



Mines Safety Bulletin No. 149

Subject: Hazards associated with batteries

Date: 16 March 2018

Background

When considering the hazards associated with electricity there can be a tendency to focus on mains power (alternating current) rather than on the batteries used to start-up, protect or maintain the operation of plant and equipment. For example, battery banks in substations, uninterruptible power supplies (UPS), or equipment power packs.

Recent inspections by the Department have raised concerns that the hazards associated with batteries are not always recognised or adequately controlled. There have also been reported incidents involving batteries that resulted in injury, the potential for serious injury, or damage to equipment.

Examples in the past 5 years include:

- two separate instances where electricians received arc flash burns to their hands after incorrectly reconnecting batteries in a UPS
- an apprentice electrician received burns to his fingers after incorrectly inserting multimeter test leads inside a UPS and causing a short circuit
- a worker fault-finding on a vehicle received burns to his wrist when the metal band of his watch caused a short circuit between the battery's positive terminal and the vehicle chassis
- two batteries at a fire pump exploded, sending fragments several metres away (no one was in the vicinity at the time).



UPS battery cabinets. Left. Potential for inadvertent access as indicated by arrow. Right. Exposed live terminals (arc flash damage indicated by circle).

Summary of hazard

The hazards associated with batteries mainly relate to their use, configuration and storage design.

- If the stored energy in a battery is released in an uncontrolled manner (e.g. short circuit), the electric current can cause an arc flash, extreme heat or fire, which can result in thermal burns.
- Many battery chemicals are corrosive and/or poisonous. If these leak, it can harm workers or damage equipment.
- Batteries can burst or explode due to the build-up of gases through excessive recharging, overcharging or short-circuits, leading to chemical burns or shrapnel injuries.
- When batteries are connected in series, the increased voltage between the end terminals can be enough to cause electric shock if touched.

Contributory factors

Incidents involving batteries usually happen when the risk controls are inadequate. Examples are listed below.

- Battery cabinet design not preventing inadvertent contact or providing adequate ventilation.
- Ineffective training and supervision of workers working on batteries and UPS systems.
- Incorrect isolation or not applying suitable barriers or clearances before working on equipment.
- Risk assessment inadequate for the work to be carried out.
- Work performed outside of the required safe system of work (procedure or instruction).
- Inadequate maintenance, test and repair program for batteries and UPS systems.
- Workers using uninsulated tools and not wearing appropriate personal protective equipment.

Actions required

Design

- Design battery and UPS enclosures to:
 - prevent inadvertent contact with terminals
 - provide adequate ventilation
 - contain chemicals in the event of a leakage or explosion (including shrapnel).
- Provide sufficient information so the user is made aware of the hazards and associated risks. This includes drawings, operating and maintenance instructions, safety information and warning labels.

Safe work practices

- Follow manufacturer instructions and safe work procedures for the maintenance, testing and repair of batteries and UPS systems.
- Undertake a risk assessment prior to work being carried out that is appropriate to the level of potential exposure to hazards.
- When fault-finding or isolating a UPS, be aware of multiple sources of electrical supply, especially the stored energy in batteries.
- Confirm that isolations have been applied correctly and suitable insulators, barriers and clearances are being used before working on equipment.

- Wear the required personal protective equipment (PPE), use appropriate tools, and remove metallic jewellery that may contact energised parts.

Supervision and training

- Provide appropriate training and supervision for workers handling batteries and UPS systems.

Further information

- Standards Australia, www.standards.org.au

AS/NZS 3000 Electrical installations (known as the Australian/New Zealand Wiring Rules)

AS 3011 Electrical installations – Secondary batteries installed in buildings (series)

AS 62040 Uninterruptible power systems (UPS) (series)

- Department of Mines, Industry Regulation and Safety, EnergySafety, www.commerce.wa.gov.au/publications

Safe low voltage work practices by electricians – code of practice

This Mines Safety Bulletin was approved for release by the State Mining Engineer on 16 March 2018