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Control of Hazards
Lithium-ion Batteries within
E-scooters & E-bikes

autosolutions

John Pye
& Sons Ltd

1 Introduction & Purpose

The purpose of this document is to outline our methodology for the hazard identification and risk assessment to evaluate both existing and potential workplace hazards in relation to lithium-ion batteries and products that contain them as well as the methods required to control or eliminate such hazards through the use of engineering or administrative controls, training and the use of personal protective equipment.

2 Application & Scope

Jointly, we handle, dispose and auction a growing number of items containing lithium-ion batteries both in terms of our own equipment as well as vendor stock waiting to be sold / processed. The standalone lithium-ion batteries as well as products used in these items can be extremely dangerous, if not handled and cared for properly, or if they have been damaged and the integrity of the battery jeopardised. This puts our business and personnel at risk when processing/storing product returns/damaged stock.

It is important that we create, implement and follow correct procedures when handling, processing, storing and disposing of lithium-ion batteries and / or e-bikes / e-scooters containing them.

3 Context

Hazard identification involving lithium-ion batteries and products containing them is completed by the SHEQ, Audit & Compliance Manager and approved by the board of directors prior to being communicated to all employees. Employees play an important role in the assessment process.

The SHEQ Team periodically review the hazard assessment to ensure that the assessment covers all our organisation's activities, considering:

1. Routine and non-routine activities.
2. Activities of all people with access to the workplace, including contractors and visitors.
3. Human behavior, capabilities and other human factors.
4. Infrastructure, equipment and materials at the workplace; provided by our organisation or others.
5. Applicable legal obligations relating to risk assessment and implementation of necessary controls.
6. Design of work areas, processes, installations, machinery/equipment, operating procedures and work organisation, including their adaptation to human capabilities.
7. Information from employee consultations, review and improvement activities in the workplace including best practice and interested parties

4 Storage and handling of lithium-ion batteries and products containing them

The Dangerous Substances and Explosive Atmosphere Regulations (DSEAR) 2002 covers substances that can be dangerous due to their flammable or explosive properties. Lithium-ion batteries are a potential hazard under DSEAR and therefore steps contained within this document must be adhered to in order to ensure compliance within these regulations.

The product must be stored securely in a locked cage, away from the building and any combustible surroundings

For products that contain lithium-ion batteries or lithium-ion batteries themselves awaiting disposal, safety precautions are to be taken including visual inspections of the products. routine product scans using approved thermal imaging scanner.

Safe storage of lithium-ion batteries and products containing them is critical to prevent hazards such as fire, leakage, or damage that can lead to thermal runaway. It is important that all staff are aware of the signs and what to do in the event of a lithium battery defect to prevent a fire.

Here are the key principles and best practices for storing lithium-ion batteries and products containing them safely:

Optimal Temperature: Store in a cool, dry place with a temperature range of 20°C to 25°C (68°F to 77°F). Avoid extreme temperatures.

Avoid Heat Sources: Keep batteries away from direct sunlight, heaters, and other sources of heat to prevent overheating.

Low Humidity: Store in an environment with low humidity to prevent condensation, which can lead to corrosion or short circuits.

Defective or damaged lithium-ion batteries that are awaiting removal from a site, should be packed in compliance with the Carriage of Dangerous Goods regulations. The packaging should be leak-proof, with suitable inner and outer containers as per the regulations. The defective/damaged batteries should be encased in a non-combustible and electrically non-conductive thermal insulation material (typically vermiculite).

This packaging will reduce vibration and shocks during transit and provide protection against any heat release that might occur. These shipping boxes should be stored in a non-combustible outside container (minimum 6m separation from buildings), awaiting removal with safety warning signage applied.

An appropriate frequency of removal by a licenced carrier should be established to avoid excessive accumulations on site.

Relevant Carriage of Dangerous Goods by Road regulations:

- Damaged or defective batteries – ADR SV 376, P908
- Critically defective batteries – ADR SV 376, P911
- Batteries for disposal and recycling – ADR P909

Lithium batteries must only be removed from ebikes / escooters by suitably training staff

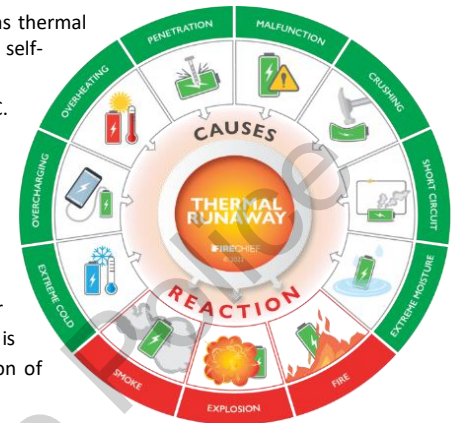
5 Assessment of Risks

The most common issue with lithium-ion batteries is when one of the cells overheats, causing what is known as thermal runaway. Thermal runaway is the chemical process when the lithium-ion battery cells enter an uncontrollable, self-heating state. This self-heating state produces heat and flammable toxic chemical gases extremely quickly.

Battery cell temperatures rise extremely fast (milliseconds), causing exceptionally high temperatures over 400°C. Once thermal runaway has begun, there is no way of extinguishing the lithium-ion battery other than with a Lith-ex fire extinguisher or Li-ion fire suppression system.

The assessment of the severity of a health and safety risk drives management attention and supports planning for mitigation. A qualitative risk assessment scheme consisting of qualitative probability and impact scales is undertaken to ensure detailed understanding of the effects of each impact.

Once the risks have been identified they are prioritised in terms of their impact upon the health and safety of our employees, each risk is assigned a significance rating to indicate the relative potential for harm. The impact rating is used to define those risks which are to be controlled through objectives and targets, or by the implementation of operational control procedures.



6 Review & Monitoring

Regular reviews are essential to ensure that hazards and risk are being appropriately managed, and that the relevant data about them remains accurate and reliable. The SHEQ, Audit & Compliance Manager will repeat the hazard and risk assessment process annually, when site conditions change, when new tasks are added or there is a significant change in vendor stock containing lithium-ion batteries to prevent the development of unsafe working conditions.

Continuous systematic and formal monitoring range from self-assessment, inspections and internal audits to detailed reviews by independent external experts.

7 Risk Register

We maintain a *Risk & Opportunity Register* which comprises all moderate to catastrophic scoring risks (15 or 25), as ratified by the SHEQ, Audit & Compliance Manager. The *Risk & Opportunity Register* is reported to the board of directors on a six-monthly basis.

Our Risk & Opportunity Register is a live, continually evolving document which provides a focus for our risk management activities, and which communicates risk information throughout the organisation. It provides the necessary assurances that risks are being effectively managed and is available on the document portal. Lithium-ion batteries have been added to the register.

8 Training & Awareness

- All members of our SHEQ team including SHEQ Coordinators and representatives have undergone 3rd party accredited lithium-ion battery management awareness training
- All operatives working on waste management at site level are trained on fire awareness and have been assigned the role of fire warden, additional 3rd party accredited lithium-ion safety training is provided to ensure they have the right knowledge and understanding of lithium-ion battery risks
- All yard operatives are trained on fire awareness including in-house lithium-ion battery safety training aimed at understanding the risks associated with physical damage to lithium batteries and vendor stock that arrives to site. This forms part of all new start inductions
- Warning posters have been created and implemented on waste bins reminding staff that lithium-ion batteries must not be placed in general waste bins
- Regular inhouse awareness training is delivered to staff in the form of toolbox talks, SSoW, communication of this document and risk assessments.

Training records including documented sign-off sheets, are uploaded to the document portal to demonstrate that our employees have been made aware of the hazards and the controls. Where hazards cannot be eliminated immediately, employees are trained and empowered to take the necessary steps to warn others of the hazard. Refresher training is provided annually.

9 Preventative action taken

- The site undergoes periodic fire risk assessments which are conducted by 3rd party approved contractors. John Pye and Sons management act on information including guidance and findings highlighted as part of the fire risk assessments to safeguard both personnel, property and stock
- Any products that show signs of damage to the battery or electrical circuitry, must be thermal scanned, quarantined, and necessary disposal action taken
- Proprietary transport containers are used for lithium-ion batteries and products containing them that are being sent off site for safe destruction, to ensure compliance with the Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations (CDG). In compliance with regulations, packaging used is leak-proof, with suitable inner and outer containers. The batteries will be encased in a proprietary non-combustible and electrically non-conductive thermal insulation material, e.g. vermiculite. Depending on the requirements of each site's waste carrier, please speak to the ESG coordinator for site specific arrangements.
- All quarantine batteries and products containing them are removed from our premises, on a regular basis, by competent and approved waste processing contractors for disposal or returned to the client in compliance with Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations (CDG)
- The site staff will conduct thermal imaging scans on all e-bikes and e-scooters that are processed, thermal imaging results will be recorded using the digital thermal imaging log on the portal, this involves a 2-stage scan process as detailed below

Thermal Scan 1 – Prior to collecting from the 3rd party

Thermal Scan 2 – Once the item arrives on site

10 Emergency Preparedness and Response

- We have in place established Fire Management Plans which also consider risks and control measures in relation to lithium-ion batteries and products that contain them

- We have fire wardens in place that have undergone 3rd party accredited training and have been deemed competent to aid safe and controlled evacuation in the event of a fire
- All staff complete periodic emergency evacuation training, as well as overall fire awareness training
- All staff receive spill kit training and are communicated a copy of our spill kit procedure
- Smoke detection and carbon monoxide alarms are installed in all areas deemed necessary based on findings from 3rd party fire risk assessments
- Our site has on hand sufficient stocks of vermiculite granules
- If the fire of a burning e-bike / e-scooter which contains lithium-ion battery cannot be extinguished, allow the pack to burn in a controlled and safe way.

11 Post Fire Management

When a lithium-ion battery fire is extinguished a significant fire hazard may remain; other batteries or products that include them may have been affected by the fire and are likely to be hot and still pose the ability to vent combustible and toxic gases with the potential to reignite.

It is therefore necessary that post fire management operations commence as soon as practicable by suitably equipped and trained personnel.

This may include:

- Ventilation due to the toxic gases produced
- Extraction
- Isolation
- Fire watch (using thermal imaging cameras to monitor the temperature)
- Recovery

The level of post fire management of the battery will be dependent on battery size for single cell/pouch devices once the fire is extinguished the risk of further fires is minimised.

12 Communication

Communication and consultation are important elements in controlling the risks posed to the business from e-scooters and e-bikes that contain lithium-ion batteries. Effective communication is essential to ensure that those responsible for implementing control, and those with a vested interest, understand the basis on which decisions are made and why particular actions are required. Regular inhouse awareness training is delivered to staff in the form of toolbox talks, SSoW, communicating of this document and risk assessments.

13 Hazards & Risks Process Map

