



Creating a Safer, Environmentally Sustainable Used Lead Acid Battery Recycling Industry for Australia

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Authors: Fenton Goddard and David Bush
UNISEG Products Pty Ltd
Battery Rescue Australia Pty Ltd

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1. Executive Summary

The purpose of this document is to highlight some of the problems that currently exist in the Australian (and Global) Lead Acid Battery Recycling Industry and the existence of a new product that has the potential to significantly improve the stewardship of used lead acid batteries (ULAB).

The Australian and global industry standard for the storage and transport of Used Lead Acid Batteries (ULABs) is the ubiquitous “Chep” type wood pallet. This very simple, yet very versatile, transport device is the mainstay of not only Australia, but the global transport system. However, this incredibly successful product, which quite literally moves the world, is simply not fit for the purpose of storing and transporting used lead acid batteries. Its current usage in the used battery collection industry exposes employees in the entire supply chain to Occupational Health & Safety (OH&S) risks, as a result of the unsafe, loading, storage and transport of batteries.

The wood pallet is also having a negative impact on the environment as it does not capture any acid leaks when used for storage and transportation of ULABs. It is frequently used to store ULABs outdoors where acid can leak directly into the soil and drainage systems.

In addition, the requirement to wrap and strap ULABs, into position onto the pallet ready for transport, is not only unsafe, but also inefficient. This time consuming and hence costly task is contributing to Australia’s relatively low recycling rates of around 84%, with many batteries being dumped in landfill or simply left to rot in remote and regional areas.

UNISEG Products Pty Ltd has designed and developed the Battery Transport & Storage (BTS) Container specifically for the safe, environmentally sustainable and regulation compliant, storage and transportation of used lead acid batteries. The BTS addresses many of the short comings of the incumbent wooden pallet.

Battery Rescue Australia Pty Ltd (www.batteryrescue.com.au), a division of UNISEG Products, is running a demonstration battery collection business using the BTS Container, in Perth Western Australia. As part of the service Battery Rescue is providing the BTS Container for free to Used Battery Generators (UBG) to store their ULABs and when full, will then collect the BTS Container at the same time providing an empty exchange unit. One of the critical advantages and efficiencies of our collection system is that it eliminates the double and manual handing of the batteries by the Scrap Metal Industry. **Instead batteries are accumulated by the UBG and transported directly to the Battery Recycler**, without the batteries being handled again.

2. Current Situation

Overview of the Australian Used Lead Acid Battery Recycling Industry

The estimated quantity of ULABs available for recycling in Australia in 2012-13 was around 137,000 tonnes (ABRI www.batteryrecycling.org.au Oct 2014), with approximately 84% or 115,000 tonnes being recycled. This compares poorly to the USA where used battery recycling rates are close to 100%. The remaining 18% are lost to illegal landfill, export or are just left in residential homes, farms, mine sites and indigenous communities, often due to the cost of collection and transport exceeding the value of the recycled lead.

In Australia, the collection of used lead acid batteries for recycling is mostly carried out by the scrap metal industry. The scrap metal companies collect ULABs from a wide range of used battery generators (UBGs), such as automotive, marine, mining and industrial companies & government organisations. Most often they will pay the UBG somewhere between \$0.05 and \$0.40/kg, but sometimes they will be provided the ULABs at no cost.

ULABs collected from the Used Battery Generators may pass through several scrap metal companies before ultimately being delivered to one of three recycling facilities, in Australia, two of which are located in NSW and one in Queensland. *This double and sometimes triple manual handling of batteries, besides being very inefficient, increases OH&S risks to Australian workers and risks to our environment.*

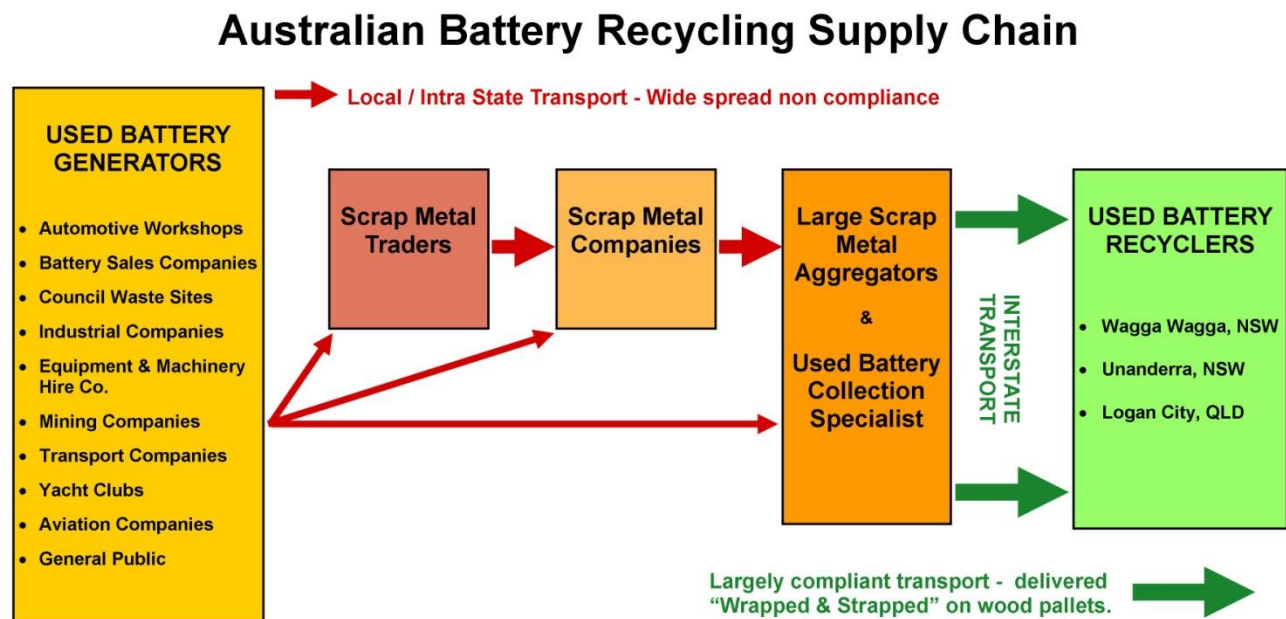


Figure 1 - Australian Battery Recycling Industry

The majority of collected batteries are sold to the reprocessing plants by the Large Scrap Metal Aggregators and Specialist Used Battery Collectors. In addition to performing their own collections these companies will also receive deliveries to their yard by Transport and Scrap Metal Companies. Most of the batteries delivered to their yards or that they collect, require repacking onto wood pallets before being shipped to the Recycling facilities.

The transport costs of the “wrapped and strapped” batteries on wood pallets to the Battery Recyclers can be very significant with a full load of ULAB pallets, costing anywhere from \$50/T to \$250/tonne from major Australian cities and regional centers and even higher from more remote regional areas. This cost reduces the available margins for the entire supply chain involved in the used battery recycling industry and coupled with the time consuming and inefficient packaging requirements and double handling of batteries, results in it being “uncommercial” to collect some batteries in regional and remote areas. For this reason recycling rates from Western Australia, estimated at less than 60%, are considerably less than the national average of approximately 84%.

From the storage of ULABs by Used Battery Generators through to their ultimate delivery to the Battery Recycling plants, **many of the current practices by the battery recycling industry are unsafe, negatively impact the environment and fail to comply with various Government Regulations** that control the storage, handling and transportation of ULABs in Australia.

Current Storage Practices

The majority of Used Battery Generators (UBGs), such as automotive, marine, mining and industrial companies & government organizations, will accumulate ULABs and engage a Scrap Metal Company to periodically come and collect the ULABs from their premises.

Aggregation of the used batteries, by the scrap metal aggregators and specialist used battery collectors, occurs in most major cities and regional centers, before the batteries are “wrapped and strapped” for transport to the reprocessing plants. Batteries collected by and delivered to, the Scrap Metal Aggregators and Specialist Used Battery Collectors, are usually stockpiled before being delivered to the Battery Recycler. These stockpiles are frequently in an open yard, where they leak acid into the soil or drains and break down due to exposure to the weather.

In Battery Rescue’s extensive marketing of it’s collection service, which primarily involved cold calling on more than 200 UBG and Scrap Metal Companies in Perth, they found numerous examples of less than ideal storage of ULABs occurring. This included the storage of batteries outdoors on non bunded devices or loose on the ground or in busy workshop areas. Figure 2 shows photos of some of the examples we have encountered from large, high profile companies and government organizations in Perth, WA.

Figure 2 - Example of ULAB storage by Perth Companies & Government Organisations



Car Yard / Auto Service



Auto Workshop



Scrap Metal Yard full of batteries, some in card boxes



Government Waste Depot

Current Transportation Methods

There are a variety of methods currently deployed for transporting used lead acid batteries however the most common method is a wood pallet. For delivery to the recycling plants most batteries are secured by plastic wrapping and straps, with the appropriate Dangerous Goods labels applied and are “largely compliant” with the Australian Code for the Transportation of Dangerous Goods (ADGC). We qualify as “largely compliant”, because the majority of shipments do not use adequate or any separators between multiple battery layers and the use of cheap wood pallets are not adequate for such heavy loads.

For local, intra-state collections within Western Australia the vast majority fail to comply with the ADGC. This is because when a wood pallet is used for local collection, the Scrap Metal Companies will wrap the batteries with plastic but will not secure them with strapping and apply the Dangerous Goods labels (see figure 3 for non-compliant examples). Alternatively Scrap Metal Companies will frequently transport the batteries loose in the back of a utility or truck.

The Wood Pallet is Not “Fit For Purpose”

Irrespective of whether the ULABs are being correctly packaged on the wood pallet, the reality is that the wood pallet has a number of significant drawbacks when used for transporting ULABs, these include;

1. **Acid leaks during storage and transportation** are not contained, resulting in damage to property, the environment and burn injuries.
2. Dangerous Good transport packaging requirements for batteries transported on Wood Pallets are time consuming and unsafe leading to systemic non-compliance and the double, manual handling of used batteries.
3. Wide variances in the “packaging standard” achieved dependent upon the operator’s training and attitude, resulting in inadequate and unsafe restraint of the batteries.
4. The use of cheap, poor quality wood pallets and the plastic wrapping proving to inadequately secure the load during transportation, **resulting in load shifting & acid spills during transport**.
5. Batteries of different sizes are difficult to pack securely on wood pallets while meeting the various transport regulations.

Figure 3 - Examples of unsafe & non-compliant transportation of ULABs



Non Compliant Transport of ULABs from Western Australian Goldfields



Unsafe Transportation - Metropolitan Collection



Non Compliant Transport of ULAB from WA Mine Site

Current Battery Recycling Methods

The reprocessing of ULAB in Australia is dominated by two companies, Hydromet Corporation and Enirgi Metal Group. Hydromet's facility is located in Unanderra, NSW and the Enirgi Group own 2 facilities, one in Wagga Wagga, NSW and the other in Alexandria, NSW. There is a smaller reprocessing facility, V Resources, located in Loganholme, Queensland.

These reprocessing plants, "break and separate" the batteries, with lead chips, which can be melted to produce lead ingots and a lead paste, which requires a high temperature smelter process to extract the lead.

Batteries delivered almost exclusively on wood pallets, to the recycling facilities are stockpiled, up to 4-5 pallets high, a practice we consider to be unsafe, due to the irregular surface formed by the batteries on the layer below and the poor quality wood pallets that are often used by the industry (see figure 4 for an example from one of the Australian Recycling Facilities).

When ready for processing, the strapping and plastic wrap is removed and disposed of as waste, along with the cardboard separators (when used).

All 4 recycling facilities manually unload the batteries by hand, onto a conveyor belt, which feeds the batteries into a crusher. It is unclear to us *why the reprocessors choose to unload the batteries manually*, however it doesn't seem very efficient and it no doubt increases the risk of injury to their staff from loading heavy batteries and from acid burns.

Figure 4 - ULAB Pallets Stacked at Australian Recycling Plant



3. Towards A Better Battery Recycling System

UNISEG Products has designed and developed the Battery Transport & Storage (BTS) Container, specifically for the safe, environmentally sustainable and regulation compliant, storage and transportation of used lead acid batteries. The BTS Containers eliminates many of the short comings of existing battery storage and transportation methods. The figure below highlights the key features of the BTS Container:

Figure 5 - Battery Transportation & Storage (BTS) Container Features



The BTS Container is manufactured using low density polyethylene that is acid proof and UV Resistant. It includes a bunded base, for acid spills, that can store up to 25 liters of free liquid. When closed it is weather resistant and hence is also suitable for the outdoor storage of ULABs. There is no need to insulate between battery layers, wrap and strap the ULAB's, or label the Pallet with the appropriate Dangerous Goods signage and it can be "transport ready" in less than 30 seconds.

Loading Batteries Into The BTS Container

The BTS Container incorporates a unique Front Load configuration that allows the batteries to be ergonomically loaded in to the pallet while the rear, left and right hand panels help keep the batteries in place. When the container is full of batteries it can be closed, and secured by the 6 over center latches, that make the pallet incredibly strong and its load of heavy batteries, up to 1.2 Tonnes (approximately 50 car batteries), very secure. The figure below shows on the left the container in the closed positions and ready for transport and on the right the container being opened / closed into the front load configuration for loading batteries.

Figure 6 - from left shows BTS Container closed, being opened or closed and in front load configuration



The following video shows how to safely load batteries into the Battery Transport & Storage Container:

- Video showing [loading of batteries onto the UNISEG Pallet](#)



Figure 7 - Collapsed BTS Container

Automatic Unloading Of Batteries For Recycling

The BTS Container's can be removed to enable the automatic unloading of the batteries using a forklift with a rotating arm. The used lead acid batteries (ULABs) can be tipped from the BTS Container onto a conveyor belt that then conveys the batteries into the battery crushing hopper. You can view a video here, [demonstrating the automatic unloading of batteries](#) from the BTS Container

The automatic unloading of batteries from the BTS Container eliminates unnecessary manual unloading of ULABs, as currently practiced by the Australian Reprocessing Facilities. ***This would help reduce injuries from lifting heavy batteries and acid burns and also reduce employee's lead exposure.***

An Australian Reprocessor has agreed to trial the automatic unloading from the BTS Container, with this trial expected to be completed by the 3rd Quarter, 2017.

The BTS Container can then be collapsed to a "flat pack" state and stacked 4 high, for efficient storage and reverse transport logistics (see figure 7).

Operating a Closed Loop Battery Recycling System

The fundamental and significant difference of using a Battery Transport & Storage (BTS) container as a replacement for a conventional wooden pallet is that it entails operating a closed loop system (see Figure 8). That is, after the containers are emptied at the reprocessing plants (and washed clean of any acid and dirt by the plant), they are collapsed and returned to the Battery Collection Company for re-deployment to their customers (used battery generators).

The basic process is for the BTS containers to be initially deployed at customer sites (used battery generators), then when full they are collected and an empty exchange container is delivered, at the same time. The full BTS containers are consolidated at the Battery Collection Company's local holding yard before being shipped, usually in quantities of 20, to the Battery Processing Plant. The Battery Processing Plant will then decant and wash the pallet before stockpiling the empty containers ready for return. When there are sufficient empty containers at the Battery Processing Plant, the empty, collapsed BTS containers are returned to the Battery Collection Company for re-deployment at their customer sites.

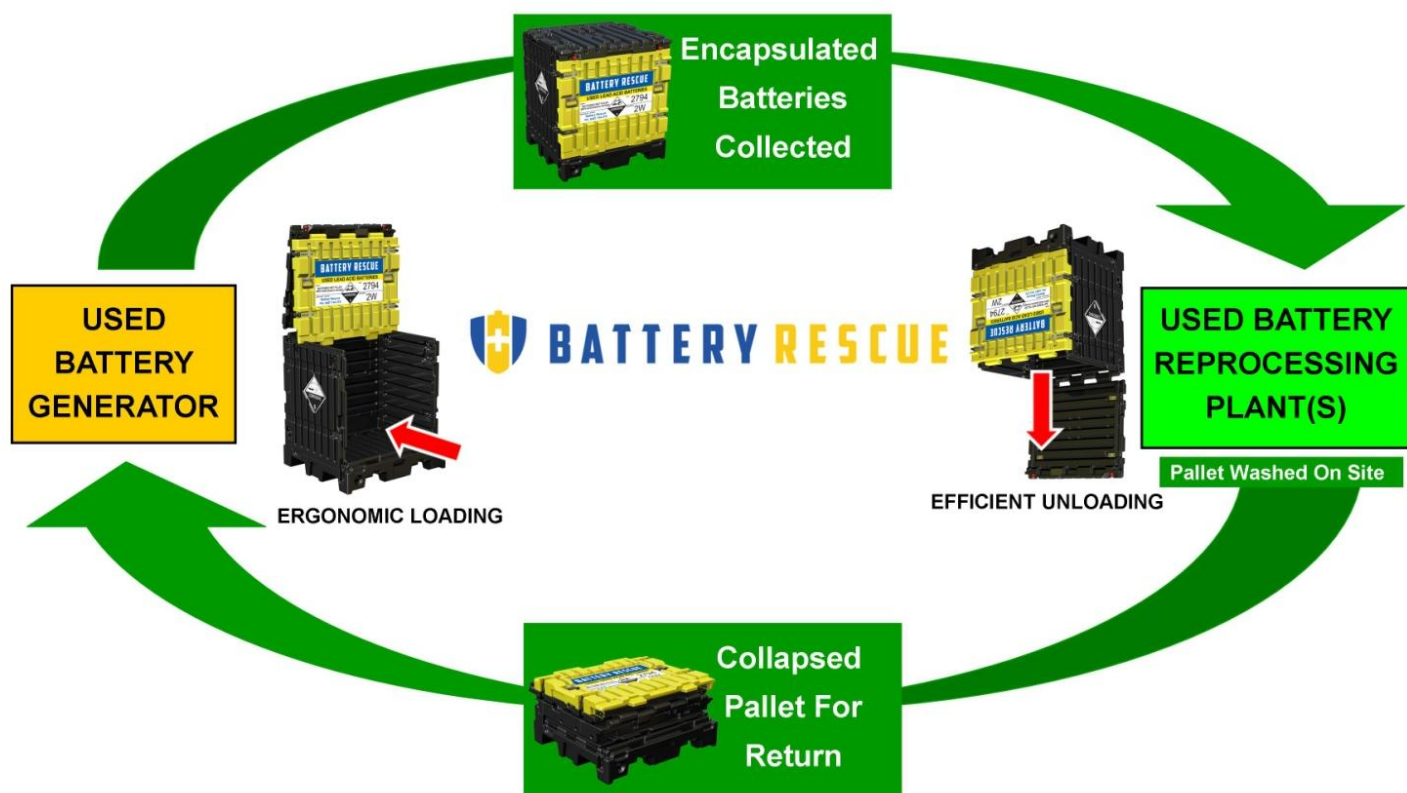


Figure 8 - Closed Loop Recycling System

Economics of a Closed Loop System

An independent costing by Kevin Jones, Director of Fleetrak Consulting (formerly the International Business Development Manager for Chep Pallecon Solutions APAC), demonstrated that despite the additional costs of washing and returning the BTS Containers within Australia, that on average there is a saving of \$21 per tonne of batteries transported using the BTS Container versus wood pallets. The savings are due to the time and materials involved in preparing the batteries for transport on wood pallets and the efficiency gains of automatic unloading from the BTS Container. Fleetrak's costing can be provided upon request.

Collection Data & Statistics

Battery Rescue's collection system records the details of each collection, including the used battery collection statistics. This is achieved using a "proof of delivery"(POD) app. Each UNISEG Pallet has a unique serial number which is displayed on the front and rear of the pallet, as a barcode and in human readable form.

The POD app enables the driver, using their smart phone, to capture the serial number of the pallet by scanning the Pallet's bar code. The POD app also enables a photo and the customer's signature to be captured. An example is show in figure 9.




BATTERY RESCUE		DELIVERY STATUS	
		D.O. NO.: DET22688822	
			
SERIAL NO.	: PEKNAA000000089	STATUS	: DELIVERED
SCHEDULED	: 2016-03-15	REASON	: N/A
DELIVER TO :		INSTRUCTIONS :	
Coates Hire, Christopher Slack 18 Wheeler St, Belmont, WA		Pickup & Return Battery Station	
NOTE	: N/A		
LAST KNOWN APPROXIMATE LOCATION AT TIME OF SUBMISSION :			
ADDRESS	: 99 Manning Road	LATITUDE	: -32.01251411588212
DATE TIME	: Tue, 15-Mar 2016, 10:41 AM	LONGITUDE	: 115.9130752390047
PROOF OF DELIVERY :			
SUBMITTED BY : Reece at 11:27 AM			
RECEIVED BY : Tony			
GOODS/SERVICES RECEIVED IN GOOD ORDER			
SIGNATURE/PHOTOS :			
			

Figure 9 - Example Digital Proof of Delivery Document

Internet Of Things

UNISEG Products have been working with several Internet of Things (IoT) providers, since early 2014, investigating the application of intelligent networking devices for tracking the location and movement of the BTS Container. It is anticipated in the near future that the BTS Container will be fitted with an IoT device, including several sensors.

This technology has the potential to provide live tracking of shipments including immediate accident reporting and useful data and statistics for the battery recycling industry and regulators.

4. Benefits

The major benefits of UNISEG's Battery Transport & Storage (BTS) Container for the Australian (and global) battery recycling industry, include;

1. Eliminates double and manual handling of batteries

The BTS Container enables batteries to be collected from the "coal face", the Used Battery Generators, and be delivered directly to the Battery Recycling Facilities, where the batteries can be automatically unloaded. There is no manual handling of batteries required from the point of storage to the batteries being recycled.

2. Safe, Convenient & Environmentally Sustainable Storage

The front load configuration of the BTS Container enables the ergonomic loading of batteries into the pallet. The 25l bunded base ensures that any acid leaks are contained and the weather resistant design enables batteries to be stored outdoors, when the container is closed. The container also provides a convenient, safe and clearly identified location for storing a business's used batteries.

3. Safe, Convenient & Efficient Collection and Transportation

The BTS Container is better suited for transporting ULABs than the commonly used wood pallet. Its bunded base ensures any acid leaks are contained during transport and when secured by the 6 steel over center latches, it is incredibly strong and the load of heavy batteries very secure. It also comes with the appropriate dangerous goods labels so that it can literally be transport ready in less than 30 seconds.

4. Automatic Regulation Compliance

Used lead acid batteries are a Controlled Hazardous Waste and a designated Dangerous Good and as such must be stored, handled, transported and recycled in accordance with Environmental, Dangerous Goods and Workplace Health and Safety regulations. Our research has found that many businesses involved in the battery recycling supply chain are failing to comply with these regulations. There is also a very significant "cash economy" operating within the industry, which is resulting in lost Government revenue and unsafe and environmentally damaging practices to exist.

The use of the BTS Container for battery storage and transportation helps ensure compliance by the entire supply chain and thereby helps companies meet their "duty of care" and "chain of responsibility" requirements. It also increases transparency and thereby eliminates the cash system and reduces regulation policing costs to the various government authorities.

5. Better Data – Increased Industry Transparency

Electronic live recording of every collection and the future potential for live tracking of shipments will provide transparency and useful data and statistics for the battery recycling industry and regulators. This will also include the ability to immediately detect and report any accidents during transportation.

5. Conclusion

UNISEG's Battery Transport & Storage Container will deliver a more efficient, safer, environmentally sustainable and regulation compliant used battery recycling industry to Australia and the world. The current global used battery collection practices are not only unsafe and environmentally unsound, they are inefficient.

Driven by companies wanting to reduce their exposure to OH&S risks, reduce their impact on the environment and desire to comply with compulsory government regulations, UNISEG Products believe the BTS Container will create a “paradigm change” in how the battery recycling industry operates here in Australia and elsewhere.

For more information on the BTS Container and Battery Rescue's battery collection service operating in Perth, Western Australia, please contact the authors, Fenton Goddard on 0487 744 275 (International +61 487 744 275) or via email at fenton@unisegproducts.com.au or David Bush on 0414 646 321 (International +61 414 646 321) or via email at davidbush@unisegproducts.com.au