The International Lead Association's Steve Binks looks at the growing threat lithium ion batteries pose to lead acid recycling.

Lead, lithium recycling mix: a clear and present danger

The efficient collection and recycling of used lead-based industrial and automotive batteries is one of best examples of the circular economy in action. A recent study reported that 99% of all used lead-based automotive batteries are collected and recycled in Europe and in North America.

Unfortunately, a new phenomenon has put this remarkable recycling success story at risk.

In late 2013 International Lead Association (ILA) member companies that operate secondary lead smelters started to report an increase in the number of lithium-ion batteries that were mixed into deliveries of used lead-based batteries ready to use as feedstock for their recycling process.

Due to their chemical composition, fires can occur if a lithium-ion battery is heated up, or is subjected to a sustained shock (something that is common in battery breaking facilities) which would subsequently cause ignition of the flammable electrolyte.

Because lithium batteries have a higher energy density than most batteries, they present a greater risk of a thermal runaway reaction that can result in a fire. If the fire is seen, and put out quickly, then an explosion is unlikely to occur, but if the fire is not identified or put out quickly, the thermal runaway could potentially lead to an explosion.

In addition, the scenario is likely to be more severe if the batteries are in a confined space, as this can result in quicker temperature and pressure increases, and therefore an increased chance of an explosion. Sadly a number of significant safety incidents have now been reported that have highlighted the risk to property, but more importantly the safety of employees.

Confusingly, several lithium-ion batteries used in automotive applications have the same dimensions and appearance as lead SLI batteries, making them extremely difficult to identify with a visual inspection — especially when received in pallets or bins containing thousands of used batteries.

Friend or foe? At first glance these lithium ion batteries appear identical to their lead acid counterparts

Unlike lead-based batteries, there is little commercial value in a used lithium-ion battery — in fact, there is a cost to dispose of them. As a result there is actually an incentive to dispose of lithium-ion batteries by co-mingling them with used lead batteries.

So what is the scale of the problem?

In 2014, after the Association of Battery Recyclers also drew attention to this issue and called for action, ILA undertook a survey of its member companies across Europe and North America and discovered that 26 out of the 27 secondary smelters who responded reported incidents resulting from the inclusion of lithium-ion batteries in feedstock.

The respondents indicated that lithium-ion batteries had caused fires or, even in some cases explosions during the transport, storage, breaking and smelting operations.

It was also reported that the number of incidents was increasing, with the frequency in 2013 almost 10 times than seen in 2010.

As a result of these problems, lead battery recyclers have initiated a number of actions including raising awareness of the importance of separating different battery chemistries during collection before supply to smelters, increased training of employees and enhanced vigilance to identify the rogue batteries when scrap arrives at the smelter.

They have also investigated the use of enhanced separating technologies at the smelter such as identification by density, X-ray, or radio-frequency identification (RFID). In addition, the industry has called for urgent action by lithium-ion battery suppliers to im-

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— Rick Leiby, East Penn

prove the ability of collection companies and recyclers to identify the different battery technologies.

One of the simplest solutions is to label the batteries with some identifier that aids visual sorting, but putting labels on consumer products that will stay attached and remain legible at the end of life is a problem.

Moreover, existing batteries in circulation would also require labelling when they reached the end of life, prior to sorting and supply to the recycler.

ILA is concerned that the lead-acid recycling industry is facing an immediate issue about how best to address the problem as any potential labelling solution, be it voluntary or mandated by changes to existing regulation is several years away.

In the meantime we can expect that the number of used lithium-ion batteries resembling existing lead-based technology will only increase as these batteries reach the end of their useable life.

The search for a solution to allow better identification of different battery chemistries is ongoing in the US through the Society of Automotive Engineers (SAE) and in Europe through the International Electrotechnical Committee (IEC) with proposals to develop standardized colour-coded labelling, based on that already used in Japan.

These initiatives are collaborative and involve both lead-based and lithium-ion battery manufacturers as well as the recycling industry represented by ILA. However, it has to be said that this type of label may not work well when sorting at higher processing rates which are typical in lead-acid battery recycling facilities.

At a recent conference Rick Leiby, vice president metals operations for East Penn Manufacturing said: "Until the issue is truly resolved, the burden of disposal could ultimately fall on the shoulders of the lead-acid recyclers. Potential liabilities will be present to everyone involved for property damage, employee injury and environmental damage."

Lithium into lead won't go: an accident waiting to happen

He concluded that: "The burden for the sustainability and the responsible recycling of their products needs to be borne by the manufacturers of the alternative chemistries and not shirked off to other recycling industries".

It is clear that producer responsibility needs to play a significant role in any solution.

However, until improved battery chemistry identification solutions are adopted, all players including lithium ion battery manufacturers, battery sorters and lead battery recyclers, must work together to ensure that we are not faced with the tragedy of a fatality, or significant industrial injury, that has resulted from a fire or explosion caused by a lithium-ion battery erroneously entering the lead battery recycling stream.

THE ECONOMICS OF LEAD RECYCLING

All of the lead in a battery is available for recycling and with rates of lead recycling at 99% in both Europe and the US, lead batteries can be considered one of the most recycled consumer products in the world.

One of the reasons for high recycling rates is that there is a significant economic incentive to collect and recycle used automotive lead-based batteries.

Recycling lead is relatively simple and cost effective and, in most of the current applications where lead is used, it is possible to recover it for further use over and over again — in lead batteries, or other products — without any loss in quality.

STEVE BINKS

Steve Binks joined the ILA as its regulatory affairs director in 2011 having previously worked as director of hazard assessment & communication at GlaxoSmithKline