Aspects of Battery Legislation in Recycling and Re-use

Perspectives from the UK and EU regulatory environment

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Batteries are present in all areas of life, from electronic devices to electric cars, fork lift trucks and more. But there is a lack of awareness that runs even to the highest levels of the complexities in the battery industry: the chemistries; the applications; the cell sizes; the risks; the legislation. As uptake of batteries grows across many applications there will inevitably be growth in the numbers of battery packs reaching their end-of-life. The challenges of re-use or recycling will become increasingly important.

A number of grant-funded projects that have been trying to develop novel recycling or remanufacturing processes have been surprised, and even hampered by legislation or by the way the waste battery market operates commercially. This article will try to outline some of the ways in which legislation impacts (either positively or negatively) the re-use and recycling of batteries that reach the end of their life in an application.

One key issue that has come to the fore in recent years is that whilst the technological developments of batteries (new chemistries and applications) and the development of markets for them move very quickly, legislative changes to provide necessary controls move extremely slowly – to the extent that there is a risk that technological innovation could be stifled by slow-moving inappropriate legislation.

In the UK there are more than 14 separate pieces of legislation that may impact those who work with batteries on a professional basis at some level, but three of these are more battery-focused than the others, and it is these I will focus on. They are:

- The Batteries Directive (1) (There have been a number of further directives since this first one that have refined and amended the initial legislation (2–5))
- The Hazardous Waste Regulations (6–11)
- European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR) and the Carriage of Dangerous Goods Regulations (12–17).

Battery legislation varies widely across the world, and even within Europe where the Batteries Directive set out to unify the environmental aims across all Member States, there are differences in legislation from country to country. There is insufficient space in this article to provide any insight into the very many different regimes of battery regulation, and so I will focus mainly on Europe-wide requirements, and in particular how the UK has addressed these.

The Batteries Directive

The principles of the Batteries Directive are quite straightforward:

- it applies the principles of Producer Responsibility – so that the producers of batteries are made responsible for meeting any costs of collection and recycling when the batteries they produce become waste
it sets targets for the collection of (portable) batteries
it sets targets for the quality of recycling that must be achieved when waste batteries are processed – known as the Recycling Efficiency.

These broad aims are universal across the European Community, but how those requirements are met was left up to the individual Member States when the Directive was transposed into each member’s national law. Therefore, each Member State has approached its compliance with the Directive in its own way, and so if a company has a system to deal with waste batteries which works perfectly adequately in one European Member State, it does not necessarily follow that same system would work in another – it is still necessary to understand the detail of how the legislation has been transposed in each country and comply with those requirements.

The directive initially classifies batteries by application into:
• automotive batteries
• industrial batteries
• portable batteries.

and has slightly differing requirements for the collection of waste batteries in each of these categories.

Once collected as waste, all batteries must be sent through a recycling process (landfill and incineration are prohibited), and the Recycling Efficiency target must be met. These targets are based on the chemistry of the batteries (rather than the application), with three targets:
• 75% for nickel cadmium batteries
• 65% for lead acid batteries
• 50% for all other batteries (including lithium-ion, lithium metal, NiMH, alkaline, etc.).

Broadly speaking the Directive is achieving its aims – it is certainly true that many more batteries are being collected and recycled than before its introduction (see Table I) (18–21). However, despite the generally positive results, there do remain a number of issues that, if resolved, could make the environmental achievement of the Directive even better, as well as potentially encouraging battery development and the application of technological developments.

An example of such issues could be the emergence of a potential market for second life batteries, or other re-use alternatives. Maybe understandably, vehicle manufacturers are concerned about still having full producer responsibility and being asked to pick up the bill for an electric vehicle battery that has had a second life in, say, a stand-by power application. The issue of producer responsibility becomes even cloudier if there is an element of remanufacture before the battery enters its second (or third) life application. If a cell or module in a battery pack is changed as part of a refurbishment, is it still the same battery that it was before, and who is the producer after the re-work has taken place?

Also there is no legal definition for, amongst other things, remanufacture, and whilst a recent set of proposals from the European Commission on the Circular Economy (22–34) encourages the re-use of batteries, the lack of legal definition of their activity is a problem for businesses wishing to get involved in the emerging market for extending the life of batteries (through refurbishment, remanufacture, repair, etc.).

When a battery does get to the end of its useful life, and is sent for recycling the Recycling Efficiency target is somewhat problematic. Firstly, the calculation of the Recycling Efficiency is very complex (35), so much so that, in some research undertaken into views of the reporting requirements of the Recycling Efficiency, every European trade association and compliance organisation asked, thought that the information being supplied to the European Commission by Member States was incorrect (36). European battery trade associations are generally calling for a level playing field for Recycling Efficiency calculation and reporting.

Table I Portable Battery Collection Rates in the UK (Proportion of Waste Batteries Collected Against New Batteries put on the Market)

<table>
<thead>
<tr>
<th>Year</th>
<th>Collection rate, %</th>
<th>Quantity, tonnes</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009a</td>
<td>&lt;10</td>
<td>–</td>
<td>(18)</td>
</tr>
<tr>
<td>2010</td>
<td>9.45%</td>
<td>4325.534</td>
<td>(19)</td>
</tr>
<tr>
<td>2012</td>
<td>28.34%</td>
<td>10,873.577</td>
<td>(20)</td>
</tr>
<tr>
<td>2015</td>
<td>40.08%</td>
<td>15,238.203</td>
<td>(21)</td>
</tr>
</tbody>
</table>

aPrior to the introduction of the legislation
There is an opportunity to address some of these issues, as the Batteries Directive is due to be reviewed, and potentially recast in a process that starts at the end of 2016, but that might take several years to achieve any changes.

**Hazardous Waste Regulations**

The point at which a battery becomes waste is determined by the last user of that battery – and if the user says it’s waste then it is waste, no matter what condition it is in.

Once a battery is declared waste, the way it is handled is governed in the UK by the Waste or Hazardous Waste regulations. Again these are rooted in, and aligned with, European legislation for waste.

Some batteries are deemed to be Hazardous when waste, and some are not (see Table II). UK waste regulations say how waste batteries should be handled when they enter the waste stream. For example, batteries that are Hazardous Waste must be moved by a company with an appropriate carriers’ licence, can only be taken to a site with a suitable waste management licence, every movement must be accompanied by a consignment note that describes the batteries, gives details of the movement, and for which a fee is payable to the Environment Agency. It is also worth noting that since devolution there are slightly different rules about moving hazardous waste in England and Wales, Scotland and Northern Ireland. The three regions have different consignment note requirements, and if moving waste between regions (say, from Glasgow to Manchester within the UK), Environment Agencies in both regions may need to be notified.

If we consider as an example an electric vehicle battery that the user of the vehicle has decided needs to be changed, then the user will declare the old battery waste, and so it is as far as he is concerned. However, a company operating second-life EV batteries in a stand-by power application may regard that battery as being perfectly adequate for their needs. However, the battery has been declared waste, and it is not necessarily a straightforward process to stop it being waste and get it back into use again. There is a way to achieve this that involves getting approval from the Environment Agency, but in the case of batteries this end of waste process is in its infancy. Re-use of batteries is starting to attract a good deal of interest, and so one might expect to see many more operators taking waste batteries back into use in the near future.

If we are to make the most of the possibilities for re-use, it would certainly help if there was an attitude shift from waste being something that we really don’t care for, and treat accordingly, which not only can reduce the scope for re-use if battery packs are damaged in the disposal process, but also a lack of care in the disposal process can be quite dangerous, leading to an increased risk of fire or pollution from batteries that are leaking or thrown together with a possibility of short circuit (Figure 1).

**ADR – Transport of Dangerous Goods**

The final piece of legislation I will touch on concerns the Transport of Dangerous Goods. Here it is important to distinguish between the hazardous waste regulations categorisation of some batteries as hazardous when waste, and the ADR classification of batteries as Dangerous Goods (for transport), which apply whether batteries are new, used or waste.

Table II shows that some batteries can be Dangerous Goods, but not Hazardous (when waste), some are both Hazardous (when waste) and Dangerous, and some are neither.

<table>
<thead>
<tr>
<th>Battery type</th>
<th>Hazardous when waste</th>
<th>Dangerous (whether new or old) – subject to ADR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkaline</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>NiMH</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Lead acid</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>NiCad</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Lithium and lithium-ion</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Damaged and defective lithium and lithium-ion</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Fig. 1. Thoughtlessly discarded batteries can pose a risk

The ADR regulations are mainly concerned with how batteries should be packed when being transported. These regulations move quite slowly, with an update adopted internationally every two years. With the emergence of lithium-ion batteries, the safe packing regulations have been running to catch up with the technological advancement. Still today, industry is grappling with how to safely pack and move a full electric vehicle battery that may weigh over 500 kg, and that may have become damaged in an accident. The packing requirements are quite onerous, but this is better than moving potentially flammable or explosive damaged lithium-ion batteries without addressing the risks adequately.

Conclusions

The variety of regulations in force in the UK for batteries are serving a great need, they are in principal necessary and proving broadly effective. However, it is vital that the legislating authorities (whoever they may be in the future) recognise not only the commercial requirements of supporting innovation and technological advancement, so that development is not stifled, but also the environmental and safety requirements that mean batteries can be dealt with without causing damage to people or the environment. This is a balance that is quite difficult to achieve, but that could be too costly either commercially or environmentally if it is not.

References

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The Author

Michael Green was Managing Director of G & P Batteries Ltd for 18 years. In 2015 he left G & P to become an independent consultant to the waste battery industry. In addition to project work covering topics such as battery, hazardous waste and transport legislation and the remanufacture of electric vehicle batteries, Michael has also undertaken consultancy work both in the UK and further afield. Such work has included research into attitudes towards legislation, and a detailed analysis of legal shipment methods for lithium-ion batteries and the ADR regulations. He is also a member of the Steering Committee of the International Congress for Battery Recycling, a conference held annually in Europe.