



CARE Preliminary Findings and Research Needs Report: Lithium Battery Safety in Cardiff

The Open University

September 2026

Collective Action for Responsible Environment (CARE) is an interdisciplinary partnership between Cardiff Council and The Open University, grounded in a Common Good HRM approach. CARE brings together researchers, policymakers, practitioners, schools, and communities to address environmental challenges through shared responsibility, collective action, and evidence-based solutions that promote environmental sustainability and societal wellbeing.

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Acknowledgements

The CARE in Action team thanks Cardiff Council for its partnership and commitment to addressing lithium battery safety and environmental sustainability.

We are also grateful to St Illtyd's School Eco Club and Mary Immaculate High School students, teachers and households whose ideas and experiences help shape the project.

We further thank all partners, practitioners and community organisations contributing their expertise, time and support to strengthen awareness, collective responsibility and action for a safer and more sustainable future.

Executive Summary

Between January and July 2026, the Collective Action for Responsible Environment (CARE) partnership between Cardiff Council and The Open University conducted research with 77 participants across Cardiff, including residents, school pupils, waste professionals and key stakeholders, to understand lithium battery awareness, disposal behaviours and opportunities for intervention. The research was organised into four stages: Knowledge Mapping, Behaviour Mapping, Solution Mapping, and Research Needs Mapping.

Knowledge Mapping found that while participants were generally familiar with lithium battery-powered devices such as phones, laptops, power banks, e-scooters and electric vehicles, many struggled to identify lithium batteries, understand fire risks, and know how to dispose of them safely. This revealed a significant **awareness-action gap**.

Behaviour Mapping identified common disposal practices, barriers and motivations. Batteries were frequently stored at home or disposed of incorrectly, largely due to uncertainty, convenience, and a lack of visible disposal options. However, participants demonstrated strong motivations linked to family safety, environmental protection, and community wellbeing. This analysis led to **Public Segmentation Mapping**, which identified distinct citizen groups with different awareness levels, attitudes and behaviours, highlighting the need for targeted interventions.

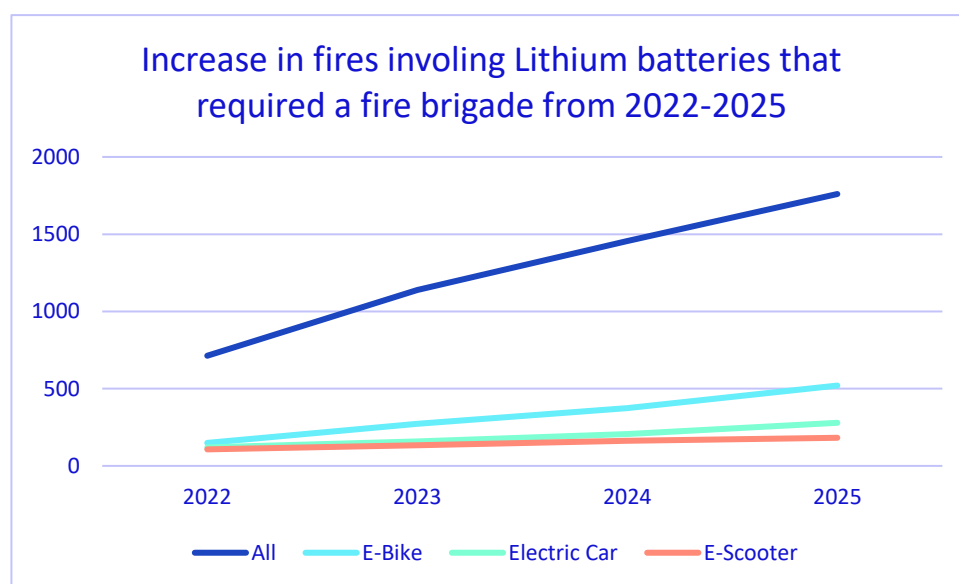
Solution Mapping generated and prioritised a range of interventions, resulting in a Solutions Roadmap. Key priorities included school-based education, clearer public guidance, improved collection infrastructure, retailer involvement, and stronger leadership and coordination from Cardiff Council.

Finally, **Research Needs Mapping** identified important evidence gaps, including understanding how **collective responsibility** develops, how awareness can be translated into sustained action, and how participatory approaches such as **Green Game Design** can support long-term behaviour change.

Overall, the findings demonstrate that lithium battery safety in Cardiff is not simply a waste-management issue but a **collective responsibility challenge** requiring coordinated action across citizens, schools, local authorities, industry and policymakers.

Introduction

Lithium-ion batteries are becoming increasingly common in homes, schools and workplaces through the growing use of mobile phones, laptops, e-bikes, e-scooters, vapes and electric vehicles. However, improper disposal is creating growing safety and environmental risks. Between 2022 and 2025, lithium battery-related fires attended by UK fire brigades **increased by 147%**, from 713 to 1,760 incidents annually, while e-bike battery fires rose by 249%. Waste operators, local authorities and fire services are reporting increasing numbers of fires in bin lorries, recycling facilities, waste sites and homes linked to discarded batteries and vapes.



A growing number of lithium battery-related fires and explosions across Cardiff and South Wales has raised significant concern among local authorities, fire services and waste operators. Between 2020 and 2025, 136 lithium battery fires were recorded across South Wales, with 100 incidents occurring in the last two years alone, highlighting the rapidly escalating nature of the problem.



In response, the Collective Action for Responsible Environment (CARE) partnership between **Cardiff Council** and **The Open University** conducted research across Cardiff between January and July 2026. The study explored public awareness of lithium batteries and associated risks, disposal behaviours, barriers and future research priorities.

Methodology

The research was conducted between **April and May 2026** and involved **77 participants** from across Cardiff. Data were collected through

- **three adult focus groups** involving 28 participants,
- **two school focus groups** involving 40 pupils,
- **three interviews with waste collection and waste management professionals**
- **three informal stakeholder meetings** with representatives from Veolia, HR and waste management providers, and
- **email consultations** with Cardiff Council contacts.

The primary data were supplemented by a review of relevant industry reports, media articles and published papers. Together, these sources provided insights into public awareness of lithium batteries, disposal practices, stakeholder perspectives and potential solutions for improving lithium battery safety in Cardiff.



Figure 1: A focus group at Eco Committee at St Illtyd's Catholic High School

Findings

Knowledge Mapping

Understanding lithium batteries, risks and disposal practices

Across all groups, awareness of lithium batteries was relatively high. Participants could readily identify devices containing lithium batteries, particularly mobile phones, laptops, tablets, power banks, e-scooters, e-bikes and electric vehicles. However, understanding of the batteries themselves was often limited.

One school student explained:

"Lithium batteries are in electronics e.g. phones, TVs, power banks, e-scooters, laptops." (FG1)

Another associated them with rechargeable technologies:

"They are rechargeable, they are used in electric bikes and cars." (FG2)

Despite this familiarity, many participants struggled to identify lithium batteries correctly or distinguish them from other battery types. Knowledge was often based on assumptions rather than certainty.

"You can tell it is a lithium battery because it will need charging." (FG1)

"You can ask the person that you buy them from if they are lithium batteries."
(FG2)

Key findings

- Most participants recognised lithium battery-powered devices.
- Many struggled to identify lithium batteries themselves.
- Awareness of disposal requirements was inconsistent.
- Fire risk was better understood than environmental risks.
- Practical battery literacy was generally low across participant groups.

Key insight

People recognised lithium batteries in everyday life but often lacked the knowledge needed to identify, store and dispose of them safely.

Behaviour Mapping

How people dispose of lithium batteries

Participants described a range of disposal practices. While many wanted to dispose of batteries responsibly, uncertainty and convenience often shaped behaviour.

Several participants admitted storing batteries at home:

“Most of the lithium batteries I've got are mostly stored at home.”

Others acknowledged uncertainty around correct disposal routes:

“People, including myself, aren't always sure what the right thing to do is.”

Waste professionals reported finding batteries regularly entering residual waste streams, mixed recycling and public litter bins.

A particularly concerning theme was the growing connection between incorrect disposal and fire incidents. As highlighted by a waste management stakeholder:

“We've had two vehicle fires within two weeks and lithium batteries are thought to be involved.” (paraphrased from professional interview evidence)

Key barriers

- Uncertainty about disposal locations.
- Poor understanding of battery types.
- Convenience and habitual behaviour.
- Limited visibility of disposal facilities.

Key motivations

- Protecting family safety.
- Preventing fires.
- Environmental responsibility.
- Keeping communities safe.

Key insight

Unsafe disposal is often driven by uncertainty and convenience rather than a lack of concern.

Public Segmentation Mapping

Different people, different behaviours

Analysis of awareness, attitudes and behaviours revealed that Cardiff residents cannot be treated as a single audience.

Persona	Size (n / %)	Age	Ethnicity	Employment	Household	Location Pattern	Distance to Recycling	Key Behaviours	Main Barriers	Key Motivations
Urban Young Professionals	7 (32%)	<29	Mostly BAME	Full-time	Medium-large (4-10)	CF10 / CF11 (central)	Mixed (often >1km)	High device use, mobile lifestyle, irregular recycling	Time, convenience, lack of awareness, shared responsibility	Convenience, social norms, environmental concern
Family-Focused Households	4 (18%)	30-40	Mixed	Full-time	Large (5+)	Mixed (central + outer)	1-5 km typical	Structured routines, high waste volume	Time pressure, logistics, coordination across family	Responsibility to children, routine integration
Older Residents	7 (32%)	41+	Mostly White	Retired / part-time	Small (1-2)	More dispersed (CF5, CF14, CF24)	Mostly <1 km	Habit-driven, lower consumption	Lack of habit, low urgency, unclear guidance	Civic duty, simplicity, local engagement
Budget-Conscious Workers	4 (18%)	Mostly <40	Mostly White	Part-time	Small-medium	Less central	Often >1 km	Practical, cost-focused, selective engagement	Effort vs reward imbalance, low perceived impact	Incentives, ease, tangible benefits
Shared Living Group (cross-cutting)	~5 (subset across above)	<30	Mostly BAME	Full-time	Large/shared	Central (CF10/CF11)	Mixed	Shared consumption, unclear ownership	Diffusion of responsibility, disorganisation	Clear systems, peer influence

Table 1: Five citizen segments

Analysis of awareness, attitudes and behaviours identified **five citizen segments**, which can be grouped into three broad profiles:

- **Environmentally aware but convenience-driven users** (e.g., young professionals and many students), who recognise environmental risks but often prioritise convenience when disposing of batteries.
- **Safety-motivated households** (particularly families), who are most responsive to messages about protecting children, preventing fires and keeping communities safe.
- **Less confident or less engaged users** (including some older residents, budget-conscious workers and shared-living households), who often struggle with battery identification, disposal knowledge or see disposal as a low priority.

Key Insight

Residents differ significantly in their awareness, motivations and disposal behaviours. As a result, effective interventions will require tailored messages, communication channels and support mechanisms rather than a one-size-fits-all approach. For example, family-focused campaigns may emphasise safety, while younger groups may respond better to convenience-focused solutions and digital engagement.

Solution Mapping and Solutions Roadmap

What participants think should happen next

Participants generated a wide range of ideas for reducing battery-related risks. The strongest support was for solutions that combined education, infrastructure and shared responsibility.

School pupils frequently suggested practical solutions:

“There should be battery bins in schools.”

Participants across all groups called for clearer communication:

“People need to know where they can take them.”

Waste professionals emphasised that disposal cannot be solved through awareness alone:

“The easier we make it, the more likely people are to do it.”

Priority solutions

Education

- School programmes.
- Public awareness campaigns.
- Fire safety messaging.

Infrastructure

- More collection points.
- School collection schemes.
- Retailer take-back initiatives.

Shared Responsibility

- Greater involvement from manufacturers.
- Clear leadership from Cardiff Council.

- Better coordination across organisations.

Key insight

Participants consistently favoured system-wide solutions rather than relying solely on individual behaviour change.

Research Needs Mapping

What we still need to know

Participants recognised that lithium battery safety is an emerging challenge and highlighted several unanswered questions.

These included:

- How can awareness be translated into long-term behavioural change?
- Which interventions work best for different citizen groups?
- How can schools influence household disposal behaviours?
- What role can community-based approaches play in reducing risks?
- How can organisations work together more effectively?

Key insight

Lithium battery safety was viewed not simply as a waste issue, but as a collective responsibility challenge requiring ongoing collaboration between citizens, schools, Cardiff Council, industry and policymakers.

Overall Finding

The research shows that lithium battery safety in Cardiff is fundamentally a **collective responsibility challenge**. While awareness exists, uncertainty about identification, disposal and risk remains widespread. Participants strongly supported a combination of **education, infrastructure improvements, community engagement and coordinated leadership** to reduce the growing risks associated with lithium batteries

Discussion and Implications

The findings suggest that lithium battery safety in Cardiff is not simply a waste-management issue but a **collective responsibility challenge** involving residents, schools, local authorities, retailers, manufacturers and waste management organisations. While awareness of lithium battery-powered devices was generally high, practical understanding of battery identification, associated risks and safe disposal routes was often limited. This disconnect between awareness and action emerged as the most significant finding of the study.

A key challenge is that many residents appear willing to dispose of batteries responsibly but lack the confidence, information or infrastructure required to do so consistently. As one participant observed:

“People, including myself, aren’t always sure what the right thing to do is.”

Similarly, school pupils demonstrated strong familiarity with lithium battery-powered devices but often struggled to identify lithium batteries themselves or understand what should happen to them at the end of their life.

The findings also suggest that many unsafe disposal practices are not the result of negligence but rather a combination of **uncertainty, convenience and limited visibility of disposal options**. Batteries are frequently stored at home, forgotten, or placed in general waste streams because people are unsure where to take them or do not encounter disposal opportunities during their daily routines. This has important implications for future interventions: information alone is unlikely to be sufficient if safe disposal remains difficult or inconvenient.

The research further highlights the importance of understanding different citizen groups. Some participants were strongly motivated by environmental concerns, while others responded more readily to messages about fire prevention and family safety. The segmentation analysis demonstrated that different groups experience different barriers and require different forms of engagement. A single communication campaign is therefore unlikely to achieve widespread behaviour change. Instead, interventions should be tailored to the needs and motivations of specific audiences.

Perhaps the most consistent message from participants was the need for **shared responsibility**. Residents, schools, retailers, manufacturers, waste operators and Cardiff Council were all seen as having important roles to play. Participants repeatedly called for clearer guidance, stronger leadership and greater coordination between organisations. This suggests that lithium battery safety should be approached as a systems challenge requiring collaboration across multiple stakeholders rather than relying solely on individual behaviour change.

Implications for Cardiff Council

The findings suggest several priorities for Cardiff Council:

- Develop targeted awareness campaigns focused on battery identification, fire risks and disposal routes.
- Improve the visibility and accessibility of battery collection infrastructure.
- Coordinate communication across council services, schools, retailers and community organisations.

- Use audience segmentation to tailor messages to different resident groups.
- Position lithium battery disposal as a public safety issue as well as an environmental issue.

Implications for Schools

Schools emerged as an important setting for intervention because young people are frequent users of battery-powered technologies and can influence behaviour within their families.

The findings suggest opportunities to:

- Integrate battery safety into environmental and sustainability education.
- Develop practical battery literacy activities focused on identification and disposal.
- Introduce school-based collection schemes.
- Engage pupils as ambassadors for safe battery disposal within their communities.

Implications for Industry and Waste Management Organisations

The findings highlight the need for stronger collaboration between manufacturers, retailers and waste operators to support residents throughout the battery lifecycle.

Potential actions include:

- Clearer labelling of lithium battery products.

- Expansion of retailer take-back schemes.
- Improved point-of-sale information.
- Greater consistency in disposal guidance.
- Continued investment in prevention rather than responding to incidents after they occur.

Overall Conclusion

Taken together, the findings indicate that reducing lithium battery-related risks requires more than simply raising awareness. Success will depend on combining **education, accessible infrastructure, targeted communication and coordinated leadership**. By addressing the awareness-action gap and strengthening collective responsibility, Cardiff has an opportunity to reduce fire risks, improve environmental outcomes and build a more informed and engaged community around lithium battery safety.

Appendices

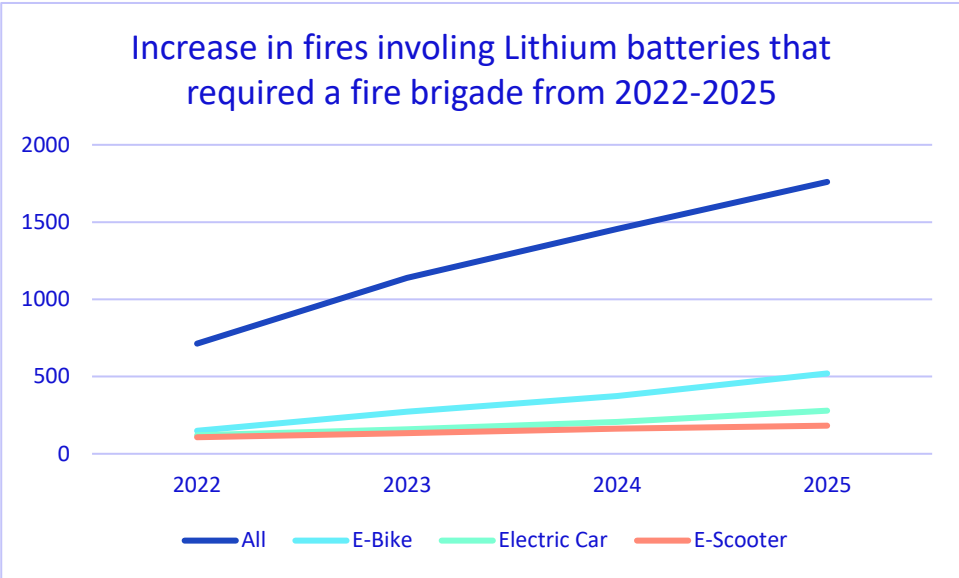
Batteries cause bin fires

Written by James Gibbs

The increase in Lithium-Ion batteries is leading us into trouble. While the energy used may be clean, the aftermath of improper disposal is not. Local environmental hazards can include water pollution and fires as well as the fact

that a number of associated electrical components contain other substances hazardous to health.

The most obviously growing area of concern is the increasing incidence of fires requiring a fire brigade. The multinational insurance group QBE released



research in May 2026 that revealed there has been a 147% increase in Lithium-Ion battery linked fires since 2022, up from 713 to 1760 in

2025, meaning that brigades are now putting out an average of 4.8 Li-Ion fires per day. The largest increase is in E-bike batteries with an increase of 249% in fires during the same time period.

Source	2022	2023	2024	2025
All	713	1138	1456	1760
E-Bike	149	272	373	520
Electric Car	120	158	207	279
E-Scooter	107	134	162	182

While we can't eliminate the risks posed by these batteries it seems that a good number of incidents could be avoided with better education on the potential

hazards, and better practices being observed by both the public and professionals particularly with regards to disposal and recycling. A number of fires in bin lorries have been attributed to vapes thrown in general waste or mixed recycling and subsequently being damaged by the machinery. This includes an incident reported in the Cambrian News, when an LGV carrying 30 tonnes of mixed recycling caught fire while on the Newtown bypass requiring crews to be called out from both Newtown and Llanidloes. The fire, which occurred on the 7th of June 2024 required a multi agency response involving not just Mid and West Wales Fire and Rescue Service but also the local authority, Dyfed-Powys Police and Natural Resources Wales. Fire crews left the scene the following day.

Perhaps unsurprisingly considering the ever-increasing quantity of lithium batteries thrown away (the Environmental Services Association states that around 6bn batteries were thrown away across the UK in 2024) this sort of incident is unfortunately increasingly common, whether in transit or at a facility. According to reports in The Western Telegraph, two separate fires at an industrial estate in Pembrokeshire required a multi crew response. The first incident which broke out in a section reserved exclusively for electronics took crews from six different stations around eighteen hours to put out. The second fire, which took place at a car breakers on the same estate, also attributed to lithium batteries, took a total of twelve appliances and crews from seven different stations more than three hours to control. This theme is repeated regularly across the country. Suez, who operate a number of recycling facilities throughout the UK estimate that of 670 fires across their sites in 2025, 368 were confirmed to be caused by batteries or vapes, with a further 176 suspected to be

linked. Dr Adam Read, the companies Chief Sustainability and External Affairs Officer was quoted in the Guardian as saying

“Across the sector we estimate around £1bn a year is being spent, or needs to be spent, dealing with this issue”

He is also quoted recalling a major fire at a site in Aberdeen in 2021

“It was £20m of investment gone... These are serious risks”

Unsurprisingly there are far more examples across the industry. In an article on the BBC website the contractor Veolia is reported to have said that across its sites and vehicles there were 370 fires in 2025 where a battery is the suspected cause. One other example is a waste facility in Bletchley, where a fire broke out last March causing an estimated £1m of damage to a building that was only in use because the previous storage building had already burned down in a suspected battery fire. Brian Ashby (the head of municipal collections for FCC Environment who run the site in Bletchley) is quoted by the BBC.

“As an industry, it is becoming harder and harder to even get these sites insured, we have to price the service commensurately. Obviously that then gets passed down the chain”

Clearly if we don't tackle this problem, we will all pay the price. Quite aside from that there is the very real risk to lives and livelihoods from these incidents. Outside of the waste disposal industry there have also been a number of terrible fires starting in homes with all the loss and risk that house fires entail. The question must not be “Can we do better” but “How can we afford not to?” from not only the fiscal, but more importantly a moral point of view. When a lack of

information on safe use and disposal of Lithium-Ion battery powered devices results in fires that cost people their homes, their health, and in the worst case scenario their lives, it's surely no question at all.

Data, quotes and incidents taken from:

- [Why batteries in our bins are a burning issue - BBC News](#)
- [Cause of fire at Waterston Car Breakers fire confirmed | Western Telegraph](#)
- [Cause of fire at Waterston Industrial Estate unit confirmed | Western Telegraph](#)
- [Disposable vapes believed to be the cause of lorry fire | cambrian-news.co.uk](#)
- [Fire experts 'kept awake' over growing hazard of lithium-ion batteries | Lithium-ion batteries | The Guardian](#)
- [Why batteries in our bins are a burning issue - BBC News](#)
- [Fire Experts Warn of Escalating Lithium-Ion Battery Hazards as Incidents Surge Across the UK | CTIF - International Association of Fire Services for Safer Citizens through Skilled Firefighters](#)
- [UK brigades tackling lithium-ion battery fire every five hours - QBE European Operations](#)
- [Fire and 'sheer volume': how Britain's 6m-vape problem is putting recycling under strain | Vaping | The Guardian](#)

This project offers a fresh perspective by applying CGHRM to the management of hazardous waste, emphasising the role of HRM practices in fostering sustainable behaviours within organisations and local communities.

This research not only contributes to the advancement of environmental health research by linking HR practices with environmental sustainability but also provides actionable insights for policy development, institutional alignment, and employee engagement strategies.

For more information regarding the project, please visit our website:

<https://business-school.open.ac.uk/research/research-projects/common-action-responsible>

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