ENTECH ENVIRONMENTAL

Risk assessment for end of life consumer mixed handheld batteries: collection, storage and transport

Prepared by Helene Macready
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Introduction

In November 2012, the Australian Battery Recycling Initiative (ABRI) commissioned Entech Environmental to prepare guidelines for the safe collection, storage and transport of mixed handheld batteries (including lithium primary). The aim of the guidelines is to provide stakeholders involved in battery collection, storage or transport with information on 'good practices' by providing a standard risk assessment and a series of succinct guides. This risk assessment can be used as a basis for any site specific risk assessment.

Risk assessment

In recent years ABRI has received requests for information on the safe handling of spent batteries. This may be attributed to publicity about the potential dangers caused by spent lithium batteries incidents, as well as increasing awareness of safety issues when dealing with waste and recycling. This risk assessment is a tool that can be used by interested parties; either by individuals for general information or by organisations as part as their environmental management plans.

This risk assessment was undertaken using the risk management process detailed in AS/NZS 4360:2004 (Standards Australia 2004). The key steps are: communication and consultation, establishing the context, identification of the risks and analysis, evaluation and treatment of the risks and monitoring and review.

Communicate and Consult

This involved communication and consultation with internal and external stakeholders.
In this case, the risk assessment was done through:

- Documentation provided by ABRI;
- Internet research;
- Reference to Australian legislation;
- Past experience from the management of waste batteries collection programmes and considerable time "on the ground";
- Internal consultation by means of "brainstorming" meeting involving senior and junior staff members of Entech Environmental;
- External consultation with key ABRI members through a teleconference.

Establish the context

The context of the risk assessment is specified in the scope of the project provided by ABRI and covers the three stages of the recovery chain: collection, storage and transport of spent handheld batteries for recycling. It includes risks associated with external factors and risks associated with the inherent properties of spent batteries. This risk assessment excludes the activities of sorting and recycling of these batteries.

The three stages can be defined as per below:

1/ Collection: in this context, the collection of spent handheld batteries is defined by the act of aggregating the waste in a receptacle either at home, in an office or in a public area.

2/ Storage: in this context, the storage of spent handheld batteries is defined by the act of short-term holding with the intention of retrieving the waste at a later time. It doesn't include the act of transfer from the collection receptacle into the storage receptacle.

3/ Transport: in this context, the transport of spent handheld batteries is defined by the act of carrying either one or several collection receptacles or storage receptacles from one point to another using public roads.

This risk assessment provides a general analysis of the risks but is not exhaustive. Some risks can be a direct result of the site's configuration and properties. It is recommended that a specific risk assessment be undertaken before commencing any activities involving spent handheld batteries.

The legislative context is:

- The Australian Dangerous Goods (ADG) Code (7th Edition)
- Hazardous waste laws and regulations
- Workplace Health and Safety laws and regulations

Identify the risks

The risks are identified within the context above by answering the following questions:

- What can happen?
- When and where?
- How and why?

It involves the identification of potential sources of risks as well as potential environmental impacts. The potential sources of risks are related to any, some or all of the following:

- The sensitivity of the surrounding environment;
- The type of manual handling carried out on site;
- The types and quantities of spent batteries dealt with;
- The presence or absence of management controls already in place to minimise impact of the risk.

A list of potential sources of risks and environmental impacts were identified and are listed in *Appendix I.*

Analyse, evaluate and treat the risks

The analysis of a risk is the examination of the combination of the likelihood of an event occurring and its consequences. We employed a qualitative method as per tables 1, 2, 3 and 4 below.

Table 1: Likelihood scale

Rating	Annual occurrence
Almost certain	More likely than not – Probability greater than 50%.
Likely	As likely as not – 50/50 chance.
Possible	Less likely than not but still appreciable – Probability less than 50% but still quite high.
Unlikely	Unlikely but not negligible – Probability low but noticeably greater than zero.
Rare	Negligible – Probability very small, close to zero.

Table 2: Consequence scale

Rating	*Health and Safety*	*Environment & Sustainability*	*Economic**
Catastrophic	Large numbers of serious injuries or loss of lives	Major widespread loss of environmental amenity and progressive irrecoverable environmental damage	Total financial loss; complete loss of facilities or plant and equipment; more than a year production loss
Major	Single death &/or long-term illness or multiple serious injuries	Severe loss of environmental amenity and a danger of continuing environmental damage	Major financial loss; major damage to plant and equipment; more than a month production loss
Moderate	Injury; Possible hospitalisation & numerous days lost	Isolated but significant instances of environmental damage that might be reversed with intensive efforts	Financial loss; damage on plant and equipment; up to a week production loss
Minor	Serious near misses or minor injuries, medical treatment & some days lost	Minor instances of environmental damage that could be reversed	Some financial loss; some minor damage on plant and equipment; up to 1 day production loss
Insignificant	No or only minor personal injury; First Aid needed but no days lost	No environmental damage	Minimal financial loss; minimal damage to plant and equipment; less than 1hour production loss

**The economic scale is not costed as it greatly depend on the place of activity, significant economic loss is assessed in the context of the entity (household, school, industrial facility etc.)*

Table 3: Management Priority

		Consequences				
		Insignificant	*Minor*	*Moderate*	*Major*	*Catastrophic*
Likelihood	*Almost Certain*	Medium	Medium	High	Extreme	Extreme
	Likely	Low	Medium	High	High	Extreme
	Possible	Low	Medium	Medium	High	High
	Unlikely	Low	Low	Medium	Medium	Medium
	Rare	Low	Low	Low	Low	Medium

Table 4: risks ratings

Extreme	Extreme management priority results from extreme risks which demand urgent attention at the most senior level and cannot be simply accepted as a part of routine operations without executive sanction. They should be treated as soon as possible as a priority, and may include closure of the facility. Specific monitoring and review of all required controls are necessary.
High	High risks are the most severe that can be accepted as a part of routine operations without executive sanction but they will be the responsibility of the most senior operational management and reported upon at the executive level. High risks should have the highest priority in scheduled risk treatment plans. Frequent monitoring and review before and after treatment should be undertaken to ensure the risk treatment is effective.
Medium	Medium risks can be expected to form part of routine operations but they will be explicitly assigned to relevant managers for action, maintained under review and reported upon at senior management level. Medium risks should be prioritised for treatment and regularly monitored and reviewed to ensure changing circumstances do not also change the level of risk. Medium risks are only acceptable in situations where there are no reasonable or feasible risk mitigation options available. Stringent monitoring programs should be in place to identify potential impacts and procedures established to respond to situations where the monitoring identifies a potential issue.
Low	Low risks will be maintained under review but it is expected that existing controls will be sufficient and no further action will be required to treat them unless they become more severe. Low risks can be accepted with ongoing monitoring and review to ensure changing circumstances do not also change the level of risk.

Each stage (collection, transport, storage) has been analysed and can be used independently and can be found in the risk assessment tables included in *Appendix II*. Each stage may have a number of risks in common and might appear repetitive but we felt it was important to be able to use the risk assessment for each of them independently. The activities of sorting and recycling are outside of the scope.

Monitoring and review

Monitoring and review is a crucial component of the overall risk management process. It should be repeated at the lesser of the following intervals:

- → After an incident occurs that can directly affect the level of risk assessed as part of the previous assessment;
- → The availability of new or updated information directly relevant to the previous risk assessment;
- → After a period of 12 months from the previous assessment.

Appendix I: Sources of risk

Collection	Storage
Spent mixed batteries: - Presence of potentially hazardous chemicals in spent batteries - Larger quantities of spent batteries collected - Short circuit potential (position of terminals, welded connectors, residual charge) - Sharp parts on batteries - Ruptured batteries - Incompatible materials, mistaken battery waste (such as transformers)	*Spent mixed batteries:* - Presence of potentially hazardous chemicals in spent batteries - Larger quantities of spent batteries stored - Short circuit potential (position of terminals, welded connectors, residual charge) - Ruptured batteries, reactive and unstable batteries (eg by driving over loose batteries and breaking containment) - Incompatible materials, mistaken battery waste (such as transformers)
Collection container: - Adequacy of receptacle (potential presence of non-battery waste, eg appliances; vermiculite, non-conducting) - Potential for water ingress within battery container - Appropriateness of signage and labelling	*Storage container:* - Adequacy of receptacle (vermiculite, non conducting) - Potential for water ingress within battery container - Excessive humidity/moisture inside container, contact with air - Appropriateness of signage and labelling - Segregation from incompatible materials
Collection site: - Security of premises (site access, theft, vandalism, dumping, access by children) - Adequacy of Bunding , containment and weather protection - Poor housekeeping (litter) and poorly stored materials (slips, trips and falls), uneven and slippery surfaces - Fire and escape plan (isolation, CO_2 or foam) - Emergency response/contact details/duty officer - Adequacy of ventilation - Adequacy of lighting	*Storage site:* - Security of premises (site access, theft, vandalism, dumping) - Adequacy of Bunding and containment - Poor housekeeping (litter) and poorly stored materials (slips, trips and falls), uneven and slippery surfaces - Fire and escape plan (isolation, CO_2 or foam) - Emergency response/contact details/duty officer - Compliance risk - Adequacy of ventilation - Adequacy of lighting - Excessive indoor temperature - Supervision and monitoring of storage arrangements
Operations: - Vehicle movements (safety around collection areas - Other hazardous substances - Manual handling and PPE - Staff training	*Operations:* - Vehicles movements (safety in shared operator/vehicle areas, container damage) - Other hazardous substances - Manual handling and PPE - Staff training - Incorrect tools and equipment - Poor stability and ease of access - Poor visibility - Exposure to live electrical conductors - Vibrations/micro movements

Transport
Spent mixed batteries: - Presence of potentially hazardous chemicals in spent batteries - Larger quantities of spent batteries transported - Short circuit potential (position of terminals, welded connectors, residual charge) - Ruptured batteries, reactive and unstable batteries (eg by driving over loose batteries and breaking containment)
Transport container: - Adequacy of receptacle (vermiculite, non conducting, ventilation) - Potential for water ingress within battery container - Excessive humidity/moisture inside container, contact with air - Appropriateness of signage and labelling - Segregation from incompatible materials
Transport vehicle: - Security of vehicle: access, theft, vandalism, dumping - Containment and securing load in place - Poor housekeeping - Uneven and slippery surfaces - Fire and escape plan (isolation) - Emergency response/contact details/duty officer - Compliance risk (transport docs: MSDS, EPA docs, vehicle signage, truck licensing waste and DG) - Extreme temperatures - Sensitivity of surrounding environment (National Parks, tunnels) - Supervision and monitoring
Operations: - Other Vehicles movements (collision) - Other hazardous substances (mixed loads of DG) - Manual handling and PPE - Staff training - Incorrect tools and equipment - Poor stability - Poor visibility - Exposure to live electrical conductors - Vibrations/micro movements

Appendix II: Risk management tables (see Excel attached)