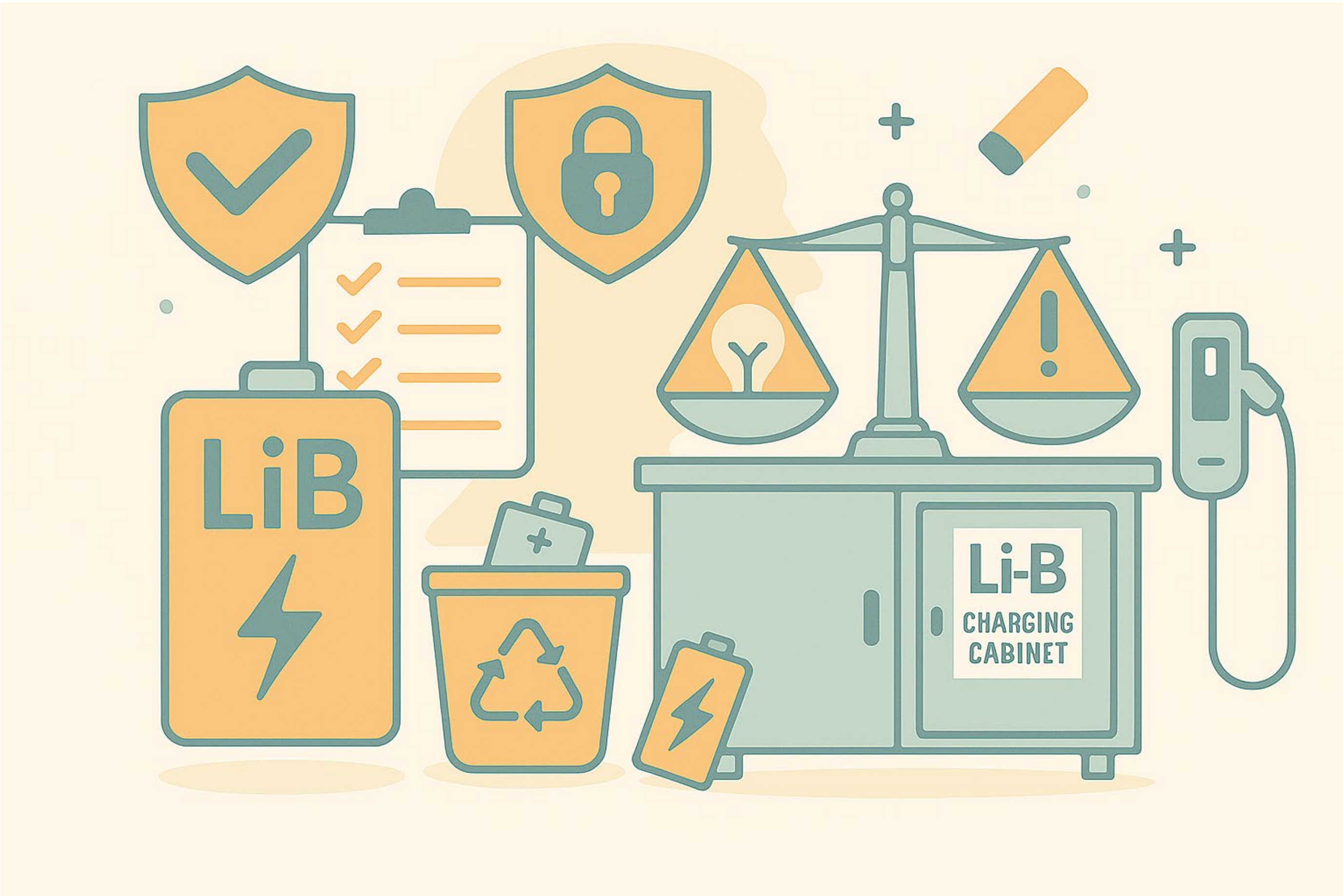
Lithium-Ion Battery Guidance for the Higher Education & Research Sectors



Contents

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Part 1 – Introduction and Context

Foreword

The rapid adoption of lithium-ion battery technologies across higher education institutions and affiliated organisations has brought not only opportunity but also new and complex risk considerations. As the custodians of learning environments, we must be proactive in addressing these risks with foresight and collaboration. This guidance paper, developed through the combined efforts of Unimutual and higher education sector experts, provides an essential roadmap for understanding and managing the fire safety and operational challenges associated with lithium-ion batteries. I recommend this resource to all who share responsibilities of safeguarding our campuses and communities.

Geoff Henderson
Unimutual CEO

Acknowledgments

We would like to thank the following individuals and organisations for their contributions to the lithium-ion battery guidance working group: Simon Iliffe, Glenn Mowbray and Greg Burton (Unimutual), Matt Smith (TEFMA), Andrew Thomson (University of Western Australia), Craig MacKenzie (University of Western Australia), Dominic Marafioti (University of South Australia), Graeme Johnstone (Curtin University), James Roth (University of Wollongong), Jey Ramathasan (RMIT), Mark Pritchard (University of Canberra), Michael Bird (University of Tasmania), Ty Christopher (University of Wollongong), and Wilson Quintero Ortega (La Trobe University).

About this Document

This guidance document is the result of a collaboration between Unimutual and Associate Members of TEFMA (Tertiary Education Facilities Management Association), established to support universities and affiliated institutions in understanding and managing the emerging risks associated with lithium-ion batteries (LiBs).

The use of lithium-ion battery-powered devices and charging infrastructure is rapidly increasing across the higher education sector. This growth is being driven not only by the uptake of electric vehicles (EVs) and personal mobility devices (PMDs) for travel across and between campuses, but also by the broader adoption of battery-powered tools, equipment and robotics for facilities and grounds maintenance. Universities are also increasingly integrating electric vehicle fleets to support progress toward Net Zero goals.

> ***Electric vehicles (EVs) account for over 80% of global lithium-ion battery demand, highlighting their dominant role in battery adoption***
>
> - ***statista.com***

While lithium-ion batteries are generally safe and efficient, they have gained a reputation for fire risk – particularly due to quality and compliance issues associated with some imported products. As the range and volume of battery-powered devices grows, so too does the need for fit-for-purpose charging infrastructure, and for proactive management strategies to minimise risk to people, property and continuity of operations.

Purpose

The purpose of this document is to provide clear, concise and pragmatic guidance to help facility and estate management teams:

- Manage the risks related to LiBs used in EVs, PMDs, tools and equipment.
- Understand minimum protection requirements for battery charging locations.
- Minimise the likelihood of incidents and mitigate potential impacts to people and property should an event occur.
- Navigate the evolving regulatory landscape in a practical and informed way.

Intended Audience

This guidance is designed for:

- Facility, asset and estate management teams
- Capital works teams & project managers
- Engineers, architects and designers
- Contracted service providers based on campus
- University Controlled Entities
- Accommodation providers
- Ancillary on-campus service providers
  - Eg. cafes, childcare
- Risk and insurance officers
- Procurement officers
- Work Health and Safety (WHS) teams

> ***Global demand for lithium-ion batteries is projected to increase nearly seven-fold between 2022 and 2030, reaching 4.7 terawatt-hours.***
>
> - ***statista.com***

Scope

This document is **not** a technical or design standard. It provides general guidance on:

- The current legislative and regulatory framework
- Hazards associated with lithium-ion batteries and charging
- Location and minimum protection considerations for EV and PMD charging
- Safe charging and storage of lithium-ion powered tools and equipment
- Operation, management and monitoring of charging infrastructure
- Procurement considerations for lithium-ion powered devices
- Safe disposal of lithium-ion batteries
- Insurance and risk management considerations

Guidance Exclusions

This document focuses specifically on the practical management of risks associated with lithium-ion batteries used in electric vehicles (EVs), personal mobility devices (PMDs), and portable tools and equipment within higher education environments.

To maintain a clear and manageable scope, this guidance **does not** address the following:

- **Battery Energy Storage Systems (BESS):** These large-scale, often stationary systems involve significantly different risk profiles, installation requirements, and regulatory considerations beyond the scope of day-to-day campus operations.

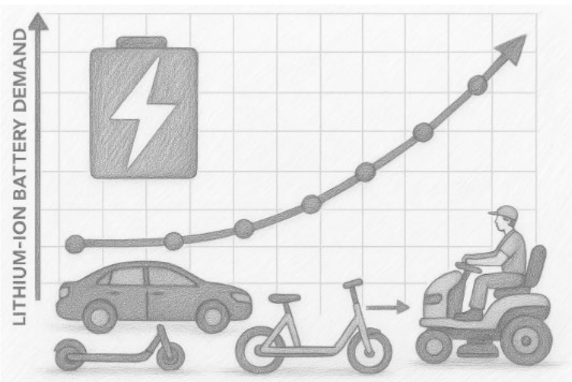
- **Uninterruptible Power Supplies (UPS):** While these systems may also use lithium-based chemistries, their use in critical infrastructure and data protection requires separate risk management approaches.

- **Mobile Phones and Laptop Computers:** Although they contain lithium-ion batteries, these devices are considered to pose relatively low risk when used and charged in accordance with manufacturer instructions and standard workplace policies.

- **Redox Flow Batteries and Lead-Acid Batteries:** These battery types use fundamentally different chemistries and behaviours and are not currently in widespread use in the contexts addressed by this guidance.

These exclusions ensure that the document remains focused, practical, and relevant to the most pressing lithium-ion battery risks in university operational settings.

Given the rapid pace of change in battery technology and regulation, this document will require regular review and updating to remain current with changes in legislation, standards, and best practice. Existing guidance exclusions may be incorporated into future guidance material published by Unimutual and/or TEFMA.



Executive Summary – LiB Guidance for HE & Research Sectors

Lithium-ion batteries (LiBs) are rapidly reshaping operations across institutions – embedded in electric vehicles (EVs), personal mobility devices (PMDs), and maintenance equipment. While offering operational and environmental benefits, their widespread integration introduces new and underappreciated property risks.

The insurance market is increasingly concerned with the retrofitting of battery charging infrastructure into existing buildings not originally designed for high-energy battery use. Older building stock often lacks adequate fire protection, thermal containment, and spatial separation which leaves facilities vulnerable to fire, smoke, and heat damage that may extend well beyond the point of ignition. Additionally, property underwriters are now seeking demonstrable evidence of site-level risk control before offering competitive terms.

In response, Unimutual and TEFMA Associate Members have developed this guidance to support institutions in strengthening risk awareness and embedding property protection measures into capital works, operations, and lifecycle planning. Unimutual is available to assist members in reviewing plans for new developments, helping align designs with reinsurer expectations before construction.

Key Property & Protection/Insurance Risks

- *High-Severity Claims*: Battery incidents now generate disproportionate property losses – with fire events causing structural compromise, extended clean-up, and prolonged business interruption.
- *Inadequate Legacy Controls*: Charging stations retrofitted into underground carparks, office corridors, or near egress paths pose high risks when unprotected.
- *Structural Degradation*: Concrete spalling, smoke migration, and HVAC contamination are common in LiB-related fire events.
- *Insurance Market Pressure*: Clear evidence of protection systems, spatial planning, and maintenance regimes are now essential to secure right-priced cover.




Critical Recommendations for Campus Property Teams

Stakeholder	Recommended Action
Facilities Managers	Identify and assess legacy battery charging areas; retrofit physical containment, thermal monitoring, or relocate where needed.
Capital Projects Teams	Engage Unimutual early in new build design stages to ensure EV/PMD charging aligns with reinsurer expectations.
Procurement Officers	Specify certified battery systems, chargers and containment; require supplier declarations of battery chemistry and compliance.
WHS & Emergency Teams	Update emergency plans to include LiB-specific scenarios; ensure response capability (e.g. extinguishers, signage, isolation protocols).
Asset & Risk Managers	Maintain documented evidence of charging infrastructure, inspection records, and alignment with building code and insurer guidance.

Call to Action

The risks associated with lithium-ion batteries cannot be managed in isolation.

Through this guidance, Unimutual and TEFMA provide a sector-wide foundation for shared learning, risk reduction and professional development – empowering institutions to:

- Benchmark risk maturity across campus assets;
- Support design and procurement decisions with insurer insight;
- Build internal capability through tailored training and knowledge-sharing.

> *Now is the time for facilities and asset managers to act – not only to prevent costly property damage, but to future-proof infrastructure and ensure a well-managed improving risk profile. With underwriters tightening scrutiny on lithium-ion battery risks, institutions must demonstrate proactive planning, compliance, and risk maturity to protect their assets and their bottom line.*
>
> ***— Unimutual 2025***

Part 2 – Context and Risk Landscape

Background

Rechargeable lithium-ion batteries are now the [leading portable energy storage technology]() globally. They are embedded in a wide variety of consumer, industrial, and commercial products. Within university environments, their presence is increasingly common – driven by technological advancement and the sector's transition toward net zero emissions. The examples below illustrate typical applications across campus settings.

Lithium-ion batteries are increasingly used in maintenance and trade operations across sectors such as construction, logistics, and facilities management due to their superior performance and practicality. Compared to traditional battery types, they offer a longer lifespan, higher efficiency, faster charging times that reduce operational downtime, and lower maintenance requirements – eliminating the need for fluid checks or frequent servicing. These benefits make them especially well-suited for powering tools, equipment, and support vehicles in demanding, fast-paced environments.

As the higher education sector advances its transition toward net zero emissions and a circular economy, the demand for lithium-ion battery-powered technologies is set to rise significantly. This global trend is being driven by a combination of government incentives, ongoing technological and research advancements, and growing consumer expectations for automation, mobility, and energy efficiency.

> *"We will roll out our $2.3 billion Cheaper Home Batteries Program from 1 July 2025, reducing the cost of a typical installed battery by 30 per cent – with over one million new batteries expected by 2030."*
>
> **— Anthony Albanese, Prime Minister of Australia**

However, this widespread adoption brings with it a new class of emerging risks. While LiB incidents remain relatively rare compared to the volume of devices in use, the number of fire and explosion events is growing – both in Australia and internationally. Reports from fire departments across jurisdictions universally report that fires involving these products typically burn longer and more severely than other types of fires, cause secondary loss potential including greater structural and smoke damage, or longer incident recovery periods post an incident or loss event.

Importantly, there are significant limitations in available incident data, making risk quantification and comparison across jurisdictions difficult.

Incident underreporting is common, and variations in how data is collected and classified make it challenging to draw reliable conclusions about prevalence and causes. In many cases, the destructive nature of LiB fires complicates post-incident analysis, making it hard to definitively confirm battery failure as the cause.

What is clear, however, is that LiBs can present serious hazards, especially when:

- Low-quality or non-compliant products are in circulation
- Unsafe charging or storage practices are used; or
- Batteries are damaged, modified, or exposed to heat or moisture

Once ignited, LiB battery fires are notoriously difficult to extinguish, can produce toxic vapours, and have a high risk of thermal runaway, where heat leads to further ignition or explosion. These fires may also reignite spontaneously, requiring extended firefighting efforts and posing significant risks to people, property and emergency responders. These hazards are discussed in greater detail within "Part 3 – Risk Identification" of this paper.

Insurance Industry Perspective

From the insurance industry's perspective, lithium-ion battery incidents are an increasingly costly and complex risk. Insurers are particularly focused on the batteries' unique fire characteristics – such as rapid ignition, escalation potential, and the difficulty of containment once an incident begins.

> *In a November 2023 submission to an NSW Government inquiry, Allianz reported a 440% rise in lithium-ion battery fire claims since 2020, with claim costs up 900% - driven largely by high-value commercial property losses.*
>
> ***— 9NEWS November 2023***

Underwriters seek "confidence around the management of thermal runaway risks, public safety liabilities, and transit and cargo challenges" (GCube, *Lithium Battery Risk Report*, 2023). To mitigate these risks, the insurance market is placing greater emphasis on:

- Clear and enforceable strategies for safe charging and storage
- Ongoing maintenance and monitoring protocols
- Documented accountability for battery procurement, handling, and disposal
- Alignment with current safety regulations and standards

For universities and facilities managers, this underscores the need for transparent, well-documented systems that demonstrate both a duty of care and operational readiness to manage potential LiB-related incidents.

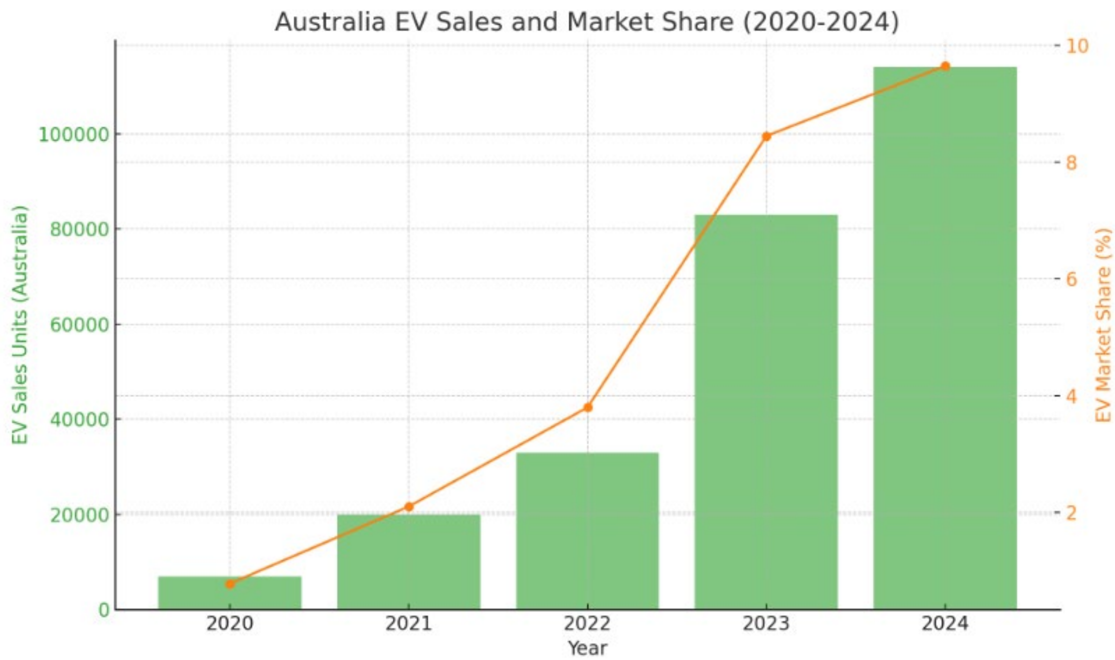
As battery technology evolves, so too do protection practices. Notable trends include:

- Increased regulatory oversight, with stricter safety and compliance mandates
- Use of predictive analytics for more precise, data-driven risk profiling
- Introduction of specialised protection and insurance products tailored for organisations managing large volumes of LiBs

Although lithium-ion batteries are essential to modern operations, they present serious protection challenges. Proactive safety measures are critical – not only to reduce risk but to help secure suitable coverage and keep protection contributions and insurance premiums under control. As the Insurance Council of Australia advises, battery owners should "review coverage, prioritise safe storage and charging, and adhere to building regulations."

Market Growth: EV Uptake and Battery Demand

Electric vehicle adoption continues to accelerate globally, with EVs making up around 25% of all new car sales in 2024, up from nearly 20% in 2023. In Australia, the Electric Vehicle Council reported record sales of approximately 114,000 EVs in 2024, representing 9.65% of new vehicle sales. The uptick in sales is driven by environmental policies and incentives, reflecting society's evolving expectations of good corporate citizens. While EVs still represent a relatively small share of Australia's total vehicle fleet, the frequency and severity of fire-related EV incidents are expected to increase over time as this share grows and existing batteries age and degrade.



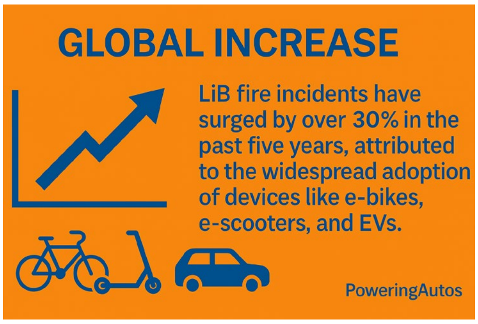
Grand View Research notes that the lithium-ion battery market is experiencing robust growth, driven by the surge in EV adoption and the expansion of renewable energy storage solutions. Globally, the LiB market was valued at approximately USD $97.88 billion in 2024 and is projected to grow at a compound annual growth rate of 17.69%, reaching around USD $499.31 billion by 2034. In Australia, the LiB market size reached USD $1.08 billion in 2024 and is expected to reach USD $4.18 billion by 2033.

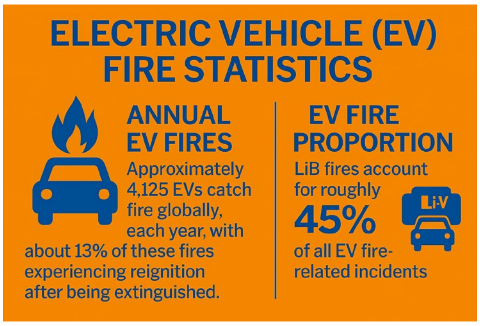
PMDs, including e-bikes, e-scooters, and other micro-mobility options, are also experiencing rapid growth in Australia and globally, driven by demand for affordable and sustainable transport. However, this surge has been accompanied by an increase in battery-related fires, which are occurring at a higher rate and with greater severity than for EVs. This elevated risk is largely due to factors such as poor manufacturing standards, user modifications, and the common practice of charging and storing devices inside buildings – conditions that amplify the potential for serious fire incidents as PMD numbers continue to climb.

LiB Incident Statistics

Lithium-ion battery incident statistics reveal a sharp and concerning upward trend in fire events linked to battery-powered technologies. According to the *Fire Safety Position Paper – Electric Vehicles (EV) and EV Charging Equipment in the Built Environment* by Fire and Rescue NSW (FRNSW), LiB-related fire incidents surged by 66% between 2022 and 2023. EV fires accounted for 15% NSW vehicle fires in 2023/2024, despite EVs only making up 3.2% of all vehicles on road. These incidents are not only increasing in frequency but are also significantly more dangerous, causing injuries at a rate four times higher than other non-LiB related fires.

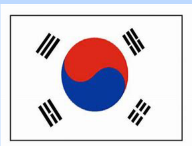
Although EV battery fires account for just 1.5% of all LiB-related incidents, they tend to result in disproportionately severe outcomes. Contributing factors to battery failure and fire risk include the age and degradation of battery cells, the quality of materials and charging equipment, user care and maintenance practices, and exposure to environmental or climatic stressors.





International data underscores additional risk factors:

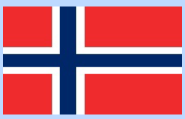
In **China**, most EV fires are linked to short circuits, overcharging, or battery damage from collisions - issues often tied to product quality. Poor manufacturing standards and subpar components significantly raise the risk of thermal events.



South Korean data indicates that nearly half of all EV fires occur while the vehicle is stationary – often during charging. This is a risk unique to electric vehicles and not typically present in internal combustion engine (ICE) vehicles. As a result, when comparing vehicle fire statistics, this key difference is often excluded, leading to a skewed and potentially misleading comparison that underrepresents the distinct fire risks associated with EVs.

Korean data also shows that EV fires are, on average, 240% more costly per incident than those involving internal combustion engine vehicles (ICEVs). This higher cost is likely due to the intensity of battery fires, the difficulty in extinguishing them, potential damage to surrounding infrastructure, and the higher value of EVs and their components.

From 2017 to 2022, over 25,000 LiB-related fire incidents were reported in the **United States of America**, underscoring growing safety concerns. These fires, often linked to poor-quality devices or improper charging, highlight the need for stronger regulations and public awareness.

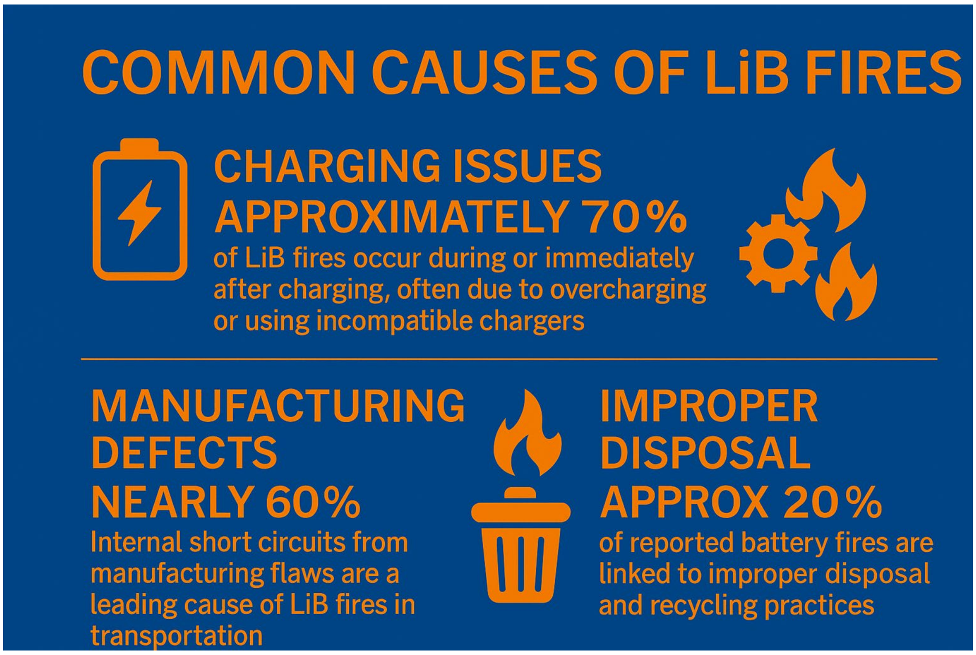


As one of the earliest adopters of EVs, **Norway** is seeing rising fire rates linked to aging vehicle batteries. This trend points to the need for improved safety standards, reporting, and fire mitigation as global EV fleets mature.

> *"As lithium-ion batteries age, their performance deteriorates, leading to a heightened risk of thermal runaway [especially where improper storage or product modification occurs], which poses significant safety threats".*
>
> — ***SAE Technical Paper 2025-01-8562***

Underreporting of incidents remains a significant barrier to understanding the true scale and nature of lithium-ion battery and personal mobility device (PMD) fire risks. Currently, there is no consolidated, Australia-wide dataset capturing these incidents, making it difficult to track trends or inform targeted risk mitigation. A recent UNSW publication estimated approximately 450 LiB-related fires across Australia in the past 18 months – yet the absence of standardised reporting suggests this figure may underrepresent the true number of cases.

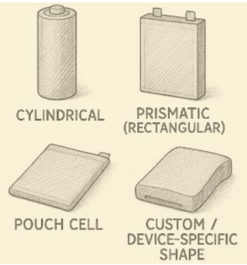
In this context, could institutions and/or TEFMA's incident reporting benchmarking consider incorporating a standardised reporting framework aligned with categorisation methods and definitions used by emergency services and risk protection sectors? Collaboration between TEFMA and Unimutual could support more consistent incident logging across institutions, enabling clearer data trends, improved benchmarking, and ultimately more informed risk management strategies.



Part 3 – Risk Identification

How to Identify a Lithium-Ion battery

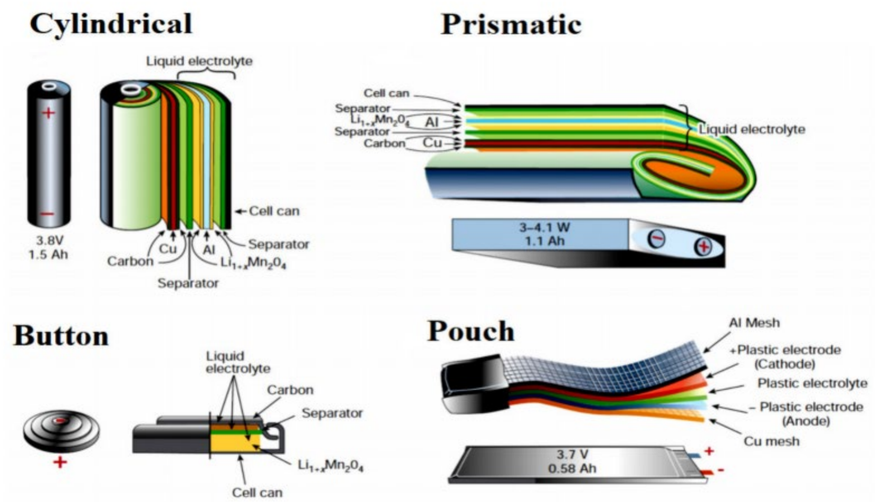
Lithium-ion batteries are widely used across consumer electronics, mobility devices, power tools, energy storage systems, and increasingly within infrastructure and facilities operations. Despite their prevalence, they can be difficult to identify (particularly when embedded within devices) due to the lack of a universal labelling standard.



LiBs come in a variety of shapes and formats, including:

- Cylindrical – commonly found in power tools and e-bikes
- Prismatic / rectangular – used in laptops and energy storage units
- Pouch cells – lightweight and flexible, used in phones and drones
- Custom / button / device-specific shapes – integrated into proprietary enclosures to suit the product

The image below, from a [Nature article] illustrates the components within LiBs including a cathode, anode, separator, and electrolyte, enabling the movement of lithium ions during charging and discharging. The materials and structure of these cells contribute to their fire risk, particularly under damage, overheating, or improper handling. These risks are discussed further within the Hazards section of this paper.

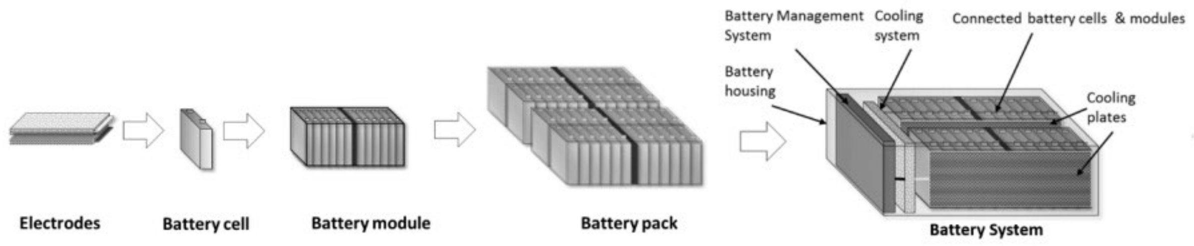


Labelling

Most lithium-ion batteries feature some form of labelling or printing, often using terms such as **"lithium-ion," "Li-ion," "LiB," "Li-po" (lithium-polymer)** or other "Li" variants to indicate lithium chemistry. If a rechargeable battery includes "Li" or "lithium" in its labelling, it can generally be assumed to be a lithium-ion battery. However, where no external markings are visible (particularly in embedded or sealed products) further technical assessment may be required. The label pictogram illustrated to the right is the international illustration used to highlight the combustible risks of LiBs.

Composition of a lithium-ion battery system

This diagram below, adapted from Ecodesign Batteries, illustrates the hierarchical structure of a typical LiB system – from individual electrodes and cells through to modules, packs, and the integrated battery system. It also highlights essential components such as the Battery Management System (BMS), cooling system, and housing that support safe operation and performance.



Battery Management Systems (BMS)

Many lithium-ion batteries, especially in larger formats or higher-risk applications, are now integrated with Battery Management Systems (BMS). A BMS is a critical layer of embedded technology that manages and protects the battery pack. It monitors battery health and behaviour to prevent overcharging, overheating, and other failure modes.

A typical BMS provides:

- Continuous monitoring of voltage, current, and temperature
- Protection mechanisms to prevent unsafe operating conditions
- Estimation of the battery's charge and health status
- Optimisation of performance and longevity
- Communication of operational data to external systems or users

The presence of a BMS may also be indicated on the product or in technical documentation. In institutional contexts such as universities, facility managers should be aware of BMS-enabled devices as they often signal higher power applications and increased energy density—factors that can elevate fire and safety risk if unmanaged.

Understanding Embedded versus Removeable Batteries

Lithium-ion batteries can be broadly categorised as embedded or removable, depending on how they are integrated into a device.

- **Embedded batteries** are fixed within the device and are not designed to be easily removed by the user. They are increasingly common in modern smartphones, laptops, tablets, smart watches, medical devices, and vapes – often making the presence of a battery less obvious to the user.
- **Removable batteries**, on the other hand, can be taken out for charging or replacement. They are still frequently found in devices such as cameras, remote controls, toys, e-bikes, and older models of mobile phones.

Many people remain unaware that everyday devices contain embedded lithium-ion batteries. As a result, these items are often unknowingly discarded in general waste or recycling bins, posing serious fire and environmental risks.

Quick Reference LiB Checklist for Education Institutions

Lithium-ion batteries are commonly found in a broad range of devices and equipment across university and higher education campuses. Being able to identify them is essential for managing safety risks and meeting fire safety and protection obligations. The checklist below summarises practical guidance to help staff recognise LiBs and the products that contain them.

🔋 Common LiB containing devices

- Rechargeable tools (cordless drills, soldering irons, electric screwdrivers)
- Personal or shared mobility devices (e-scooters, e-bikes, wheelchairs)
- AV and teaching equipment (microphones, speakers, VR headsets)
- Medical/laboratory tools (portable monitors, pumps, meters)
- Consumer electronics (laptops, tablets, smartphones, drones)

📌 Tips for Campus Staff

- Assume rechargeable + portable = lithium-ion unless confirmed otherwise
- Include battery ID as part of procurement and risk assessment processes
- Engage facilities or WHS staff when unsure – especially for bulk equipment or lab devices
- Ensure contractors and suppliers declare battery types in new installations

🧾 What to Look For

✅ **Labels & Wording**

- "Lithium-ion," "Li-ion," "LiB," "Li-po," or "Lithium-polymer"
- UN numbers UN3480 (batteries) or UN3481 (batteries in/with equipment)
- Combustible battery pictogram (battery with flame symbol)

✅ **Product & Packaging Clues**

- Rechargeable battery markings (typically printed near charging ports or on the battery itself)
- Compact battery compartments with no access (likely embedded LiBs)
- Import/shipping documents listing battery type or hazard class
- SDS or technical spec sheets noting "LiB" / "Li-ion battery" or similar chemistry

🗂️ When Receiving or Storing Equipment

- Inspect packaging for lithium battery warnings
- Flag unknown battery types for review
- Log devices with embedded LiBs in asset registers
- Store spare or replacement batteries in battery-rated containers

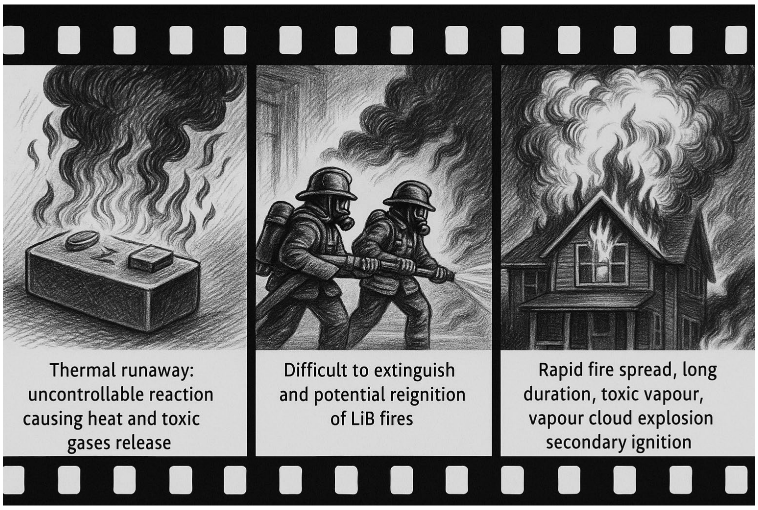
The following list of hazards has been adapted from the Australasian Fire and Emergency Service Authorities Council (2022) *Electric Vehicles (EV) and EV Charging Equipment within the Built Environment* (AFAC Publication No. 3098). The types of hazards associated with lithium-ion battery fires include, but are not limited to, the risks outlined below.

These risks are grouped to support clear understanding, prioritisation, and effective management of LiB-related hazards. Each register is designed to systematically document and manage key risks and may be adapted by institutions to develop site-specific risk management strategies. Each entry includes:

- **Risk Description:** A clear definition of the specific hazard or failure mode.
- **Potential Impact:** The consequences if the risk occurs, highlighting why it matters.
- **Key Risk Factors:** The causes or conditions that increase the likelihood of the risk.
- **Comments / Notes:** Observations, mitigation ideas, or relevant standards.

Fire and Explosion Risks

Risk Description	Potential Impact	Key Risk Factors	Comments / Notes
Thermal runaway: uncontrollable reaction causing heat and toxic gases release	Can cause intense fires, serious injuries, and significant property damage.	Typically triggered by physical damage to the battery, overheating, overcharging, or internal faults.	Often initiated by impacts, manufacturing defects, or improper charging practices.
Difficult to extinguish and potential reignition of LiB fires	Fires tend to last longer and can reignite hours or even days after being thought extinguished.	Requires specialized firefighting agents and methods not commonly used for conventional fires.	Storage facilities must be equipped with advanced fire suppression systems, increasing costs.
Rapid fire spread, long duration, toxic vapour, vapour cloud explosion, secondary ignition	Can lead to widespread damage to property and pose serious health risks due to toxic fumes and explosions.	Influenced by battery chemistry, environmental conditions, and presence of flammable vapours.	Fire behaviour is often unpredictable, complicating firefighting efforts and safety planning.



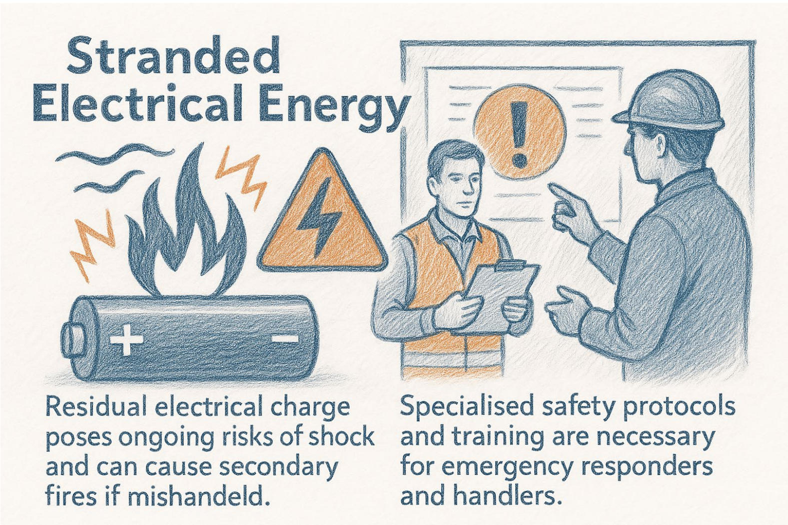
Structural and Environmental Risks

Risk Description	Potential Impact	Key Risk Factors	Comments / Notes
Fire impact on building structural integrity	Fire can compromise the load-bearing capacity of structures, leading to partial or full collapse.	Severity depends on fire intensity, duration, and construction materials used in the building.	Structural engineers should assess buildings after fire incidents to determine safety.
Contaminated run-off from firefighting water	Firefighting water can carry hazardous chemicals into the environment, polluting soil and waterways.	Battery materials and fire suppressants contain toxic substances that can leach into water sources.	Environmental regulations require containment, and remediation plans to prevent long-term damage.

Reinforced concrete slab damaged by a LiB-related fire in an underground car park, showing severe cracking and spalling. Prolonged exposure to high temperatures led to structural weakening through concrete degradation and potential deformation of embedded steel, highlighting the risk LiB fires pose to a building's structural integrity.

Electrical / Energy Risk

Risk Description	Potential Impact	Key Risk Factors	Comments / Notes
Stranded electrical energy	Residual electrical charge poses ongoing risks of shock and can cause secondary fires if mishandled.	Depends on battery design, state of charge, and damage sustained during the fire or accident.	Specialised safety protocols and training are necessary for emergency responders and handlers.



Transportation Risk

Risk Description	Potential Impact	Key Risk Factors	Comments / Notes
Damage during transport causing thermal runaway or chemical spills	Accidents during transport can trigger fires, explosions, or release of hazardous chemicals.	Risks arise from collisions, overturning, improper packaging, and handling failures.	Compliance with strict transport regulations and use of certified containers is essential

Operational Liability Risk

Risk Description	Potential Impact	Key Risk Factors	Comments / Notes
Manufacturing defects leading to fires	Defective batteries can spontaneously ignite, causing recalls, financial loss, and reputational harm.	Often caused by poor quality control, substandard materials, or design flaws during manufacturing.	Robust technical specifications, procurement, quality assurance and supplier management programs are critical to minimise this risk.

Part 4 – Risk Control and Mitigation

Effective risk mitigation for lithium-ion batteries requires a multi-layered approach aligned with applicable legislation, standards, and codes of practice. This section sets out the key regulatory frameworks and outlines practical controls (administrative, engineering, behavioural, and emergency response measures) that can significantly reduce the likelihood and severity of LiB-related incidents. In addition to these core controls, we provide guidance on suitable and unsuitable locations for installing charging points, with the aim of helping institutions avoid common pitfalls that increase fire and safety risks.

Operational considerations such as day-to-day storage, handling, maintenance, and supervision of battery systems are addressed in *Part 5: Operational Considerations*. However, the controls described here form the broader risk management foundation that supports safe operational practices. Facilities and built environment professionals, safety advisors, and those responsible for protections and risk in higher education and research settings should use this section to inform planning, design, and policy decisions involving the use of LiBs across teaching, research, mobility, and energy infrastructure.

Legislation, Standards & Codes of Practice

This section outlines the key legislative instruments, Australian and international standards, and codes of practice to provide a foundation for understanding the broader regulatory context governing the safe use, handling, storage, charging, transport, and disposal of LiBs. These frameworks are critical when planning and designing charging locations for EVs and PMDs, as well as during the procurement and deployment of LiBs, battery-powered tools and equipment across higher education and research built-environments.

While not exhaustive, this overview is intended to assist facilities, risk and safety personnel in identifying relevant obligations and considerations during project planning and risk assessment processes. We highlight selected legislation from Australian jurisdictions where it demonstrates leading practice or offers practical insight.

At present, Australia lacks a unified national legislative framework or mandatory safety standard specifically covering LiBs. The existing system is fragmented across state and territory electrical safety regulators, resulting in regulatory gaps and inconsistent application of safety measures – a [concern noted by the Australian Competition and Consumer Commission](#) (ACCC), which has recommended a harmonised national approach.

Legislative Overview

The legislative environment surrounding LiBs in Australia is complex and evolving, shaped by increasing demand for EVs, PMDs, and battery energy storage systems. While there is no single national law dedicated to LiB safety, a range of legislation and regulatory instruments governs how LiBs are used, stored, transported, and integrated into the built environment. For those responsible for facilities, safety, and risk management in research and higher education settings, understanding this framework is critical for ensuring compliance, managing safety risks, and meeting insurer expectations.

At the federal level, the New Vehicle Efficiency Standard was passed in May 2024 and took effect from 1 January 2025. While not directly regulating battery safety, it aims to accelerate the uptake of low- and zero-emissions vehicles – driving wider adoption of LiB technologies across Australian campuses, fleets, and infrastructure.

More directly relevant to LiB safety and compliance are the following key instruments:

- **Work Health and Safety Act 2011 (Cth) and state-based WHS regulations** – These impose *mandatory duties of care* on employers and PCBUs (persons conducting a business or undertaking) to eliminate or minimise risks associated with hazardous materials and electrical equipment. This includes identifying foreseeable risks related to LiBs and implementing appropriate control measures. These obligations are enforceable, and non-compliance can lead to significant penalties to both individuals and organisations.

- **Electrical Safety Standards and Regulations** (state-specific) – These *mandatory legal requirements* cover the installation, maintenance, and certification of electrical equipment. They regulate who can carry out electrical work, under what conditions, and require that systems – such as EV chargers or battery installations – meet specified safety criteria.

- **Australian Dangerous Goods Code (ADG 7.7)** – While technically a model code adopted into law by states and territories, the ADG Code is *legally binding where adopted*, particularly regarding the classification, packaging, storage, and transport of LiBs. Institutions managing bulk storage or movement of batteries must comply with its provisions to avoid breaching dangerous goods transport laws.

- **National Construction Code (NCC)** – The NCC is *a minimum performance standard* for building design and construction. Its focus is on *life safety* – ensuring that buildings provide safe evacuation routes, adequate fire compartmentation, and essential services during emergencies. However, it does *not* account for broader *property protection*, business continuity, or insurer requirements. As such, relying solely on NCC compliance may leave gaps in risk mitigation – particularly for high-density battery installations or locations with limited passive fire protection.

At the state and territory level, planning and infrastructure legislation regulates the location and approval of LiB infrastructure. In New South Wales, the State Environmental Planning Policy (Transport and Infrastructure) Amendment (Electric Vehicles) 2023 governs development consent, environmental assessment, and siting criteria for EV charging stations. Similar frameworks apply across other jurisdictions, and institutions are advised to consult local planning authorities early in the project lifecycle.

Where infrastructure interfaces with public land or roads, additional legislation such as the Roads Act 1993 (NSW) applies. Under Section 138, any works within the road reserve (including footpaths) require separate consent from the relevant road authority. These obligations operate independently of planning approvals and must be addressed in parallel.

There is encouraging regulatory leadership emerging across Australian jurisdictions, notably in New South Wales, where from February 2025 all e-micromobility devices sold must meet prescribed safety standards and mandatory labelling requirements. This shift in product regulation is expected to influence other states. Institutions should also monitor international developments, as evolving global standards and regulatory models may shape future compliance obligations in Australia.

Considering this evolving and somewhat fragmented regulatory environment, higher education institutions should maintain active engagement with relevant authorities and industry guidance. While legislative compliance forms the baseline, it should be complemented with higher-order risk controls to meet institutional risk appetite and protection expectations – especially where property damage, operational disruption, or reputational impacts are at stake.

Standards and Codes of Practice

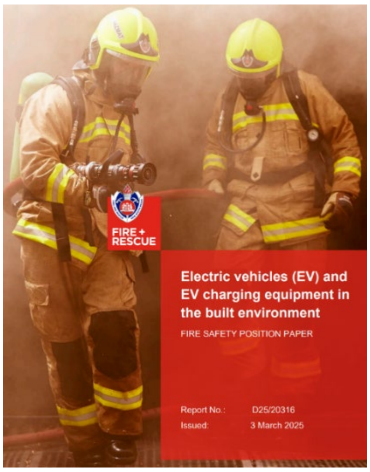
The management of LiBs is further governed by a growing set of standards and codes that provide minimum safety, design, and performance requirements. These instruments play a critical role in guiding the safe design, installation, maintenance, and emergency planning associated with LiB technologies and their associated infrastructure. While compliance with applicable standards is essential, institutions should be aware that many standards represent minimum benchmarks – often focused on life safety rather than the protection of property, continuity of operations, or broader coverage considerations.

In New South Wales, e-micromobility devices (including e-bikes, e-scooters, e-skateboards, and self-balancing scooters) along with the lithium-ion batteries that power them, are now classified as *declared electrical articles* under the Gas and Electricity (Consumer Safety) Act (2017). From February 2025, these products must comply with *prescribed electrical safety standards* before they can be sold, a move aimed at reducing the number of substandard and potentially hazardous devices in the Australian market. Whilst this jurisdictional leadership reflects an important shift toward pre-market compliance and may inform future national approaches, institutions must remember that older products imported or manufactured under less stringent controls still exist and pose risk.

Australian and international standards underpin safe practices in LiB management, including the following, with other relevant standards highlighted in Appendix 2:

- **AS IEC 62133 –** Safety requirements for portable secondary lithium cells and batteries
- **AS/NZS 5139:2019 –** Guidelines for the safe installation of battery energy storage systems
- **AS/NZS 60335.2.29 –** Safety standards for battery chargers for household and similar use
- **AS 3745 –** Emergency planning for facilities, including battery-related incidents
- **AS 1851 –** Routine service and maintenance of fire protection systems and equipment
- **UN Manual of Tests and Criteria – Section 38.3 –** Transport safety standards for lithium batteries, widely adopted for international compliance

As previously noted, the **National Construction Code (NCC) 2022** also plays a key role in shaping how battery-powered infrastructure is integrated into the built environment. Clauses *E1D17* and *E2D21* outline considerations for EV charging equipment, with a primary focus on *life safety* – such as fire resistance levels (FRLs), egress routes, and emergency response systems. However, compliance with the NCC should be treated as a baseline. Where higher risks to life or property exist, such as enclosed or retrofitted EV charging spaces, institutions should consider additional controls beyond code requirements to mitigate thermal runaway events or fire propagation.



Fire & Rescue NSW (FRNSW) issued a [March 2025 position statement] regarding EVs and associated infrastructure, particularly within Class 2–9 buildings. It recommends enhanced fire safety measures including fire hydrant coverage; automatic sprinkler systems for indoor installations; no reduction in FRL requirements; automatic smoke detection with remote notification (not just local alarms); and strategic car park design to support emergency access, exclusion zones, and enhanced monitoring.

Institutions retrofitting car parks or other high-occupancy areas with LiB charging infrastructure must also balance competing demands, such as accessibility compliance versus fire response planning, and consider solutions that enable early intervention (e.g. detection & CCTV), passive containment, ongoing maintainability and safe occupant evacuation.

Additional guidance on applicable standards and their relevance to lithium-ion batteries is summarised in *Appendix 2: Standards and Codes*.

Administrative Controls

Administrative controls are a critical layer in the hierarchy of risk management, aimed at influencing human behaviour, processes, and governance frameworks to reduce the likelihood and/or impact of adverse events. Unlike engineering or physical controls, administrative measures rely on clearly defined policies, documented procedures, training, contractual expectations, and oversight mechanisms to manage risk. When effectively implemented, administrative controls provide the foundation for consistent decision-making, accountability, and compliance – particularly in high-risk environments or areas of emerging risk such as LiB management, where mandated controls are limited. These controls support alignment with insurer requirements, legislative obligations, and institutional risk tolerance thresholds.

Building on this foundation, the following table presents a suite of recommended administrative controls relevant to lithium-ion battery (LiB) management within higher education and research institutions. Each control is designed to strengthen institutional governance, clarify responsibilities, and embed safe practices – supported by clear purposes and performance indicators to monitor their effectiveness over time.

Control Description	Purpose(s)	Performance Indicator(s)
Policy implementation and clarity of responsibility	1. Define institutional expectations for the safe and responsible use, storage, and charging of LiBs. 2. Establish accountable roles for oversight and compliance. 3. Enable consistent application of LiB risk management practices across the institution.	Policy document published, reviewed, and communicated to relevant stakeholders. Formal appointment of responsible persons (e.g. WHS officers, lab managers). Periodic internal audits show consistent implementation across departments.
Cover & protection review and alignment	1. Ensure institutional property, liability, and business interruption policies reflect evolving LiB-related exposures. 2. Maintain cover confidence through demonstrable controls and mitigation strategies. 3. Minimise potential coverage gaps arising from unrecognised risks or poor documentation.	Annual protection review includes specific reference to LiB-related risk and coverage adequacy. Controls (e.g. charging policies, training programs, suppression systems) documented and shared with cover providers. Claims history reviewed annually to identify any gaps in coverage or trends.
Third-party and contractor battery protocols	1. Minimise uncontrolled risks from third-party operators (e.g. couriers, drone pilots) using or charging LiBs on campus. 2. Ensure external parties are inducted to site safety standards. 3. Maintain compliance and accountability for outsourced or unauthorised battery activities.	Induction or onboarding records for external operators maintained and reviewed. Signed acknowledgment of institutional battery policies in contractor agreements. Spot checks or inspections conducted; non-compliance actions documented.
Role-specific training and emergency awareness	1. Equip staff and students with the knowledge and skills required for safe LiB handling and use. 2. Enhance readiness and response in emergency situations involving LiB failures or fires. 3. Improve institutional safety culture	Completion rates for role-specific training modules tracked (e.g. lab staff, cleaners, security). Inclusion of LiB-specific scenarios in emergency training and drills. Emergency signage installed in high-risk areas and reviewed for visibility and clarity.
Data governance and cybersecurity for smart batteries	1. Safeguard connected battery systems (e.g. BMS, charging stations) against cyber threats or unauthorised access. 2. Maintain the integrity and reliability of systems supporting LiB operations. 3. Ensure compliance with institutional or national cybersecurity requirements.	Firmware update logs maintained for all smart LiB devices. Network access to battery systems secured with user authentication and permissions. Activity on battery management systems logged and monitored. Third-party vendor security practices reviewed before procurement or installation.

Engineering Controls

Engineering controls are a core component of the risk management hierarchy, designed to physically isolate people from hazards or reduce the likelihood and severity of incidents through design, construction, and system-based interventions. Unlike administrative controls, which rely on human behaviour and procedural adherence, engineering controls operate independently of user actions. They offer a more reliable and durable layer of protection when designed appropriately. In the context of lithium-ion battery (LiB) risk, these controls may include physical infrastructure, system design features, safety devices, and environmental controls that help contain fire, prevent thermal runaway, and enable safe charging, storage, and disposal. Engineering controls are especially important where institutional activities involve dense battery installations, high charging throughput, or indoor use of LiB-powered devices.

The table below outlines key engineering controls applicable to LiB risk management within higher education settings. Each control is accompanied by its intended purpose and relevant performance indicators to support continuous improvement.

Control Description	Purpose	Performance Indicator(s)
Dedicated charging and storage rooms with fire-rated construction, smoke/heat detection, and suppression systems	1. Contain thermal runaway events and prevent fire spread to adjoining areas. 2. Protect life safety and structural assets. 3. Enable effective emergency response and compliance with fire safety codes.	Certification of fire-rated materials (walls, doors, penetrations). Routine testing of detection and suppression systems. Completed and documented fire risk assessments for LiB charging areas.
Charging points located in mechanically ventilated, low-risk or external areas	1. Minimise exposure to flammable gases and heat. 2. Prevent LiB-related incidents in high-traffic or sleeping areas. 3. Reduce risk to critical infrastructure and emergency egress paths.	Charging points physically separated from high-occupancy or sleeping zones. Ventilation systems installed and maintained. Charging station siting documented in design risk assessments.
Installation of RCDs, surge protection and load capacity checks for dedicated LiB circuits	1. Prevent arcing, short circuits and overloads that could lead to ignition. 2. Protect building electrical infrastructure and ensure charging safety. 3. Comply with electrical safety regulations and standards.	Quarterly electrical inspections (RCD trip tests, thermal imaging). Load analysis reports to confirm safe capacity margins. Surge protection devices tested and replaced per manufacturer schedule.

Control Description	Purpose	Performance Indicator(s)
Battery-specific signage, no-charging zones, disposal bins, and physical access controls	1. Reinforce behavioural safety through visual cues. 2. Prevent unsafe charging behaviours and improper disposal. 3. Promote awareness of emergency response and exclusion areas.	Signage and safety zones visibly marked and maintained. Regular audits of battery disposal points and bin servicing logs. Physical barriers or access control in sensitive areas.
Thermal monitoring systems (manual or automated) in high-risk storage or charging areas	1. Provide early detection of overheating or thermal runaway. 2. Support proactive intervention before escalation. 3. Enhance safety in unattended areas or during after-hours operations.	Real-time monitoring system in place and tested. Alert logs reviewed monthly, and anomalies investigated. Integration with fire panel or central BMS where applicable.
Fire compartmentation and passive fire protection around battery-dense zones	1. Prevent fire spread between battery storage/charging and critical assets or high value equipment 2. Support building code compliance (eg. NCC, AS 1851). 3. Allow safe evacuation and fire service intervention.	Fire-resistance levels (FRLs) verified in design documentation. Regular inspections of fire stopping and penetrations. Fire safety assessments include LiB-related hazards.
Mechanical ventilation systems in enclosed or semi-enclosed charging/storage rooms	1. Dilute flammable vapours and manage heat build-up. 2. Reduce risk of ignition in confined areas. 3. Improve air quality and occupational safety.	Ventilation systems regularly tested and maintained. Air change rates meet design requirements. Fail-safe and alarm functions operational.
Designated exclusion zones around charging stations or battery storage	1. Prevent unauthorised access and reduce risk to bystanders. 2. Enable emergency responders' safe access. 3. Minimise asset damage in event of thermal runaway.	Physical barriers or floor markings in place. Inclusion in site emergency plans. Compliance confirmed during WHS or insurer audits.
Fixed or mobile clean agent fire suppression units for high-risk battery zones	1. Provide targeted fire suppression without water damage. 2. Enable first response containment of LiB fires. 3.Support rapid knockdown of fire prior to full escalation.	Suppression units installed, serviced and logged in maintenance system. Staff trained in unit use and limitations. Visual checks conducted during regular area inspections.

Behavioural Controls

Behavioural controls represent the final, lowest tier in the hierarchy of risk controls, focusing on the actions, decisions, and habits of individuals. These controls depend heavily on consistent human performance, adherence to procedures, and institutional culture. They are inherently less reliable than engineering or administrative controls (due to their reliance on people rather than systems) however they remain essential in mitigating LiB risks linked to misuse, non-compliance, or error. Procedural safeguards, work practices, and clearly defined behavioural expectations help reduce incident likelihood, particularly in dynamic or decentralised environments such as campuses and research settings. The following behavioural controls provide a baseline for safe LiB use, handling, and decommissioning across institutional environments:

Control Description	Purpose	Performance Indicator(s)
Role-specific permissions for transport, use and / or charging LiBs	1. Ensure only trained and authorised personnel interact with battery systems. 2. Reduce likelihood of human error during operation or storage.	Access control systems applied to storage/charging areas. Completion of battery-specific induction/training logged per user role.
Prohibition of charging in unauthorised areas (eg. under desks, within offices or unsupervised laboratories, student residences)	1. Minimise fire and safety hazards in high-risk or unsupervised locations. 2. Ensure compliance with spatial and design risk controls.	Routine inspections or patrols conducted and recorded. Non-compliance incidents tracked and followed up.
Ban on use of uncertified, modified or damaged batteries	1. Prevent use of unsafe or substandard products. 2. Encourage early identification and safe disposal of compromised items.	Visual inspection checklists used in high-use areas. Procurement restricted to pre-approved, certified suppliers.
Defined procedures for battery decommissioning and replacement	1. Promote safe handling and environmentally responsible disposal. 2. Avoid risk of thermal events from expired or damaged units.	Decommissioned battery log maintained. Waste contractor documentation retained. Compliance with AS 5377 or equivalent e-waste handling standards.
Vendor and warranty documentation retention	1. Support recall, claims, or fault investigation processes. 2. Ensure reference to technical or safety information post-purchase.	Vendor documentation indexed and accessible in asset or facilities systems. Warranty periods tracked and expiry dates flagged.
Behavioural reinforcement through routine audits and feedback	1. Encourage compliance via observation and feedback. 2. Identify and correct unsafe habits early.	Annual battery-use audit program in place. Feedback shared through WHS reporting dashboards.

Peer-based observation or reporting mechanisms (eg. near miss alerts)	1. Create a culture of mutual accountability. 2. Encourage early reporting of unsafe practices.	Near miss reporting rates tracked. Uptake of safety reporting tools (e.g. apps, QR posters).
Use of signage and prompts near battery-use areas	1. Reinforce critical rules (e.g. "No charging here") at point-of-action. 2. Support visual learning and environmental cues.	Signage deployed at all known risk sites. Checks included in routine WHS inspections.
Behaviour-based safety incentives or recognition programs	1. Positively reinforce safe conduct. 2. Encourage repeatable good practices through reward structures.	Number of positive observations or commendations tracked. Participation in safety programs measured.

Emergency Response & Recovery Controls

Even with well-designed administrative, engineering, and behavioural controls in place, lithium-ion battery (LiB) incidents can still occur – often without warning. Emergency response and recovery controls are therefore essential to limit harm, contain damage, and support a safe return to operations. These controls focus on preparedness before an incident, effective first response during a failure or fire, and structured recovery actions afterward. Institutions must plan for battery-specific emergencies, including fire suppression, thermal containment, incident reporting, and continuity planning, to ensure that risk is not only mitigated but recoverable.

Control Description	Purpose	Performance Indicator(s)
Pre-incident Preparedness		
Battery-specific emergency planning and drills	1. Ensure readiness for LiB incidents by simulating fire, thermal runaway, or explosion events. 2. Validate effectiveness of evacuation plans and refine procedures *before* a real event occurs.	Frequency of training exercises with LiB scenarios Participation by relevant staff (e.g. lab users, and fire wardens) Post-drill evaluations completed with improvements logged
Fire warden and first responder training (LiB-focused)	1. Equip responsible staff with the knowledge to recognise and respond effectively to LiB incidents, reducing panic and injury. 2. Supports WHS compliance and incident containment.	Number and coverage of trained personnel Currency of training (refresher intervals) Staff feedback on readiness/confidence
Risk area mapping and response planning	Identify and classify LiB risk areas across campus to inform emergency plan zoning, signage, and suppression equipment placement.	Up-to-date risk maps LiB zones integrated into emergency response plans Reviews conducted after new installations
Inclusion of LiB risks in emergency signage and site plans	Ensures responders and occupants are aware of high-risk LiB zones to inform safe evacuation and targeted intervention.	LiB risk areas marked on evacuation maps Wall signage installed at key entry points
Regular audit of emergency supplies (extinguishers, blankets, PPE, lancets/nozzles)	Prevents degradation, depletion or misplacement of essential response equipment, especially in remote or low-traffic areas.	Equipment audit logs Replacement cycles documented and maintained
Integration of LiB risks in new project planning (design stage)	Ensures buildings and refurbishments pre-emptively address battery-related emergency risks (e.g. ventilation, separation, signage).	Risk registers include LiBs Design reviews reflect LiB-specific measures Change control process captures additions

Control Description	Purpose	Performance Indicator(s)
First Response Capabilities		
Suitable extinguishers (F-500) near LiB zones	Enable safe, immediate response to battery fires without escalating hazards	Extinguisher type suitability confirmed during inspections Extinguishers located within 10m of battery use/storage Visual signage in place
Thermal barriers between LiB storage and occupancy areas	Contain fire or thermal propagation to protect building occupants and reduce infrastructure loss.	Fire-rated construction certified Separation distances maintained Risk assessments documented and reviewed
Spill kits and thermal isolation materials accessible	Contain thermal runaway or leaking batteries without exposure to staff or facilities. Includes fire blankets and LiB isolation boxes.	Spill kit availability in battery-handling areas Restocking logs maintained Battery use tracked, and incident-linked
Clearly marked, and appropriately located emergency power isolation points	Enable rapid shutdown of power or ventilation systems to control LiB-related incidents and support first responders.	Power isolation points sufficiently distanced from charging points Clear labelling Instructions displayed near battery systems Monthly test logs

F 500 Lithium-ion battery extinguisher

Fire resistant battery bag

Control Description	Purpose	Performance Indicator(s)
Recovery and Continuity		
Salvage and post-incident clean-up protocols	Protect salvageable property, ensure safe disposal of damaged batteries, and reduce downtime.	Availability of clean-up guides Staff trained on post-incident salvage steps Incident recovery debriefs completed
Business continuity plans with LiB scenarios	Reduce operational disruption in research, teaching or infrastructure due to battery incidents. Prioritise recovery of high-value assets.	Continuity plans reference LiB-related events Identify and track, functional recovery time objectives (RTOs) Annual testing of continuity plans
Critical spares and redundancy planning	Ensure spare batteries or devices are available following damage or loss, supporting research continuity.	Inventory levels of critical equipment Lead times for LiB replacements understood Backup assets pre-identified

E-scooter lounge room fire

Dedicated storage and charging shed

Charging Safety Advisory – LiB Powered Personal Mobility Devices

Given the increasing use of electric bikes and scooters by students, academic staff, and operations personnel for intra-campus travel, it is strongly recommended that institutions ensure these devices are charged only in locations that meet safety requirements. To reduce the risk of fire, collateral damage, and injury, **avoid charging** in:

- **Student accommodation rooms**
- **Offices and laboratories**
- **Corridors and egress paths**
- **Living rooms and high-traffic indoor spaces**
- **Areas with high combustible loads or flammable liquids**

Failure to comply with these precautions may result in lithium-ion battery fires that trigger emergency response, damage critical infrastructure, and require activation of business continuity and recovery plans - with serious consequences for safety and operations.

Control Description	Purpose	Performance Indicator(s)
Notification and (Regulatory) Reporting		
Mandatory reporting of near misses and incidents	Capture early signs of failure, improve controls, and meet WHS and protection obligations.	Reporting compliance tracked Lag and lead indicators analysed Reporting system accessible and well-publicised
Root cause analysis and lessons learned integration	Feed investigation outcomes from incidents into continuous improvement, reducing recurrence and supporting accountability.	RCA completed for all LiB incidents Lessons incorporated into training, SOPs, and risk registers Audit of corrective actions
Occupant and stakeholder communication plans	Maintain trust, safety, and clarity during and after LiB-related emergencies through coordinated internal and external messaging.	Communication templates prepared Timeliness of alerts measured Feedback surveys issued after events

EV & EV Charger Minimum Protection Considerations

As EVs become more prominent across Australian cities and regions, their supporting infrastructure (particularly EV charging systems) is rapidly becoming a standard feature in both new developments and existing built environments. While this transition supports decarbonisation and modern mobility goals, it also introduces a complex set of risks spanning fire safety, electrical capacity, and spatial planning. These risks are especially important from a cover perspective due to their implications for life safety, property protection, business continuity, and potential claims exposure.

Recent guidance from the Australian Building Codes Board (ABCB), and supporting Arup fire safety in carparks research underscores that the built environment is not yet uniformly prepared to safely and effectively accommodate EV charging infrastructure. One of the most significant challenges is the variability in building age, type, condition and function – leading to markedly different risk profiles between purpose-designed new facilities and older buildings undergoing retrofitted installations. Older facilities often lack modern detection, suppression, and evacuation systems, heightening risk and response concerns.

As previously noted, current building codes in Australia generally lack mandatory fire performance requirements specific to EVs. As a result, designers, facility managers, and asset owners must exercise enhanced due diligence and apply best-practice guidance (including international considerations and/or this Unimutual LiB guidance document) to ensure safe system integration, equipment siting, and fire risk mitigation.

New Developments: Proactive Risk Management through Design

In new developments, EV-related risks can often be proactively addressed during the design stage. The flexibility afforded by early integration allows project teams to embed risk mitigation strategies into the base build, significantly reducing exposure and supporting long-term operational safety. Designers can optimise charger locations, ensure compliance with structural and electrical standards, and incorporate fire safety features from the outset to reduce the likelihood of future costly retrofits or claims.

Key design-stage inclusions to manages EV-related risks in new developments may include:

- *Spatial planning*. Allowing for adequate separation between charging bays to prevent clustering of EVs in configurations that may promote fire spread.
- *Ventilation systems*. Designing for effective heat, gas, and smoke dispersal in the event of a thermal incident, especially in enclosed or underground carparks.
- *Passive fire protection* such as fire-rated compartmentation to limit fire spread.
- *Active fire protection* including targeted sprinkler coverage and smoke detection systems aligned with charger locations.
- *Smart energy management*. Incorporating features such as solar-powered EV chargers and dynamic load-balancing systems to manage electrical demand and prevent overload.
- *Emergency response readiness*: Embedding redundancies and designated isolation zones to support safe, rapid intervention by emergency services.

Collectively, these measures enable EV infrastructure to function safely, efficiently, and with minimal additional protection risk when integrated into the base build of new developments (including new car parks, as depicted on the following page):

 *Well-spaced EV charging points*	 *Solar EV chargers*

Existing Buildings: Legacy Constraints and Higher Risk

In contrast, retrofitting EV chargers into existing buildings, particularly in underground or enclosed carparks, presents a higher and more complex risk profile. These buildings were typically not designed with the electrical or fire safety requirements of EV infrastructure in mind, and their existing systems may not support necessary upgrades.

Common issues observed in these settings (and per illustration below) include:

- Lack of passive fire protection, such as inadequate compartmentation or insufficient separation between EVs, chargers, and critical building infrastructure.
- Inadequate ventilation, particularly in enclosed carparks, increasing the risk of off-gassing or smoke accumulation.
- Insufficient electrical capacity or protective devices, resulting in potential overloads, impact damage to charging equipment and increased fire risk.
- Poor charger placement, including installation near fire escapes, building exits, or in hard-to-reach locations that impede emergency service access.
- Uncontrolled fire spread between vehicles, exacerbated by thermal runaway events involving lithium-ion batteries.

The challenge is amplified in relation to legacy charging station installations – those already installed within or adjacent to existing building envelopes. These often predate current best-practice guidance and may now be in locations considered high-risk. Where significant upgrades to fire or electrical systems are unfeasible, facilities must consider:

- Retrofitted passive or active protections.
- Enhanced surveillance and monitoring (eg. thermal imaging or CCTV).
- Fire response strategies specific to EV incidents, including isolation plans and pre-incident planning.

EV Risk-Based Approaches and Policy Responses

In recognition of these challenges, ACT Fire and Rescue (ACTF&R) and Economic Development Queensland recommends a risk-based approach when installing EV charging infrastructure, particularly in existing buildings. They acknowledge that while new buildings can incorporate safety systems at the design phase, older structures often cannot accommodate significant modifications due to physical constraints or prohibitive costs. In these cases, layered mitigation strategies – procedural, spatial, and technological – must be implemented to reduce fire risk and protect occupants and emergency responders.

Emerging Global and Sectoral Trends

Internationally, several jurisdictions have adopted restrictive policies in response to mounting concerns over battery fires in enclosed spaces:

- In South Korea, EVs are restricted from entering underground car parks if their batteries are more than 90% charged.
- Businesses in Zhejiang, China, have begun banning EVs from underground carparks due to fears of spontaneous combustion.
- In Malaysia, EV charging is explicitly banned in basement carparks, with installations only permitted outside the building envelope or on open rooftop areas with easy fire brigade access.

Malaysia banned EV charging in basement car parking

Underground charging of EVs: Seoul City South Korea

In Australia, the strata sector is increasingly taking its own precautions. Many strata owners' corporations have banned EV charging in apartment basements, and some institutions (e.g. Monash Health in Victoria) have imposed blanket bans on EV and PMD charging at their sites, reflecting the broader concern across the residential and healthcare sectors.

Australian Building Code Board Advisory Note

In June 2023, the Australian Building Codes Board (ABCB) released an advisory note on EV charging in buildings, informed by international practices and input from EV FireSafe. The guidance outlines low-cost, easy-to-implement measures that support safer EV charger installation without creating barriers to adoption. It aims to reduce fire and electrical risks while helping prevent poor-quality equipment and installation practices. An extract of these recommendations is provided below:

To support safer EV charging, the ABCB recommends:

Master isolation
Provide a master isolation switch with signage at fire indicator panel/Fire Detection Indicator Control Equipment (FDCIE) or building entrance.

RCM Tick compliance
Use chargers that have the Regulatory Compliance Mark (RCM).

Emergency services information pack (ESIP)
ESIPs developed for each site and provided for first responders.

Break glass fire alarm
Provide additional break glass unit (BGU).

Placarding site
Provide placarding/signage to identify each EV charge points.

Collision protection
Provide vehicle impact bollards or stops.

Block plans
Block plans should be updated for existing sites and implemented for new builds to clearly show the location of charging hubs and master isolation.

AS/NZS 3000 App P compliance
Mode 3 and 4 chargers should only be installed by a qualified person and in accordance with AS/NZS 3000 Appendix P.

Proximity to evacuation routes and flammable risks
Carefully assess proximity to avoid blocking evacuation routes or placing chargers too close to other flammable risks.

Regular maintenance
Ensure the owner of the charging unit understands and meets their maintenance obligations.

Complex buildings
Complex buildings and higher-risk environments should seek comprehensive, specialist fire safety assessment and advice.

Directional signage
Directional signage to be provided – to the charging units and to the emergency exits.

Smart charging
Where possible, prioritise the use of 'Smart charging' to enable remote monitoring and access to disconnect power supply to a connected EV. This gives emergency responders another potential method of shutdown from unit to EV. Encourage operators to monitor for faults and provide early intervention when detected.

Placarding at site entrance
Sites with 5 or more Mode 3 or 4 chargers to install ground level or other appropriate level placards to indicate which entrance is most closely located to EV charging hub.

Pre-incident plans (PIP)
Where 5 or more chargers are installed, then building owners should invite local fire crews to attend a site familiarisation visit in order to develop a pre-incident plan (PIP).

Siting and Safety Considerations Checklist for EV Charging Equipment

As EV adoption continues to rise, safely integrating charging infrastructure into a wide range of built environments has become a critical risk management priority. In situations where full engineering controls may not be practical (particularly in existing buildings) the siting of EV charging infrastructure plays a pivotal role in reducing fire risk, supporting emergency response, and protecting both occupants and key building systems.

The following checklists are designed to assist facilities personnel, project teams, and asset owners in the safe planning, installation, and maintenance of EV charging infrastructure. They outline key risk control measures aligned with best-practice fire safety and cover risk reduction, structured across common parking settings. A general checklist also highlights essential safety principles applicable across all environments.

General Siting and Design Checklist (Applicable to All Installations)

Charger Location Considerations:

- Avoid proximity to fire exits and essential egress points
- Separate vehicles and chargers with adequate spacing or physical barriers
- Site away from critical utilities, building services infrastructure & heritage protection areas
- Provide visible signage at entry and throughout the carpark
- Update block plans to show all EV-related infrastructure and shutdown points
- Ensure car park geometry permits ease of access for emergency response vehicles

Fire Protection Systems:

- Install AS2118.1 compliant sprinkler systems with fast response (Special Hazard) heads
- Preferably supply active firefighting through dual town main feeds
- Compartmentation to contain fire events; recommend 120/120/120 FRL or higher
- Install thermal or smoke detection to AS 1670.1 with integrated EWIS, BOWS, or interconnected systems (AS 3786-2014)
- Manual call points at all exits, connected to Fire Indicator Panel (FIP)

Ventilation and Emergency Systems:

- Design ventilation to AS 1668.1:2015 for 200°C continuous operation
- Treat ventilation systems as essential emergency equipment
- Enable manual and automatic shutdown controls for EV chargers (interlocked with FIP)

Electrical Safety and Load Management:

- Engage qualified installers for charging equipment and install RCDs for every outlet
- Ensure electrical supply can accommodate additional loads
- Provide a master isolation switch with clear signage at the FIP or building entry
- Integrate Load Management Systems (LMS) to regulate charging and prevent overloads

Impact Protection and Housekeeping:

- Install bollards for pillar-type chargers; assess need for wall-mounted units
- Maintain 6m clear separation in enclosed charging zones; increase based on risk assessment
- Enforce no-storage policies (especially waste or flammables) near chargers
- Maintain 10m separation from flammable/hazardous storage

Ongoing Management:

- Implement manufacturer-compliant maintenance regime for EV chargers and infrastructure
- Prepare an AS 3745 compliant Emergency Response Plan, inclusive of procedures, contacts, and isolation details (provide a copy at FIP for emergency respondents)
- Facilitate pre-incident site training and familiarity with local emergency responders

Outdoor Car Parking Areas EV Checklist **(Most Preferred)**

- Prioritise outdoor locations with adequate space and electrical infrastructure
- Maintain 10m separation from adjacent buildings
- Avoid locating chargers under trees (fire and maintenance risk), or construct appropriate barriers to prevent fire spread to vegetation areas
- Provide separate charging points for PMDs and EVs
- Ensure firewater access adjacency to EV chargers
- Consider containment pits to manage contaminated water runoff
- Use solar-powered chargers where feasible
- Assess risks between trickle vs fast charging use cases (staff vs visitor)
- Space charging bays to prevent fire spread between vehicles

Outdoor parking facilities – isolated from buildings

EV charging under solar car park canopy (USA)

Open Areas of Multi-Level Car Parks EV Checklist **(Moderate Risk – Accept with Controls)**

- Prefer locations on open-air peripheries or top levels with natural ventilation
- Ensure ease of access for emergency services
- Provide sprinkler coverage and detection near charging locations
- Maintain adequate separation from electrical rooms
- Verify location and accessibility of fire hydrants and sprinkler valves
- Ensure bounding construction provides suitable fire resistance

Below-Grade (Underground) Locations EV Checklist **(High Risk – Avoid Where Possible)**

- Avoid siting chargers in below-grade areas in new developments where possible
- If unavoidable, implement the following:
- Conduct fire risk assessment by a qualified Fire Engineer
- Install early detection systems with automatic emergency service notification
- Automate emergency ventilation and smoke hazard management
- Integrate emergency shutdown controls with FIP
- Provide AS2118.1 sprinkler system (OH2 or higher hazard category)
- CCTV monitoring of charger areas
- Clearly marked manual shutdown controls and master isolation switches
- Adequate FRL-rated construction and fire compartmentation
- Facilities to capture and contain contaminated firewater
- Designated access for fire-affected vehicle removal
- Placarding/signage at carpark entries and charger locations
- Block plans showing charger, distribution board, and shutdown locations
- Separation from flammable hazards (minimum 10m)
- Include PMD fire risk considerations emergency exit design, and fire service access

Charging Infrastructure for Personal Mobility Devices and Utility Equipment

As the adoption of LiB powered technologies expands beyond road vehicles, institutions must also address the safe siting and operation of charging systems for PMDs (eg e-bikes and e-scooters) as well as electric utility vehicles used in maintenance operations.

Although typically smaller in scale than EV charging stations, LiB-powered mobility and maintenance equipment (such as PMDs and utility vehicles) pose similar fire and electrical risks. By applying the same rigorous planning, siting, and maintenance principles outlined for EV infrastructure, appropriately scaled to the risk profile, institutions can significantly reduce hazards and better support the safe electrification of mobility across campuses.

End-of-Trip (EOT) Facilities

EOT facilities across higher education campuses are increasingly expected to support PMDs. Where possible, consider relocating charging to external EOT facilities to limit fire load inside buildings and simplify response. When located within building envelopes, these areas require additional safeguards, including:

- Fire-rated compartmentation appropriate to the battery hazard (FRL 120/120/120).
- Provide natural ventilation, ideally with at least one open side or external louvres.
- Integrate two-hour timer switches for charging GPOs to reduce unattended charging risk.
- CCTV coverage (and potentially AI monitoring) within a local security control room.
- Smoke/heat detection connected to the Fire Indicator Panel (FIP) for early warning.

Charging for Grounds and Facilities Vehicles

Maintenance teams often use electric golf carts, ATVs, and utility buggies, requiring appropriately designed charging points. These facilities should follow similar design principles to EV siting, scaled to reflect the risk profile of these smaller vehicles:

- Locate charging areas outside or in naturally ventilated sheds with at least one open side. Alternatively, introduce new purpose-built facilities such as battery storage shipping containers to facilitate bulk charging of tools and equipment.
- Maintain separation from occupied buildings and essential services.
- Install CCTV monitoring and fire detection linked to the FIP.
- Consider using bollards or physical barriers where vehicles charge adjacent to structures.

Solar e-bike charging station

Battery storage shipping container

Part 5 – Operational Considerations

The management of lithium-ion batteries within higher education environments requires a deliberate, integrated operational framework. While technological innovation continues to improve battery safety and performance, it must be matched by a parallel evolution in operational readiness. Institutions must not overlook the practical systems, processes, and capabilities required to safely procure, manage, and ultimately dispose of these assets.

A central pillar within an effective operational framework is education and training. Higher Education environments are complex institutions with a diverse array of stakeholders – including staff, contractors, vendors, students, and residents. While institutions can exert direct control over some of these groups, others must be influenced through well-considered tactical approaches, such as the strategic placement of charging infrastructure, smart procurement decisions, and carefully designed disposal pathways. Consistent, aligned messaging across professional, teaching, research, and learning domains will help equip the broader institutional community with the awareness and understanding required to manage lithium-ion batteries responsibly.

Education alone is insufficient without the infrastructure and governance necessary to act on it. This section outlines the operational foundations necessary for institutions to manage lithium-ion batteries safely and effectively. It focuses on systems and processes that reduce risk, ensure compliance, and strengthen resilience across the battery lifecycle.

These elements must work in tandem. For example, incident response protocols cannot succeed without trained staff and the right equipment on hand. Similarly, strong monitoring systems are only effective when informed by well-managed procurement processes and supported by responsive contract frameworks.

Together, these considerations form the operational backbone for institutions aiming to responsibly manage the risks associated with LiBs. The guidance that follows offers practical, actionable insights to support risk informed decision-making and strengthen institutional readiness in line with evolving best practices.

Education and Training

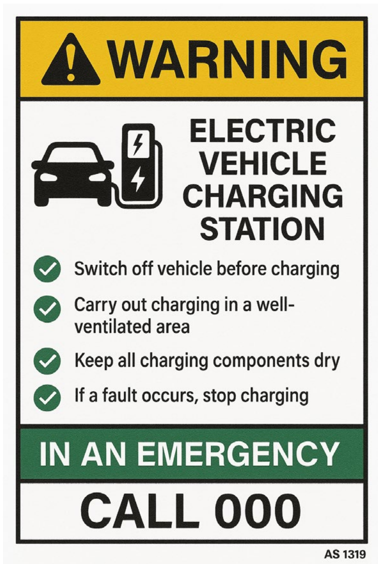
Effective education and training are essential to managing the unique risks posed by lithium-ion batteries within higher education institutions. The complex nature of LiB hazards requires embedding battery safety into existing workplace health and safety systems, governed by Australia's WHS regulatory framework.

Key components of a robust education and training program include:

- **Integration with WHS frameworks:**
  Training should ensure LIB risks are incorporated into incident reporting, risk assessments, and safety management systems as outlined in AS 4801:2001 (Occupational Health and Safety Management Systems) and ISO 31000:2018 (Risk Management). This integration empowers staff to identify hazards and report incidents promptly, fulfilling legal obligations and enhancing overall safety.

- **Incident Response and Emergency Preparedness:**
  Lithium-ion battery incidents, particularly thermal runaway events, can escalate rapidly and require specific response protocols. Unlike conventional fires, LiB fires generate oxygen internally through chemical decomposition, rendering oxygen-starvation tactics ineffective. Training must cover:
  - The chemistry and behaviour of LiBs under stress
  - Early detection of thermal runaway signs
  - Emergency protocols including non-traditional suppression methods such as sand or water immersion techniques, consistent with AS 2444-2001 (Portable Fire Extinguishers) and AS 4146-1997 (Fire Protection for Battery Rooms)
  - Evacuation procedures and clear communication during incidents in line with AS 3745-2010 (Planning for Emergencies in Facilities)
  - Use of appropriate personal protective equipment (PPE) as guided by AS 4501 series (Occupational Protective Clothing)

- **Signage and User Awareness:**
  Facilities must display clear, visible signage to inform users, contractors, and emergency responders about the presence of LiBs, associated risks, and required actions during incidents. Signage should comply with AS 1319-1994 (Safety Signs for the Occupational Environment) to support situational awareness and accelerate safe evacuation or containment.



- **Cross-institutional and Role-specific Training:**
  Training programs should extend beyond technical teams to include procurement, logistics, administrative staff, and end-users. Each stakeholder group must understand their roles and responsibilities in managing battery safety. Regular drills and joint exercises with internal teams and external first responders, including local fire services, foster coordinated and effective emergency responses.

Embedding these elements within institutional education and training frameworks strengthens compliance with WHS legislation and relevant Australian Standards, cultivating a proactive safety culture. This integrated approach equips higher education institutions not only to prevent LiB incidents but also to respond swiftly and effectively should emergencies arise.

Tools and Equipment

Like PMD batteries, LiBs in hand tools and other equipment (e.g. landscape maintenance and vacuum cleaners) can vary in quality and are often more physically exposed. This makes them more prone to damage, particularly from impacts that may not be visible.

NZ Fire department warning


Battery operated vacuum cleaner fire in NSW

Overcharging, especially repeated overcharging, is a known trigger for thermal runaway in these types of devices. To reduce the risk of collateral damage, tools and equipment should ideally not be charged in workshops with high combustible loads, offices, corridors, student accommodation rooms or near flammable liquids.

To further minimize hazards:

1. Purchase only from reputable manufacturers and suppliers.
2. Only use supplied, or certified third-party charging equipment that is compatible with the battery specifications. Using chargers with incorrect power delivery (voltage and current) can cause overheating and fire.
3. Ensure chargers bear the Regulatory Compliance Mark (illustrated to the right), indicating compliance with Australian Standards under the Electrical Equipment Safety System (EESS).
4. Consider specialist charging areas such as battery storage shipping containers, which can be separated from other buildings or hazardous areas.

Operation, Management and Monitoring

Across university campuses and student accommodation, the widespread use of LiBs – from laptops and personal mobility devices to lab equipment – requires consistent safety practices. To mitigate the risk of battery-related incidents such as fires, overheating, or failure, the following recommendations outline best-practice procedures for safe operation, storage, and monitoring across Australian higher education environments.

1. Implement Strict Charging Protocols

Incorrect charging is a major contributor to lithium-ion battery failures and thermal events. To minimise this risk:

- Always follow the manufacturer's charging instructions
- Only use charging equipment provided by or certified for use with the device
- Avoid charging batteries unattended for extended periods, particularly overnight or in confined spaces such as student rooms
- Ensure charging occurs in well-ventilated areas, away from combustible materials
- Do not charge visibly damaged or swollen batteries, and remove any device from charge if it begins to overheat or emit unusual smells

These measures should be clearly communicated in student accommodation guidelines, and promoted in staff training, particularly in facilities where high-power or multi-battery charging is common (eg. research labs, workshops or IT servicing areas).

2. Regular Inspection and Maintenance

Routine inspections are critical for identifying potential hazards before they escalate.

- Establish a proactive preventative maintenance schedule for inspecting lithium-ion batteries in equipment, tools, and backup systems.
- Look for visible warning signs of damage or condition change such as swelling, corrosion, leakage, cracked casing, or a change in colour or smell.

- Use logs to track battery condition, usage cycles, and expected replacement dates – especially for shared-use items like AV equipment, e-bikes, or lab gear.
- Encourage students and staff to report damaged equipment
- Remove and safely isolate any suspect battery unit, power tool or piece of electric equipment until it can be tested, repaired or disposed of properly.

For universities managing large numbers of devices, a centralised asset management system linked to a computerised maintenance management system is recommended to ensure trends can be identified, and proactive or corrective actions are reported. Best practice also links incident trends to maintenance and procurement activities.

3. Use Quality and Certified Batteries Only

Quality control begins with procurement (covered in greater detail in the next subsection). Using certified batteries not only reduces the risk of malfunction but also provides traceability if issues arise.

- Source batteries and equipment from reputable suppliers who meet Australian Standards (e.g. AS/NZS IEC 62133 for safety of rechargeable batteries)
- Avoid purchasing batteries from unverified online retailers, as these may include counterfeit or non-compliant products
- Require proof of compliance or safety certification for batteries acquired through research projects, international collaborations, or student imports
- Clearly document purchasing policies that prohibit the use of unverified third-party or aftermarket batteries.

4. Ensure Proper Storage Conditions

The storage environment, and in particular storage temperature, has a significant impact on battery safety and longevity.

- Store lithium-ion batteries in cool, dry locations, ideally between 15–25°C.
- Avoid areas exposed to direct sunlight, excessive heat, or moisture, such as windowsills, near radiators, or damp basements.
- Batteries should be kept away from flammable materials (eg. paper and chemicals.)
- Do not stack or crush batteries – store them in a stable, upright position with sufficient space to avoid physical stress.
- In shared workspaces, provide designated battery storage locations with signage and hazard markings where appropriate.
- In shared workspaces, provide designated battery storage locations with signage and hazard markings where appropriate
- Particularly in student accommodation, discourage battery storage in drawers, under bedding, or in other confined or concealed spaces.

5. Utilise Lithium-Ion Battery Charging Safety Cabinets

One of the most effective ways to protect against LiB fires is the use of a safety cabinet designed specifically for charging and storing these batteries.

- When charging multiple batteries or larger battery packs (e.g. tool batteries, e-scooters, drones), purpose-built safety cabinets offer significant risk reduction.
- Safety cabinets are made of fire-retardant materials and are designed to contain flames or explosions in the event of a battery failure.
- Some models feature active temperature regulation, ventilation, and fire suppression capabilities to prevent overheating or thermal runaway.
- Cabinets improve organisation and security, preventing overcrowded power boards or tangled charging cables in general access areas.
- Institutions should prioritise these cabinets in laboratories, engineering workshops, maintenance depots, and tech stores.

6. Install Smoke and Heat Detection Systems

Early detection can prevent a minor issue from becoming a serious fire or loss and enhance the ability for first response teams to actively detect, isolate and respond to issues or incidents that may reduce damage, lost productivity or disruption.

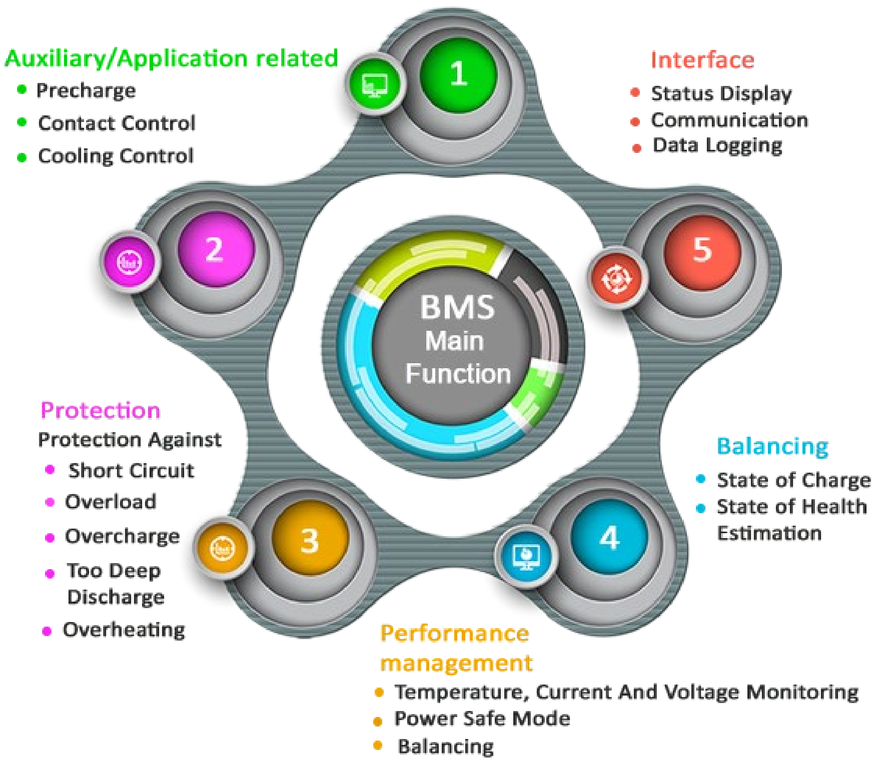
- Install smoke and heat sensors in areas where batteries are regularly stored or charged, such as accommodation rooms, server rooms, and e-bike garages.
- Ensure these systems are integrated into the building's central fire detection and alarm infrastructure, and preferably with back to base monitoring.
- Use thermal cameras and AI based CCTV monitoring within larger battery storage areas, high risk areas or remote areas where heat build-up may go unnoticed.
- If EV parking is provided within building envelopes, consider enhanced detection near charging stations or shared e-mobility storage areas.
- Test and maintain all sensors regularly per AS 1851-2012 (Routine service of fire protection systems and equipment) to ensure reliability and compliance.

7. Leverage Battery Management Systems (BMS)

For institutions managing larger, high-capacity, or embedded battery systems (e.g. in solar panels, UPS systems, electric vehicles), advanced monitoring is essential.

- A Battery Management System monitors battery voltage, charge/discharge cycles, temperature, and real-time state of health
- When connected with Building Management Systems, can coordinate automated equipment isolations or shutdowns if unsafe conditions are detected
- BMS can extend battery lifespan through load balancing and charging optimisation
- Data from BMS can also support maintenance planning and regulatory compliance

Universities with facilities teams managing backup power systems, electric fleet vehicles, or solar infrastructure should integrate BMS as standard practice to other asset and data management systems.



8. Follow Safe Transportation Protocols

Transporting batteries poses risks if not done correctly. Where regular battery transport occurs, formal handling procedures should be documented and incorporated into risk management plans.

- Always transport batteries in containers or packaging that prevents physical damage. Cover anodes with sticky tape to prevent accidental short circuiting
- Use original packaging where possible, or transport boxes with internal insulation
- Isolate and handle damaged batteries these as hazardous waste
- Staff involved in battery movement (e.g. logistics teams moving equipment between laboratories, campuses, or storage sites) should be aware of relevant Australian Dangerous Goods Codes
- For larger batteries, affix warning labels to indicate risk of fire, explosion, or chemical leakage if dropped or punctured.

Procurement Considerations

Most institutions exercise delegations alongside a purchasing or procurement policy, which ensures financial probity and accountability through defined procurement processes (those that don't should lean on their peers within the higher education sector, or host institution for guidance). These typically include competitive tendering and contracting obligations, alignment with preferred supplier lists, and mechanisms for ethical and sustainable purchasing.

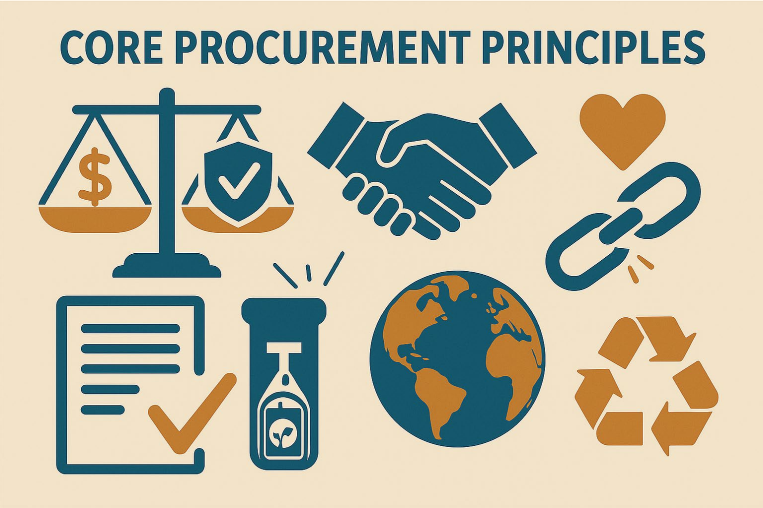
In the context of lithium-ion batteries and battery-powered products, procurement must extend beyond basic cost and availability. It should integrate environmental, social, and governance (ESG) considerations, especially due to the high-risk nature of battery materials, manufacturing processes, and end-of-life impacts.

Core Procurement Principles

Procurement involving LiBs should typically reflect the appropriate policy principles:

- Value for Money – balancing cost, performance, quality, and lifecycle impacts
- Ethical Sourcing – ensuring responsible labour and environmental practices
- Modern Slavery Compliance – addressing risks of forced or exploitative labour
- Sustainability – supporting carbon reduction, recyclability and circularity

Consult with your procurement team to confirm whether proposed suppliers are on an approved vendor list. If not, a due diligence process is recommended to be undertaken.



Procurement Due Diligence

Due diligence is essential when procuring lithium-ion batteries, given their complex global supply chains, evolving technologies, and associated environmental and human rights risks. For universities, responsible sourcing supports both product safety and institutional obligations, including compliance with the Modern Slavery Act 2018 (Cth) and alignment with Environmental, Social and Governance (ESG) commitments.

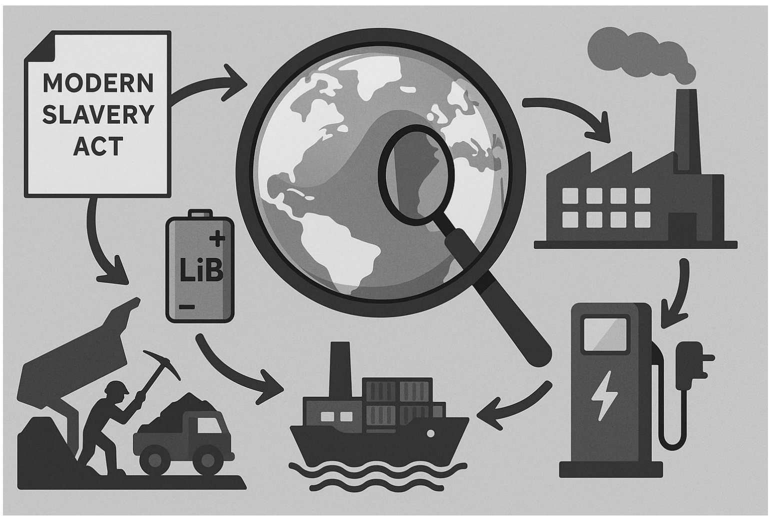
The due diligence process should be proportionate to the scale and risk of the procurement. As shown below, it typically involves three key steps that together ensure informed, ethical, and legally compliant procurement decisions.

1. **Supply Chain Traceability**

Universities and other organisations subject to the Modern Slavery Act 2018 (Cth) must assess and report annually on modern slavery risks in their operations and supply chains. Lithium-ion battery procurement poses elevated risks due to sourcing of raw materials like cobalt and lithium, often from high-risk regions. Understanding the origin of materials and manufacturing processes is essential to ensure alignment with the university's Modern Slavery Statement and broader ESG commitments. Key considerations include:

- Origin and traceability of raw materials
- Countries and entities involved in production and assembly
- Compliance with recognised labour and environmental standards
- Supplier transparency and declarations related to modern slavery

Supply chain traceability supports ethical procurement and is critical to fulfilling your organisations' legal reporting obligations.



2. **Risk Assessment**

Conduct a multi-layered risk analysis considering the following dimensions:

Risk Description	Potential Impact	Key Risk Factors	Comments / Notes
Manufacturing (product) defects	Defective batteries can spontaneously ignite, causing recalls, financial loss, and reputational harm.	Poor quality control, substandard materials, or design flaws during manufacturing.	Robust technical specifications, procurement, quality assurance, and supplier management are critical.
Human rights and modern slavery violations	Reputational damage, legal exposure under the Modern Slavery Act 2018 (Cth), and ethical breaches.	Raw material sourcing from high-risk regions with known forced or child labour.	Institutions must assess and report these risks annually under their Modern Slavery Statements.
Environmental non-compliance	Supply chain breaches of environmental regulations can lead to reputational harm or procurement bans.	Suppliers operating in jurisdictions with weak environmental oversight.	Environmental impact and sustainability should be part of supplier screening and specification processes.
Non-conformance with safety standards	Increased risk of injury, liability claims, and regulatory non-compliance.	Products lacking third-party certifications or falsely claiming compliance.	Require documented compliance with relevant Australian or international safety standards.
Lack of lifecycle accountability (grievance mechanisms)	Performance failures, higher replacement rates, or unnoticed product recalls.	No mechanism for tracking product history, faults, or recalls.	Include procurement clauses for lifecycle monitoring, post-purchase review, and end-of-life planning.

3. **Product Assessment and Review**

If a product passes supply chain and risk assessment checks, it may proceed to final review and approval. However, new LiB products (as with any other new products) should be subject to ongoing asset and lifecycle monitoring, particularly when new or high-capacity technologies are involved. Asset management and review includes:

- Verifying product recalls or consumer alerts
- Monitoring performance and safety reports
- Reviewing warranty, servicing, and end-of-life disposal processes
- Requesting safety data sheets or thermal event history (if available)

In 2022, a national safety warning was issued following a recommendation by the Australian Competition and Consumer Commission (ACCC) regarding LG lithium-ion solar batteries. These batteries were at risk of overheating and causing fires, with around 8,000 units identified. Three quarters remain unaccounted for despite a product recall. This case underscores the importance of continual product oversight beyond initial procurement.

Greenhouse Gas Emissions

Depending on your institution's sustainability commitments (such as climate action plans or mandatory GHG reporting) it is important to assess the greenhouse gas (GHG) emissions associated with lithium-ion batteries and LIB-powered equipment as part of your procurement processes. These emissions occur throughout the product lifecycle and should be evaluated in accordance with the three scopes defined by the GHG Protocol, with particular attention to Scope 2 (electricity use) and Scope 3 (value chain emissions).

For universities, research institutions, and student accommodation providers, the widespread use of LIBs can be a significant, yet often overlooked, source of emissions.

- *Scope 1 emissions* are generally minimal for LIBs unless on-site fuel use is involved
- *Scope 2 emissions* are relevant wherever grid electricity is used to recharge batteries and could be expected to increase with electrification initiatives. Emissions can be reduced through renewable energy procurement, generation or energy-efficient equipment.
- *Scope 3 emissions*, often the largest due to embedded carbon in goods and waste, are critical for institutions with net-zero targets, ESG reporting, or student-focused sustainability goals. Including them in procurement evaluations supports better emissions tracking and decision-making.

The table below outlines how LIB-related activities may contribute to each GHG emissions scope in the context of higher education and research environments:

GHG Emission	Definition	LIB-Relevant Emission Sources	Relevant Examples & GHG Protocol Categories
Scope 1 Direct - from owned or controlled sources	Emissions from on-site combustion or institutional vehicles and equipment	Limited relevance, but may apply in specific campus or housing operations	- Use of diesel / petrol generators to charge LIBs during power outages - Institutional vehicle fleets using hybrid systems with on-board fuel combustion - Lab environments with custom battery testing emitting trace gases
Scope 2 Indirect - from purchased electricity	Emissions from electricity used to charge or operate LIB-powered systems	Significant for institutions operating battery-powered devices or infrastructure	- Charging electric campus vehicles - Charging backup power systems in labs, accommodations, or server rooms - Charging student devices or loaned laptops in libraries and accommodation
Scope 3 Indirect - from the value chain	Emissions outside direct control but linked to procurement, operations, and service use	Typically, the largest contributor; spans battery lifecycle from production to disposal	**Upstream** - *Category 1: Purchased goods and services* (eg Procurement of lab equipment, drones, e-bikes, laptops with LIBs) - *Category 2: Capital goods* (Investments in EV fleets, solar-battery storage systems) - *Category 4: Upstream transportation and distribution* (Shipping of devices and batteries to campus) - *Category 5: Waste generated in operations* (Disposal of spent batteries) **Downstream** - *Category 11: Use of sold products* (LIB-powered devices distributed to students) - *Category 12: End-of-life treatment of sold products* (Institutional recycling programs)

Tenders, Contracts and Contractor Management

As lithium-ion battery technologies become increasingly integrated into campus and higher education operations, institutions must ensure that procurement and contractor engagement processes are structured to address the unique risks they pose. From electric vehicle charging infrastructure and e-mobility devices to battery-powered tools and backup systems, the engagement of third-party contractors brings both operational opportunities and safety obligations. The tendering and contracting process must go beyond traditional cost and compliance criteria to actively embed battery-specific risk controls, quality standards, and lifecycle considerations.

Effective contractor management begins at the pre-tender stage, where specifications should clearly outline expectations around product safety certifications, installation practices, and post-installation maintenance obligations. Contracts should include enforceable clauses related to compliance with Australian standards, fire safety provisions, and environmental and waste management responsibilities (particularly concerning the safe disposal of defective or end-of-life LiBs). In the context of higher education, where shared facilities and diverse user groups increase exposure to operational risk, accountability for safe battery management must be traceable through both contractor actions and institutional oversight.

Robust governance over third-party engagements also supports broader institutional risk management goals. By establishing clear selection criteria, onboarding procedures, and performance monitoring systems, universities can reduce the likelihood of unsafe installations, product recalls, and claims related to LiB incidents. Furthermore, contractors, particularly those involved in installation, servicing, or disposal, must be trained in LiB safety principles and equipped to respond to emergencies in line with campus protocols. Aligning contractual frameworks with institutional risk and safety expectations is not only a matter of regulatory compliance but a vital step in building long-term operational resilience.

Key Considerations for Tenders, Contracts and Contractor Management

When procuring, engaging or managing contractors who supply, install, maintain or dispose of lithium-ion battery-powered systems, equipment or infrastructure, consider incorporating the following tender questions, embedded contract obligations, and KPIs:

Useful Tender Questions

Product Safety & Compliance

Can you provide evidence of product compliance with Australian Standards and relevant safety certifications for lithium-ion batteries and charging infrastructure?

Installation & Fire Safety

What measures do you take to ensure fire-safe installation of LiB infrastructure, particularly in confined or high-traffic spaces?

Training and Qualifications

What training do your staff receive regarding the safe handling, installation, and disposal of lithium-ion batteries?

Incident History & Risk Management

Have you been involved in any LiB-related incidents, product recalls, or thermal events in the last five years? If so, what corrective actions were taken?

Sustainability and Lifecycle Management

How do you address end-of-life management and environmental compliance for LiB-powered equipment?

Contract Clauses to Include (Embedded Responsibilities)

Clause	Detail
Safety Compliance	Contractors must ensure all LiB-related products, installation work, and operational procedures comply with relevant Australian Standards and university safety protocols.
Mandatory Reporting	All safety incidents, product faults, or thermal events involving LiBs must be reported within 24 hours, with a written incident analysis and corrective action plan provided within 5 business days.
Disposal Requirements	Contractors are responsible for ensuring environmentally responsible disposal or recycling of any LiB-powered devices or components in accordance with EPA and institutional requirements.
Safety Induction	All contractor personnel must complete a site-specific induction covering LiB risk awareness, emergency procedures, and hazard identification.

Performance KPIs for Contractor Management

1. 100% of LiB products purchased and installed with documented certification and compliance markings
2. Evidence of LiB safety training for all staff members
3. Zero LiB-related safety incidents or near-misses per reporting cycle
4. Completion of post-installation quality inspection and acceptance of commissioning checklists within 5 business days post-handover
5. Quarterly asset audit of installed battery systems for condition, documentation, and warranty status
6. Management of batteries based on condition rather than theoretical expected life
7. Timely response to maintenance requests involving LiBs, likely aligned with an appropriate level of service (eg within 4 hours for high-risk faults)

Safe Disposal of Lithium-ion Batteries

The safe disposal of LiBs is a growing public safety concern in Australia. When discarded into general waste or recycling streams, LiBs can become damaged or punctured, particularly during compaction in bins and trucks. Damaged batteries can lead to thermal runaway, fires, and explosions. These incidents not only endanger workers and emergency responders but also result in significant environmental and infrastructure damage.

The scale of the problem is alarming. Fire and Rescue NSW, reported 177 fire incidents involving waste trucks and waste facilities in 2023, a 43% increase on the previous year. Of the 301 total waste-related fires attended in NSW, 10% were confirmed to be attributed to improperly disposed lithium-ion batteries. Nationally, the waste and recycling industry estimates it battles up to 12,000 battery-related fires annually, many of which are linked to household and commercial disposal errors.

High-profile incidents have raised public awareness, such as the 2022 blaze that destroyed the ACT's main recycling facility, believed to have started from a lithium battery. Federal and state environment ministers have since acknowledged the urgency of the issue, agreeing to pursue tighter regulations and expanded stewardship schemes to address the risks associated with battery disposal.

The images below illustrate the fire risk that emergency respondents and front-line workers face, highlight the unpredictable and dangerous outcomes of improper battery handling. As LiBs become more prevalent in everyday devices and infrastructure, universities and affiliated institutions have a duty to ensure these batteries are identified and disposed of through safe, approved pathways.

ABC News (2024) – "Tackling lithium-ion battery fires 'next big thing' for Australian recycling industry"

News.com (2023) – "Perth Street piled with rubbish after lithium-ion battery fire in garbage truck"

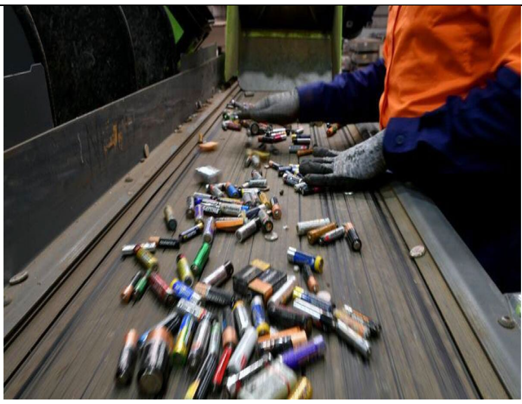
Federal and state ministers have flagged urgent reforms to battery disposal laws, following a wave of serious fires linked to discarded lithium-ion batteries. In their June 2024 communique, ministers recognised that "battery fires are escalating as an issue and require interventions through the battery life cycle – from their design to the way they are stored and disposed of at their end of life," highlighting the "critical importance of acting quickly on batteries to protect lives and property."

- Insurance NEWS 24 June 2024

Battery recycling

Lithium-ion batteries contain valuable and finite materials such as lithium, cobalt, and nickel, which can be recovered and reused through proper recycling processes. Recycling helps reduce the need for raw material extraction, conserves natural resources, and lessens the environmental footprint of battery production. Critically, safe recycling also prevents potentially hazardous incidents (such as fires and chemical leaks) that can occur when LiBs are improperly disposed of in general waste or recycling streams. In Australia, the growing number of fires linked to incorrectly discarded batteries.

Various battery recycling programs and initiatives are established within Australia and provide useful options for institutions to consider for prioritising safe and sustainable waste disposal. Direct engagement with cleaning and waste management providers to support your institutions objectives will provide tangible results to measure success.



Canberra Times – Battery Recycling & Disposal

Envirostream battery recycling process

Australia has established national programs to ensure consistent and accessible battery recycling services across the country (including those referenced in the table below). These programs provide guidance, collection networks, and resources to support individuals, businesses, and institutions in safely managing and recycling used batteries.

Entity	Reference site	Information
B-cycle Australia	www.bcycle.com.au	National battery stewardship scheme providing recycling drop-off locations (often at retailers like Bunnings) and guidance for institutions and businesses. Note that small handheld batteries and removable rechargeable batteries are only accepted.
Australian Battery Recycling Initiative	www.batteryrecycling.org.au	Resources supporting responsible battery recycling practices.
Batteries 4 Planet Ark – Business & Workplace Recycling	Batteries 4 Planet Ark	National battery recycling service via secure, fireproof collection boxes. Collections captured by Close the Loop, and recycled by Envirostream

Jurisdictional EPA Programs

State and territory environmental protection agencies (EPAs) also manage programs and regulations to address battery recycling. These programs provide region-specific guidance, compliance requirements, and support services for institutions handling battery waste.

Jurisdiction	Reference Site	Information
New South Wales	NSW EPA Battery Regulation	NSW has introduced regulations for battery stewardship, including embedded batteries, and offers grants to support safe recycling initiatives for businesses
Victoria	EPA Victoria – Battery Management	Supports compliance and provides guidelines and educational material for safe battery storage and disposal
Queensland	DES Waste Strategy	Implements a waste strategy emphasising energy recovery from waste, including batteries. Offers guidelines for institutions on managing battery waste responsibly
South Australia	EPA SA – Battery Recycling	Promotes battery recycling through public education and supports institutions by providing information on proper disposal methods to prevent environmental hazards.
Western Australia	EPA WA – Waste Management	Oversees waste management proposals, including those related to batteries, and provides assessments to ensure environmental compliance for institutional projects.
Tasmania	EPA Tasmania – Business Waste	Offers programs to assist with waste minimisation and recycling, including battery waste. Recognises sustainable practices through awards.
Northern Territory	NT EPA – Waste Batteries	Classifies waste batteries as controlled waste, requiring licensed transport and disposal. Provides guidelines to help institutions comply
Australian Capital Territory	ACT Government – Battery Recycling	Presides over 50 B-cycle drop-off points for battery recycling and offers information to institutions on proper disposal practices to prevent environmental risks.

Disposal process flowchart

Universities and higher education institutions have a duty of care to manage the risks associated with battery disposal, particularly given the range of devices and applications using LiBs found across campuses. Best practice disposal processes include:

Collect

Segregated Collection Points

Establish dedicated and clearly marked battery collection stations in workshops, laboratories, staff areas, and central campus locations. Ensure these are easily accessible and prevent batteries from entering general waste streams.

Inspect

Inspection and Preparation Prior to Disposal

Where possible, ensure batteries are intact, terminals are taped to prevent short circuits, and devices with embedded batteries are clearly labelled for recycling.

Store

Safe Interim Storage

Store collected batteries in cool, dry locations, and preferably within fire-resistant containers, located in well-ventilated, secure areas away from ignition sources

Dispose

Engage Licensed Battery Recyclers

Partner with certified recyclers through your waste management providers to ensure compliant recycling and responsible end-of-life processing.

Audit

Record Keeping and Audit Trails

Implement systems to track the quantities and disposal pathways of LiBs, including collection dates, recycling partner details, and documentation required by local regulations.

Appendix 1 – Acronyms

Acronym	Full Term	Definition / Context
ABC	Australian Broadcasting Corporation	Australia's national public broadcaster, providing television, radio, and online media services.
ABCB	Australian Building Codes Board	A government body responsible for developing and managing Australia's building and plumbing codes.
AC	Alternating Current	A type of electrical current where the flow of electric charge periodically reverses direction.
ACCC	Australian Competition & Consumer Commission	The Australian regulatory agency promoting competition and fair trading to benefit consumers, businesses, and the economy.
ACTF&R	ACT Fire and Rescue	The primary emergency service responsible for fire suppression, rescue operations, and incident response within the ACT.
AFAC	Australasian Fire and Emergency Service Authorities Council	A collaborative body providing leadership and support to fire and emergency services across Australasia (led in conjunction with Monash University)
AI	Artificial Intelligence	The simulation of human intelligence by machines, enabling them to perform tasks like learning, reasoning, and decision-making.
AS/NZS	Australian/New Zealand Standard	Joint standards developed by Standards Australia and Standards New Zealand to ensure safety, quality, and performance across various industries.
ATV	All-Terrain Vehicle(s)	Motorised off-road vehicles designed for rugged terrain and recreational or utility use.
BESS	Battery Energy Storage System	A technology that stores electrical energy for later use, often used with renewable energy sources.
BMS	Battery Management System	An electronic system that manages a rechargeable battery, ensuring it operates safely and efficiently.
CCS	Combined Charging System	A standardised charging system for electric vehicles that combines AC and DC charging capabilities into a single connector.
CCTV	Closed Circuit Television	A surveillance system using video cameras to transmit signals to specific monitors for security purposes.
Cth	Commonwealth	A reference to the federal government of Australia or laws made at the national level.
DC	Direct Current	A type of electrical current where the electric charge flows in a constant, unidirectional path.
DGR	Dangerous Goods Regulations	Regulations governing the transport of hazardous materials, including lithium batteries, to ensure safety during transit.
DoD	Depth of Discharge	The percentage of a battery's capacity that has been used; the inverse of State of Charge.
EOT	End of Trip (Facilities)	The completion point of a journey or travel segment, often used in transportation and logistics contexts.
EPA	Environmental Protection Agency	A government agency responsible for regulating and enforcing environmental protection laws.
ESG	Environment, Social & Governance	A framework for evaluating a company's ethical impact and sustainability practices.
EV	Electric Vehicle	A vehicle powered entirely or partially by electricity, typically using lithium-ion batteries.

EVC	Electric Vehicle Council (of Australia)	The national industry body advocating for the adoption and support of electric vehicles in Australia.
FRL	Fire Resistance Level	A rating that indicates how long a building element can withstand fire conditions
FRNSW	Fire and Rescue New South Wales	The primary fire and rescue service for New South Wales, responsible for responding to fires, rescues, and other emergencies.
GHG	Greenhouse Gas	Gases that trap heat in the atmosphere, contributing to global warming and climate change.
HAZMAT	Hazardous Materials (& Response)	Substances that pose a risk to health, safety, or the environment, especially during storage or transport.
HV	High Voltage	Electrical systems operating at voltages high enough to pose serious risk or require specialized insulation and safety measures.
ICA	Insurance Council Of Australia	The peak national body representing the general insurance industry in Australia.
ICE(V)	Internal Combustion Engine (Vehicle)	An engine that generates power by burning fuel inside a combustion chamber.
IEC	International Electrotechnical Commission	An international standards organisation that prepares and publishes standards for electrical, electronic, and related technologies.
ISO	International Organisation for Standardisation	An international body that develops and publishes global standards for various industries and processes.
LiB	Lithium-ion Battery	A type of rechargeable battery commonly used in portable electronics, electric vehicles, and energy storage systems. (Also commonly referenced as Li-Ion Batteries or LiPO – Lithium-Ion Polymer Batteries)
NCC	National Construction Code	Australia's set of technical provisions for the design and construction of buildings and plumbing systems.
PCBU	Persons conducting a business or undertaking	Anyone responsible for managing health and safety in a workplace, such as an employer or organisation.
PHEV	Plug-in hybrid electric vehicle	A vehicle that combines a petrol or diesel engine with an electric motor and can be recharged via an external power source.
PMD	Personal Mobility Device	Small, lightweight devices such as e-scooters or e-skateboards, often powered by lithium-ion batteries.
RCD	Residual Current Device	A safety switch that quickly disconnects electrical power to prevent electric shock from earth or other electrical faults.
SoC	State of Charge	The current charge level of a battery relative to its capacity, usually expressed as a percentage.
SOC	Safety of Charge	Used interchangeably with State of Charge – but can also refer to safety considerations related to charging processes.
TEFMA	Tertiary Education Facilities Management Association	The professional body that supports excellence in planning, development, and management of higher education facilities across Australia, New Zealand, and the South Pacific.
UPS	Uninterruptible Power Supply	A backup power system that provides electricity during a power outage to keep critical equipment running.
WHS	Work Health & Safety	Laws and practices aimed at ensuring the health, safety, and welfare of people in the workplace.

Appendix 2 – Standards and Codes

Ref Document	Full Term	Brief Context
ADG Code	Australian Dangerous Goods Code	Specifies requirements for the transport of dangerous goods by road and rail in Australia, including lithium batteries.
ADRs	Australian Design Rules	Federal standards prescribing safety and design requirements for vehicles, including measures for EV battery integrity, high voltage safety, and electrolyte containment.
AS/NZS 1940	The Storage and Handling of Flammable and Combustible Liquids	While not lithium-specific, it can apply in mixed-risk storage environments where lithium-ion batteries are stored near flammable materials.
AS/NZS 2890 (series)	Parking Facilities	Covers the planning, design and layout of off-street parking including safety, access, circulation, and integration with EV charging and fire safety requirements.
AS/NZS 3000	Wiring Rules	Sets out the requirements for the design, construction and verification of electrical installations, including those related to EV charging infrastructure.
AS/NZS 3008	Electrical installations – Selection of cables	Contains requirements for cable sizing from the upstream power supply to EV chargers.
AS/NZS 3112	Approval and test specification – Plugs and socket-outlets	Specifies the requirements for plugs and socket-outlets for household and similar purposes.
AS/NZS 3760: 2010	In-service safety inspection and testing of electrical equipment	Provides procedures for the inspection and testing of electrical equipment to ensure ongoing safety during use.
AS/NZS 3760: 2022	In-service safety inspection and testing of electrical equipment	Guidelines for safe design, installation and maintenance of electrical systems.
AS/NZS 3820	Essential Safety Requirements for Electrical Equipment	Specifies minimum safety requirements for electrical equipment intended for connection to low voltage installations.
AS/NZS 4417	Regulatory Compliance Mark – General rules for use	Provides the general rules for the use and application of the Regulatory Compliance Mark on electrical equipment.
AS/NZS 4777	Grid connection of energy systems via inverters	A series of standards covering requirements for inverter energy systems connected to the grid.
AS/NZS 5139	Installation and safety requirements for battery systems	A standard specifying the safety requirements for the installation of battery energy storage systems
AS/NZS 5732	Electric vehicle operations – Maintenance and repair	Guides technicians on the safe handling, maintenance and repair of electric vehicles.
AS/NZS 15194	Cycles - Electrically power assisted cycles EPAC Bicycles	A standard covering safety and performance requirements for electrically assisted bicycles.
AS/NZS 60079 (series)	Explosive Atmospheres	Specifies requirements for equipment and installations in hazardous (e.g. flammable or explosive) locations - relevant if LiBs are stored or used in these areas.
AS/NZS 60335	Safety of household and similar electrical appliances	A standard focusing on the safety of electrical appliances, including those incorporating LiBs.
AS/NZS 60950	Safety of information technology equipment	A standard ensuring the safety of IT equipment, which may include devices powered by lithium batteries.

AS/NZS 61000	Electromagnetic compatibility (EMC) standards	A series of standards addressing electromagnetic compatibility to ensure devices function properly without interference.
AS/NZS 61439 (series)	Low-voltage switchgear and control gear assemblies	A standard specifying requirement for low-voltage switchgear and control gear assemblies, relevant to EV charging infrastructure.
AS/NZS 61558	Safety of power transformers, power supplies, reactors, and similar products	A standard focusing on the safety of power transformers and related equipment, which may be used in charging systems.
AS/NZS 61851	Electric vehicle conductive charging system	A standard outlining requirement for electric vehicle conductive charging systems, ensuring safety and interoperability.
AS/NZS 62133	Safety requirements for portable sealed secondary cells	A standard specifying safety requirement for portable sealed secondary cells and batteries containing alkaline or other non-acid electrolytes.
AS/NZS 62368	Audio/video, information and communication technology equipment	A standard covering safety requirement for audio/video, information, and communication technology equipment.
AS/NZS 62619	Safety requirements for secondary lithium cells and batteries	A standard specifying safety requirement for secondary lithium cells and batteries used in industrial applications.
AS/NZS 62620	Secondary lithium cells and batteries for use in industrial applications	A standard focusing on the performance and safety of secondary lithium cells and batteries in industrial settings.
AS/NZS 62933	Electrical energy storage systems	A standard addressing the safety and performance of electrical energy storage systems, including those using LiBs.
AS/NZS 62934	Electrical energy storage systems – Safety requirements	A standard specifying safety requirement for electrical energy storage systems to ensure safe operation.
AS/NZS 62935	Electrical energy storage systems – Environmental aspects	A standard focusing on the environmental considerations of electrical energy storage systems, including end-of-life management.
AS/NZS 62936	Electrical energy storage systems – Performance testing	A standard outlining performance testing methods for electrical energy storage systems to ensure reliability and efficiency.
AS/NZS 62937	Electrical energy storage systems – Installation guidelines	A standard providing guidelines for the installation of electrical energy storage systems, ensuring safety and compliance.
AS/NZS 62938	Electrical energy storage systems – Maintenance and operation	A standard detailing maintenance and operational procedures for electrical energy storage systems to ensure longevity and safety.
AS/NZS 62939	Electrical energy storage systems – System integration	A standard focusing on the integration of electrical energy storage systems into existing electrical networks and infrastructure.
AS/NZS 62940	Electrical energy storage systems – Safety requirements for grid-connected systems	A standard specifying safety requirement for grid-connected electrical energy storage systems, including those using LiBs.
AS/NZS 62941	Electrical energy storage systems – Safety requirements for off-grid systems	A standard outlining safety requirement for off-grid electrical energy storage systems to ensure safe and reliable operation.
AS/NZS 62942	Electrical energy storage systems – Safety requirements for hybrid systems	A standard focusing on the safety requirements for hybrid electrical energy storage systems, combining different energy sources.

AS/NZS 62943	Electrical energy storage systems – Safety requirements for mobile applications	A standard specifying safety requirements for mobile electrical energy storage systems, such as those used in vehicles or portable devices.
AS/NZS 62944	Electrical energy storage systems – Safety requirements for marine applications	A standard addressing the safety requirements for electrical energy storage systems used in marine environments.
AS/NZS 62945	Electrical energy storage systems – Safety requirements for aerospace applications	A standard focusing on the safety requirements for electrical energy storage systems used in aerospace applications.
AS/NZS 62946	Electrical energy storage systems – Safety requirements for railway applications	A standard specifying safety requirements for electrical energy storage systems used in railway applications.
AS/NZS 62947	Electrical energy storage systems – Safety requirements for underground applications	A standard outlining safety requirements for electrical energy storage systems used in underground environments.
AS/NZS 62948	Electrical energy storage systems – Safety requirements for hazardous locations	A standard addressing the safety requirements for electrical energy storage systems used in hazardous locations, such as explosive atmospheres.
AS/NZS 62949	Electrical energy storage systems – Safety requirements for residential applications	A standard specifying safety requirements for electrical energy storage systems used in residential settings.
AS/NZS 62950	Electrical energy storage systems – Safety requirements for commercial applications	A standard focusing on the safety requirements for electrical energy storage systems used in commercial environments.
AS/NZS 62951	Electrical energy storage systems – Safety requirements for industrial applications	A standard outlining safety requirements for electrical energy storage systems used in industrial settings.
AS/NZS 62952	Electrical energy storage systems – Safety requirements for agricultural applications	A standard specifying safety requirements for electrical energy storage systems used in agricultural environments.
AS/NZS 62953	Electrical energy storage systems – Safety requirements for recreational applications	A standard focusing on the safety requirements for electrical energy storage systems used in recreational settings, such as RVs or boats.
AS/NZS 62954	Electrical energy storage systems – Safety requirements for emergency applications	A standard outlining safety requirements for electrical energy storage systems used in emergency situations, such as backup power systems.
AS/NZS 62955	Electrical energy storage systems – Safety requirements for medical applications	A standard specifying safety requirements for electrical energy storage systems used in medical devices and facilities.
AS/NZS 62956	Electrical energy storage systems – Safety requirements for data centres	A standard focusing on the safety requirements for electrical energy storage systems used in data centres to ensure uninterrupted power supply.
AS/NZS 62957	Electrical energy storage systems – Safety requirements for telecommunications applications	A standard outlining safety requirement for electrical energy storage systems used in telecommunications infrastructure.
AS/NZS 62958	Electrical energy storage systems – Safety requirements for military applications	A standard specifying safety requirements for electrical energy storage systems used in military settings.
AS/NZS 62959	Electrical energy storage systems – Safety requirements for remote applications	A standard focusing on the safety requirements for electrical energy storage systems used in remote or isolated locations.

AS/NZS 62960	Electrical energy storage systems – Safety requirements for temporary applications	A standard outlining safety requirement for temporary applications
IATA DGR	International Air Transport Association – Dangerous Goods Regulations	Global standard for the safe transport of dangerous goods by air, including lithium-ion batteries.
IEC 60086-4	Primary batteries – Safety of lithium batteries	Safety standard for non-rechargeable lithium batteries, relevant for devices or mixed inventories.
IEC 62196 series	Plugs, socket-outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles	Specifies requirements for EV charging connectors and sockets.
IEC 62955	Residual direct current detecting device (RDC-DD)	Defines performance requirements for devices detecting residual DC current in EV charging systems.
IMDG Code	International Maritime Dangerous Goods Code	Internationally accepted regulations for the safe transport of dangerous goods by sea, including lithium batteries.
NCC 2022	National Construction Code – Building Code of Australia	Clauses E1D17 and E2D21 require building designers to consider and document provisions for EV and EV charging equipment within new or modified buildings.
NEC / NFPA 70	National Electrical Code (USA)	A set of minimum standards for the safe installation of electrical systems, including specific requirements for EV charging equipment and battery storage.
UL 2849	Electrical systems for eBikes	A standard covering the design and safety requirements of electrical systems used in e-bikes.
UN38.3	UN Manual of Tests and Criteria, Section 38.3	A section outlining testing requirements for lithium batteries to ensure safety during transport.

Appendix 3 – Reference links

https://www.tefma.com/
https://100percentrenewables.com.au/2022-net-zero-tracker-and-the-impact-rankings-of-leading-australian-universities/
https://www.researchgate.net/publication/372102771_Revolutionizing_energy_storage_Overcoming_challenges_and_unleashing_the_potential_of_next_generation_Lithium-ion_battery_technology/fulltext/64a452568de7ed28ba7488ab/Revolutionizing-energy-storage-Overcoming-challenges-and-unleashing-the-potential-of-next-generation-Lithium-ion-battery-technology.pdf?_tp=eyJjb250ZXh0Ijp7ImZpcnN0UGFnZSI6InB1YmxpY2F0aW9uIiwicGFnZSI6InB1YmxpY2F0aW9uIn19
https://www.thefpa.co.uk/advice-and-guidance/advice-and-guidance-articles/how-to-control-a-lithium-ion-battery-fire-
https://gcube-insurance.com/Insights/Reports/Battery-and-Energy-Storage-Systems
https://insurancecouncil.com.au/resource/e-scooter-and-e-bike-owners-urged-to-check-insurance-coverage-and-storage-charging-practices/
https://electricvehiclecouncil.com.au/uncategorized/2024-sets-new-record-for-ev-sales-in-australia/
https://www.grandviewresearch.com/industry-analysis/lithium-ion-battery-market
https://www.fire.nsw.gov.au/gallery/resources/SARET/Fire-Safety-Position-Paper-Electric-vehicles-(EV)-and-EV-charging-equipment-in-the-built-environment-v1.0.pdf
https://www.nature.com/articles/35104644
https://ecodesignbatteries.eu/sites/ecodesignbatteries.eu/files/attachments/ED_Battery_Task 1_V29_final.pdf
https://esa.act.gov.au/sites/default/files/2023-01/afac_evs-in-built-environment_2022-12-22_v1-0.pdf
https://www.fm.com/FMAApi/data/ApprovalStandardsDownload?itemId=%7b5346762A-8355-45C1-9508-6A203088A8DE%7d
https://www.nfpa.org/education-and-research/research/fire-protection-research-foundation/projects-and-reports/stranded-energy-within-lithium-ion-batteries
https://www.accc.gov.au/media-release/consumers-urged-to-use-and-store-lithium-ion-batteries-safely-to-prevent-deadly-fires
https://www.infrastructure.gov.au/infrastructure-transport-vehicles/vehicles/new-vehicle-efficiency-standard
https://www5.austlii.edu.au/au/legis/cth/consol_act/whasa2011218/index.html
https://www.infrastructure.gov.au/infrastructure-transport-vehicles/transport-strategy-policy/transport-australia/transport-dangerous-goods/australian-dangerous-goods-code
https://ncc.abcb.gov.au/
https://legislation.nsw.gov.au/view/pdf/asmade/epi-2023-80
https://classic.austlii.edu.au/au/legis/nsw/consol_act/ra199373/
https://legislation.nsw.gov.au/view/whole/html/inforce/current/act-2017-015
https://www.fire.nsw.gov.au/page.php?id=9447&position=8
https://www.nfpa.org/codes-and-standards/nfpa-921-standard-development/921
https://www.abcb.gov.au/sites/default/files/resources/2023/ABCB-EV-Guidance-Document-June-2023.pdf
https://www.abcb.gov.au/sites/default/files/resources/2024/296877-ABCB-ARUP-Fire-safety-in-carparks.pdf
https://www.thefpa.co.uk/resource-download/360
https://esa.act.gov.au/sites/default/files/2023-08/FSG-22-Electric-Vehicles-and-EV-Charging-Equipment-in-the-Built-Environment.pdf
https://www.statedevelopment.qld.gov.au/__data/assets/pdf_file/0016/18142/practice-note-electric-vehicle-charging.pdf
https://www.abcb.gov.au/sites/default/files/resources/2023/ABCB-EV-Guidance-Document-June-2023.pdf
https://www.eess.gov.au/
https://www.legislation.gov.au/C2018A00153/latest/text
https://www.productsafety.gov.au/about-us/publications/safety-warning-notice-lg-home-energy-storage-system-batteries
https://ghgprotocol.org/
https://www.researchgate.net/publication/348151002_Thermal_Runaway_and_Fire_Suppression_for_electric_vehicle_batteries
https://www.naturalhazards.com.au/sites/default/files/2024-05/05.-Jamie-Vistnes-2024-Natural-Hazards-Research-Forum-presentation.pdf
https://www.abc.net.au/news/2024-01-29/lithium-ion-battery-fire-australian-recycling-industry/103380210
https://www.news.com.au/lifestyle/real-life/news-life/wild-reason-this-perth-street-is-piled-with-rubbish/news-story/16a4a1ad86ccfc52bef2ca2c26cf274a
http://www.bcycle.com.au/
http://www.batteryrecycling.org.au/
https://planetark.com/programs/batteries-4-planet-ark
https://www.epa.nsw.gov.au/news/epamedia/250320-nsw-leads-the-way-first-state-to-regulate-batteries
https://www.epa.vic.gov.au/for-business/find-a-topic/manage-e-waste/batteries
https://www.des.qld.gov.au/policies?a=272936%3Apolicy_registry%2Fwaste-strategy-guideline-energy-from-waste.pdf
https://www.epa.sa.gov.au/articles/2024/02/29/dont_bin_your_batteries
https://www.epa.wa.gov.au/proponent-name/waste-management-wa
https://epa.tas.gov.au/business-industry/waste-resource-recovery/business-and-industry-waste
https://ntepa.nt.gov.au/__data/assets/pdf_file/0011/1061876/waste-batteries-brochure.pdf
https://www.cityservices.act.gov.au/recycling-and-waste/batteries

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