supplier or the manufacturer.

Legal requirements: Consult with your state EPA to understand any waste licencing requirements. An export permit is required for all batteries.

Note: The information provided here is general in nature and provided for educational purposes only. Organisations must do their own research to understand their legal obligations and to ensure that they are compliant with all relevant laws and regulations. ABRI does not accept responsibility for any loss or damage occasioned by any person acting or refraining from action as a result of reliance on this document.



Figure 3: Nickel cadmium batteries are classified as a Class 8 Dangerous Good

Contact relevant government agencies for more information on legal and environmental requirements for hazardous or controlled wastes

NSW	Environment Protection Authority NSW	www.epa.nsw.gov.au
Victoria	Environment Protection Authority Victoria	www.epa.vic.gov.au
Queensland	Dept. Environment & Heritage Protection	www.ehp.qld.gov.au
ACT	Dept. Environment, Climate Change, Energy & Water	www.environment.act.gov.au
Tasmania	Dept. Primary Industries, Parks, Water & Environment	www.dpipwe.tas.gov.au
Western Australia	Dept. of Environmental Regulation	www.der.wa.gov.au
South Australia	Environment Protection Authority South Australia	
Northern Territory	Environment Protection Authority	www.ntepa.nt.gov.au
Australian Government	Dept. Environment	www.environment.gov.au



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Australian Battery Recycling Initiative The Australian Battery Recycling Initiative (ABRI) is a not-for-profit association established in 2008 to promote responsible environmental management of batteries at end of life. More information on battery recycling can be found on their website at www.batteryrecycling.org.au.