

*Electric vehicle dangers and other dilemmas*

# Battery safety: how to douse

In an industry seemingly changing with the tide, the great demand for high energy storage products is not expected to ebb any time soon. And the widely-held belief that battery safety is an unresolved, burning issue is proving equally persistent, it emerged at the latest International Congress for Battery Recycling.

**I**n case of a fire, people always assume “Well, someone must have made a mistake” - but in reality, what we see is that every actor in the chain has acted exactly according to the law,’ observed Katrin Beisswenger at the 19th International Congress for Battery Recycling (ICBR) held recently in the German city of Hamburg. ‘So how come things still go wrong? The incidents aren’t actually that surprising because none of the legal requirements in the EU Battery Directive addresses safety issues head on,’ the expert from 1cc Compliance Consulting told delegates. Despite the plethora of targets and standards out there, safety concerns are not subject to extended producer responsibility. This ‘legislative gap’ existed at the time of last year’s ICBR gathering

in Dubrovnik, Croatia, and remains relevant to this day. And Beisswenger doesn’t believe the prognosis for next year is much better. ‘It takes time to enforce legislation,’ she noted. Attacking the safety issue at take-back stage is a case of doing too little too late. ‘We need to start earlier,’ Beisswenger insisted. Investing in better packaging and innovative equipment will drive up costs for producers as well as recyclers. ‘This is why we need to provide incentives for those who do contribute - for example, those who design products so batteries may be easily removed,’ she added. ‘Producers are part of the problem; naturally, they should be part of the solution.’

### ‘Shared responsibility’

The truth is that battery removal ‘leaves a lot to be desired,’ stated Peter Binnemans, secretary general of EUCOBAT - the European association of national collection schemes for batteries. ‘As I am sure we all agree, the integrity of the batteries should be maintained during the removal process. Yet not all batteries can be removed without tools, and mechanical handling equals risk.’ And he added: ‘Collection is a shared responsibility - so is safety.’

There is a need to update the EU’s Waste Electrical and Electronic Equipment (WEEE) Directive, said Binnemans, not only to prevent safety risks but also to ensure that all batteries can be removed from appliances. He suggested that ‘quantified objectives’ should be imposed on e-scrap dismantlers for the removal of batteries from small equipment as well as IT and telecommunications equipment.

Also, all batteries have to be removed from ‘any separately collected WEEE’ prior to treatment - or during the treatment process, provided that this process can ensure that batteries can be separated in a distinct stream and that the batteries remain undamaged.

### Learning the hard way

And damage relating to batteries can be severe indeed, as Michael Green of UK-based G&P Batteries knows from personal experience. ‘Build-up of predominantly lithium-ion batteries caused two fires at our site in just three weeks,’ he lamented. ‘The first fire happened in January of this year, in which we lost 100 bins of collected batteries - thankfully, without any other damage. In February, we weren’t quite so lucky. The frustrating thing is, we were sure we had done just about everything to prevent it.’ Now G&P no longer classes batteries by type but rather by risk. This involves a crew of people deciding whether a unit is ‘low,’ ‘medium’ or ‘high’ risk. ‘The first class contains less than 5% lithium, the next up to 5% and the latter over 5%,’ Green explained to delegates. ‘This precaution goes above and beyond what is required by



Beisswenger: enforcing safety legislation is taking too long.

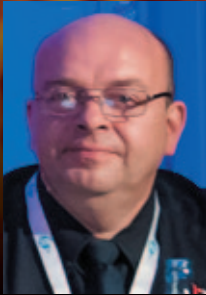


Binnemans: collection and safety are both a shared responsibility.

# the flames?



Green: G&P Batteries classes units not by type but by risk.



Vollmacher: please keep product information stupid-simple.

legislation, but we have learned the hard way.' This safety measure has been dubbed the 'customs inspection', Green noted. 'It demands us to question "Is this the material we were expecting?" If we find that the truck contains a batch with high-risk batteries, we act within 24 hours. To this end, we have established a, what we call, "sacrificial building"'. This temporary storage unit has a roof made out of fabric that will give way so the heat can escape in the event of a fire. Following these incidents, the recycler has also switched from using vermiculate as a cushioning option to regular sand, which recent tests have shown is 'much more effective'. This change is no luxury either given that stocks of mixed batteries have 'grown considerably' in the UK over the last few years.

## Ignorance is not bliss

To avoid last-minute surprises at the pick-up stage, a detailed control form is issued to prospective clients prior to collection. It covers exactly what type of (potentially hazardous) material is to be transported - ranging from

## The power of sand

**Using sand to put out battery fires is nothing new. But Dutch entrepreneur Johan van Peperzeel has come up with a new angle on a proven method.**

While enjoying his usual end-of-week cup of coffee with business partner Huib van Deutekom, the men entertained some innovative ideas. 'I suddenly realised what we need is sand, but in liquid form,' Van Peperzeel has told Recycling International about his patent-pending solution. 'At first, I thought that it wouldn't work,' he continued. 'Liquid sand equals mud, doesn't it? It was Huib who recognised I might be on to something. "Water glass is what you're talking about," he suggested. That's the common name for it; scientifically, we know it as sodium silicate.'

His idea, branded Li-Si, basically combines with the use of a standard fire extinguisher, instead filled with the liquid-type sand substance. The only reworking required is applying an inner coating of nitrogen so the 'water glass' won't eat away at the metal casing. 'We all have used sodium silicate at some point, as it is a popular ingredient in washing agents,' Van Peperzeel pointed out. 'In that case, it is included so it binds with the dirt in the washing machine, meaning it will leave the machine with the waste water. Using it to treat battery fires had never been attempted before - but that doesn't mean it can't be done.'

Latest tests carried out in September in cooperation with the Amsterdam fire brigade certainly support this claim. Lithium-ion batteries

from electric vehicles provided by Dutch car recycling authority ARN were allowed to burn 'full blast' before being treated first with water and subsequently with Li-Si. Water not only made the flames spread but also caused liquid aluminium to fly into the air. Van Peperzeel's solution, on the other hand, succeeded in putting out the fire with just two shots. A final shot of Li-Si can be applied in case the internal debris is on fire. Pitches to the Netherlands' Ministry of Defence have been concluded, with the result that the Dutch Air Force, the Royal Army and the Royal Navy are interested in employing the new extinguisher in the field of action. 'Now all that is left is finding the right partner to market the Li-Si for us,' noted Van Peperzeel. 'This could potentially be very big.'

[www.peperzeel.nl](http://www.peperzeel.nl)





Complex 'prosumer' devices might spark spectacular incidents.

button cell batteries to explosives and equipment containing polychlorinated biphenyls. It also gives details about the state of the material, about whether batteries are completely discharged and whether there are terminal wires connected to batteries, etc. Such a strict 'yes/no/I don't know' overview has really helped to provide clarity. 'They sometimes say that ignorance is bliss, but not when it comes to batteries,' Green argued. And consumers in particular can be on the receiving end of this ignorance. Sharing a low-risk example, Green recalled how small-time fraudsters had recently abused the fact that batteries can be tricky to identify. 'We were handed blocks of concrete, wrapped in black plastic labelled lithium-ion as a scheme to get the most value for it,' he said.

### Different language

Boasting 26 years of experience as a fire-fighter, Kurt Vollmacher has seen many fires at first hand. One he can't easily shake from his mind was a violent blaze following a Tesla e-car crash. 'Above all, I must stress one thing - keep information simple-stupid,' he urged delegates. 'You see, when my team and I answered that call, we had no real idea how to stop the fire.'

In his opinion, it is rare for manufacturers of batteries and manufacturers of cars actually to 'speak the same language'. The best advice would be to work on the necessary symbols and manuals together, Vollmacher observed. 'It should be easy for us to figure out if we should use water to put out the flames or not. It isn't. There is no consensus. Besides, we have no time to read a book-length guidebook at the scene of the accident.' Instant clarity by use of simple, universally-employed symbols would be ideal. But quick battery identification isn't enough, the fire-fighter pointed out. 'I have encountered a battery with a metal casing on numerous occasions,' he went on to explain. 'This makes our job nearly impossible because it means that the water can't get through and reach the battery at all.' A 'promising development' is Renault's pioneering approach to this safety problem involving a plastic battery cover that will melt in a fire. Vollmacher hailed this as a call to action for other manufacturers.

### Tunnel vision

What goes wrong on the roads might also go wrong in the sky - and sooner than we think, commented battery veteran Jean Pol Wiaux from Recharge. 'Take the drone helicopter, for example,' he said. 'This plaything has evolved from a child's toy available for under US\$ 100 to a "prosumer" product used by the military in covert operations. We are speaking of a very innovative product powered by very complicated technology. The drawback here is the potential for lithium-ion incidents. They might not occur often, yet have a spectacular nature when they do.' Wiaux also slammed the persistent belief that design of a consumer product 'must' be geared towards making it the leader in a cutting-edge market. 'Manufacturers are suffering from tunnel vision,' he complained. 'They are losing sight

of what's really important, like safety.'

Touching upon air transport, Wiaux reported that cargo aircraft are subject to 'far more' fires than passenger aircraft. Another fact is that, in 75% of the cases, the incident is linked to handling of cargo before and after a

flight. 'Transportation of devices like cameras and iPads is a catalyst for disaster,' he contended. A possible solution is to ship them separately from other goods and in a special compartment, he suggested. Headway in this area has already been made by logistics major UPS. 'Its new fire-resistant loading container can withstand up to 650 degC,' Wiaux told delegates. □

### Sorting by element



There are glad tidings for battery sorting, according to Jan Sletsgaard, project manager at Danish firm FORCE Technology. Innovation

is centring round a device capable of prompt gamma neutron activation analysis (PGNA). This portable sorting machine can be added to an existing line and is able to separate lithium-ion batteries into two groups based on the presence of cobalt.

The presence of rare earth elements in nickel-metal hydride (NiMH) batteries should, 'in theory', yield plenty of signals for analysis. In this case, initial calculations suggest a processing capacity of one battery per second, depending on the size of the battery. 'The overall contamination is as low as 0.005%; we can acquire a positive identification in tens of milliseconds,' Sletsgaard added. 'It is element-based technology. It sees which elements are inside, so to speak.' Except for lead, he was quick to add.

A total of 11 elements on the periodic table are well suited to detection via this system, namely cadmium, boron, cobalt, copper, europium, gadolinium, iron, neodymium, nickel, lanthanum and samarium. Nickel-cadmium batteries stand out owing to their abundance in the waste stream as well as their unique signal.

'As a next step, we established a set of criteria based on analysis to better sort out different types of battery,' Sletsgaard explained. 'In a sample, we sorted three generations of batteries. Also, it was able to identify six different brands of laptop batteries. We found the sorter can handle bulk identification, though we prefer single-file placement on the belt.'

There is already a model four times larger that sorts PVC. The engineer stressed: 'This is no off-the-shelf device. This is a tailor-made solution for each individual purpose.' [www.forcetechnology.com](http://www.forcetechnology.com)

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