



The Challenges of High-Energy Batteries in WEEE

Going Green – Care Innovation 2018

Manfred Fahrner

1

High-Energy Batteries in WEEE

How big is the challenge?

German battery recycling company Accurec estimated in EUWID July 2018

- 50.000 tons/year of Li-Ion-Batteries sold to European households
- to increase to 150.000 tons/year by 2025



High-Energy Batteries in WEEE

Incidents at WEEE Recycling Facilities

**It is a cold day –
but this is not the way to heat!**



ALBA Electronics Recycling



High-Energy Batteries in WEEE

Incidents at WEEE Recycling Facilities



Germany 2018



High-Energy Batteries in WEEE

Incidents at WEEE Recycling Facilities



Germany 2018



High-Energy Batteries in WEEE

Transport of WEEE gone wrong



German Motorway 2017y



High-Energy Batteries in WEEE

What is happening?

- All recycling companies experience dangerous situations
- Many reports of serious incidents – fires caused by high-energy batteries
- Often during unloading, storage und handling
- Incidents at collection centers and transfer stations
- There are reports of delayed action fires
- There are suspicions that batteries may be may have caused fires at other waste streams (packaging, paper, house-hold waste)



High-Energy Batteries in WEEE

What is the challenge?

- Risks for lives and company assets
- Increased costs for fire protection, detection and fire fighting
- Insurance costs are multiplying
- Some companies may not receive insurance coverage any more
- Lack of coverage will end operations and stop investments
- **Entire WEEE take-back systems at risk**



High-Energy Batteries in WEEE

What makes high-energy batteries dangerous?

Different batteries by chemical type

- Nickel-cadmium
- Nickel-Metal-hydrid
- Alcalic-Manganese
- Primary Lithium
- Lithium-Ionic
- Lithium-Polymer
- others



High-Energy Batteries in WEEE

What makes high-energy batteries dangerous?

Different types of batteries by design or shape

- button cells
- round cells
- power packs
- prismatic cells
- pouch cells



High-Energy Batteries in WEEE

What makes high-energy batteries dangerous?

Different types

- button cells
- most are primary lithium cells, but some special applications



Photo: ALBA Electronics Recycling



High-Energy Batteries in WEEE

What makes high-energy batteries dangerous?

Different types

- round cells
- note: no markings



Photo: ALBA Electronics Recycling



High-Energy Batteries in WEEE

What makes high-energy batteries dangerous?

Different types

- round cells
- damaged on arrival in bulk transport



Photo: ALBA Electronics Recycling



High-Energy Batteries in WEEE

What makes high-energy batteries dangerous?

Different types

- power packs with round cells
- damaged on arrival, but cells still intact



Photo: ALBA Electronics Recycling



High-Energy-Batteries in WEEE

What makes high-energy batteries dangerous?

Different types

- power packs
- removable
- good protection



Photo: ALBA Electronics Recycling



High-Energy Batteries in WEEE

What makes high-energy batteries dangerous?

Different types

- prismatic cells



Photo: ALBA Electronics Recycling



High-Energy Batteries in WEEE

What makes high-energy batteries dangerous?

Different types

- pouch cells



Photo: ALBA Electronics Recycling



High-Energy Batteries in WEEE

What makes high-energy batteries dangerous?

Different types

- power packs with pouch cells
- non removable, no protective housing



Photo: ALBA Electronics Recycling



High-Energy Batteries in WEEE

What makes high-energy batteries dangerous?

Different types

- power packs with pouch cells
- damaged on arrival, pouch cells inflated



Photo: ALBA Electronics Recycling



High-Energy Batteries in WEEE

What makes high-energy batteries dangerous?

Do you find the lithium battery?

Would you suspect this item to cause a fire?



Photo: ALBA Electronics Recycling

20



High-Energy Batteries in WEEE

What makes high-energy batteries dangerous?

Do you find the lithium battery?

It took almost 10 minutes to remove the battery



Photo: ALBA Electronics Recycling



High-Energy Batteries in WEEE

What makes high-energy batteries dangerous?

Do you find the lithium battery?

Would you even recognise it as an electronic device?



Photo: ALBA Electronics Recycling



High-Energy Batteries in WEEE

What makes high-energy batteries dangerous?

Do you find the
lithium battery?



Photo: ALBA Electronics Recycling



High-Energy Batteries in WEEE

Are all high-energy batteries dangerous?

- Institut für Energie- und Umwelttechnik e.V. IUTA
Düsseldorf, Germany

„Analyse des Gefährdungspotenzials von Hochenergiebatterien in Abfallströmen und Lösungsvorschläge (AGHBA)“

„Analyses of the hazard potential of high-energy batteries in waste...“

Preliminary report, July 2018



High-Energy Batteries in WEEE

IUTA „Analyses of the hazard potential of high-energy batteries in waste...“

chemical type	shape	nominal voltage	actual voltage	result
NI-MH	round-cell	1,2 V	0,8 V	no reaction
NI-MH	round-cell	1,2 V	1,24 V	60° C
Li-ion	prismatic cell	3,7 V	3,97 V	120° C, cell expands, gas leakage
Li-ion	prismatic cell	3,7 V	4,5 V	fire, explosion, 750° C
Li-ion	pouch cell	3,8 V	4,55 V	fire, explosion, 800° C
Li-ion	prismatic cell	3,7 V	3,89 V	85° C
Li-ion	pouch cell	3,7 V	4,52 V	fire, explosion, 600° C
Li-ion	pouch cell	3,7 V	4,48 V	fire, explosion, 800° C
Li-ion	pouch cell	3,7 V	4,49 V	fire, explosion, 800° C
Li-ion	pouch cell	3,7 V	3,57 V	95° C
Li-ion	pouch cell	3,7 V	0,55 V	no reaction

Source: IUTA



High-Energy Batteries in WEEE

Are all high-energy batteries dangerous?

IUTA „Analyses of the hazard potential of high-energy batteries in waste...“

- Moderate risks from Li-Ion prismatic cells and Li-Polymer cells
- Lower risk from button cells, round cells, battery packs
- Lower risk from other chemical types
- **Main risks from Li-Ion pouch cells**



High-Energy Batteries in WEEE

IUTA „Analyses of the hazard potential of high-energy batteries in waste...“

- Climatic strain causes little fire hazard – low risk of emissions of substances of concern
- Chemical run-away only with batteries with high remaining charge
- External shorting causes little fire hazard - low risk of emissions of substances of concern
- **Highest risk** by internal shortage due to **physical damage**
 - extend of fire hazard depending on actual charge
 - high risk when actual charge is equal or higher than nominal charge
 - high risk of emissions of substances of concern



High-Energy Batteries in WEEE

Are all types of high-energy batteries dangerous?

But:

- WEEE consists of many flammable components, and needs little to ignite
- Each movement of WEEE increases risk of damaged batteries
- Risks aggregate at recycling facilities
- **Batteries only start fires – but 1 damaged battery is enough to start a disaster**



High-Energy Batteries in WEEE

EERA-Position: What must be done?

Collection

- Collection centers shall personally accept appliances from citizens to avoid accidental dropping into large bulk container
- Collection centers shall ensure that removable batteries are removed
- All appliances containing (non-removable) batteries to be placed into dedicated containers – not bulk
- **Staff must be trained to recognize hazards**



High-Energy Batteries in WEEE

EERA-Position: What must be done?

Collection and transport

- **ADR** rules are in force and must be complied with, but
 - are very complex and were not written for waste
 - need to be reviewed for waste transport
 - **no transport of appliances containing batteries in bulk**
- **Common sense** dictates
 - no tipping of containers from height
 - no dropping of appliances from above
 - no compacting of WEEE for transport
 - avoid reloading/container change



High-Energy Batteries in WEEE

Examples of suitable transport systems for WEEE containing batteries



Source: PP Pooling Partners

Seite 31

High-Energy Batteries in WEEE

EERA-Position: What must be done?

Eco-Design and Production

- Appliances should be clearly marked if containing batteries
 - batterietype and location
- Batteries should be removable
 - without special tools or special product knowledge
- Design should take into account the actual collection systems that are close to households
 - no reference to specialised take-back locations only
- **no unprotected pouch cells**

High-Energy Batteries in WEEE

EERA-Position: What must be done?

Producer Responsibility

- Growing content of batteries will increase costs for collection and treatment
- WEEE recycling industry can not cover these costs from material yields
- Producers and producer take-back-schemes must face the challenges
 - adapt collection systems to increase of batteries
 - plan for higher costs
- **If Producer Responsibility can not master the challenges then law makers must react and enforce rules**



High-Energy Batteries in WEEE

EERA-Position: What must be done?

Electronics Industry – Circular Economy and Eco-Design

- Introduce safer batteries urgently – the environment, lives and assets are at risk
- Bringing technologies into the market without considering all phases of product life – including end-of-life – is **old thinking**



High-Energy Batteries in WEEE

EERA-Position: What must be done?

**Electronics Industry –
Circular Economy and Eco-Design**

- **New thinking is needed!**



High-Energy Batteries in WEEE

EERA-Position: What must be done?

Legislation

- **If Producer Responsibility can not master the challenges then law makers must enforce rules**



WEEE Recycling

- is not scrap recycling
- is not digging for precious metals
- means handling dangerous materials
 - electronic waste is highly complex, dangerous and messy
- requires knowledge and great care



37

WEEE Recycling

- is not scrap recycling
- is not digging for precious metals
- means handling dangerous materials
 - electronic waste is highly complex, dangerous and messy
- requires knowledge and great care
- **WEEE Recycling is clearing up the mess left by others!**



38



Manfred Fahrner

EERA
European Electronics Recyclers Association
Pels Rijckenstraat 5
6814 DK Arnhem
The Netherlands

Info@eera-recyclers.com
www.eera-recyclers.com

39

High-Energy Batteries in WEEE

Acknowledgements

- Institut für Energie- und Umwelttechnik e.V. IUTA
Düsseldorf, Germany
- ALBA Electronics Recycling GmbH, Germany
- Workshop Erstbehandlung / Arbeitskreis Batteriebetriebene Geräte
- PP Pooling Partners, The Netherlands

