



Batteries & Energy Storage Systems (DESS & BESS)

To be used in conjunction with Utilities, Fuels and Renewable Energies Tactical Guidance

HAZARD/ RISK INFORMATION	CONTROL MEASURES
<ul style="list-style-type: none"> ❑ Compromised batteries – known or suspected to be involved: <ul style="list-style-type: none"> ○ Improvised/ unregulated energy storage systems – increased risk of a volatile system ○ Thermal runaway ○ Volatile reactions ○ Rapid, unexpected pressure release of hazardous materials ○ Explosion/ blast – flying debris 	<ul style="list-style-type: none"> ❑ Use SSRI and/ or liaise with site owner site/ energy network if available ❑ Assess current and access future weather forecasts FireMet/ Met Office ❑ Approach from upwind/ upslope and avoid contact with released vapours: <ul style="list-style-type: none"> ○ Ensure personnel without appropriate RPE are kept out of smoke plumes ❑ Establish cordons/ avoidance routes/ exclusion zones: <ul style="list-style-type: none"> ○ Initial 30m upwind cordon for larger installations ❑ Carry out thermal imaging survey with TIC: <ul style="list-style-type: none"> ○ Identify battery or storage unit involved ○ Monitor battery temperature/s ❑ Eliminate ignition sources (e.g. use intrinsically safe equipment) ❑ Carry out atmospheric monitoring ❑ Seek specialist advice HMA/ HMEPA ❑ Employ a ventilation strategy ❑ Ensure appropriate PPE/ RPE (use emergency action code where available) ❑ Adopt defensive firefighting techniques – consider allowing battery to burn out ❑ Deploy firefighting media to cool/ protect batteries with copious amounts of water: <ul style="list-style-type: none"> ○ Avoid applying water to exposed battery terminals if it has not been isolated ❑ Deploy environmental protection strategy e.g. containment – see <u>OP: Environmental Protection</u> ❑ Implement decontamination Procedures
<ul style="list-style-type: none"> ❑ Release of hazardous materials: <ul style="list-style-type: none"> ○ Hydrogen gas – flammable/ explosive atmospheres ○ Caustic and toxic gas clouds/ smoke plumes – irrespirable atmospheres ○ Corrosive, caustic and toxic acids released within run-off 	
<ul style="list-style-type: none"> ❑ Thermal runaway at temperatures from 60°C: <ul style="list-style-type: none"> ○ Spontaneous ignition ○ Post incident re-ignition – up to 36 hours after 	
<ul style="list-style-type: none"> ❑ Electricity/ electrocution: <ul style="list-style-type: none"> ○ High voltage (up to 33kv) at larger battery storage sites ○ Systems may remain 'live' from renewable energy e.g. PV (solar panels), electric motors or wind turbines ○ Presence of residual electrical charge in high-voltage systems post isolation 	
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<ul style="list-style-type: none"> <input type="checkbox"/> Presence of fire suppression systems: <ul style="list-style-type: none"> <input type="checkbox"/> Irrespirable atmosphere – asphyxiation 	<ul style="list-style-type: none"> <input type="checkbox"/> Carry out atmospheric monitoring <input type="checkbox"/> Ensure appropriate PPE/ RPE <input type="checkbox"/> Employ a ventilation strategy
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OPERATIONAL ACTIONS		✓
<p>Gather information (utilise SSRI or onsite advice if available) and communicate hazard information to personnel if rechargeable batteries are involved, consider:</p> <ul style="list-style-type: none"> <input type="checkbox"/> The Type (see additional Information) <input type="checkbox"/> The location of the batteries <input type="checkbox"/> Is this a Battery Energy Storage System (BESS) or Domestic Energy Storage System (DESS)? <ul style="list-style-type: none"> <input type="checkbox"/> If so is the BESS/ DESS an approved installation or improvised/ unregulated? <input type="checkbox"/> The quantity of rechargeable batteries involved or affected <input type="checkbox"/> Is there safe isolation points for batteries and voltages? <input type="checkbox"/> Is there presence of fixed installations (e.g. fire suppression systems or extraction vents)? <input type="checkbox"/> The involvement of connected energy network or storage system installations and their associated hazards e.g. transformers, PV/ solar panels, wind turbines etc 		
<p>Consider isolating the batteries, taking into account the impact on any critical systems:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Seek consent before isolating if batteries are linked to critical systems <input type="checkbox"/> Utilise where possible an on-site engineer/ trained competent person to perform isolation <input type="checkbox"/> Ensure personnel wear appropriate PPE if performing isolation e.g. electrical gloves in line with service procedures <input type="checkbox"/> Seek specialist advice from HMA/ HMEPA where the batteries cannot be isolated 		
<p>Implement appropriate procedures/ safe systems of work if rechargeable batteries are known or suspected to be involved, consider:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Using TIC to monitor battery temperatures and look for signs of thermal runaway <input type="checkbox"/> Use of appropriate extinguishing media (consider specialist on site firefighting media): <ul style="list-style-type: none"> <input type="checkbox"/> Lithium ion – require large amounts of water in a fine spray over a prolonged period to control and extinguish any fire <p>NB. Lithium reacts with water to form hydrogen, therefore an intensified fire should be expected</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lead-acid – do not use salt water <input type="checkbox"/> Consider additional resources to support cooling for an extended period of time e.g. monitors/ waters supplies 		
<p>Manage environmental impacts from compromised batteries and energy storage systems:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Manage and control battery leaks and contaminated run-off, e.g. containment <input type="checkbox"/> Liaise with police to warn and inform public and initiate downwind protection zones from gas clouds/ smoke plumes 		

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| <p>□ Request a Chemet report for early forecasting of smoke plume extent, direction and travel</p> | |
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FURTHER CONSIDERATIONS

<p>Consider additional resources required to support cooling for an extended period of time e.g. monitors/ waters supplies.</p>	✓
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<p>Specialist extinguishers may be available at certain sites and only following consultation with the Responsible Person can they be deployed.</p>	
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ADDITIONAL INFORMATION

The traditional type of storage batteries are usually of the lead acid or nickel iron type and will be found in many electricity company and commercial premises. They are also used in all motor vehicles. Other substances used in batteries are zinc and lithium.

Lithium-ion batteries (Li-ion)

- These can pose a safety hazard since they contain, unlike other rechargeable batteries a flammable electrolyte and are also kept pressurised
- Lithium-ion batteries flames are ferocious and directional reaching temps in excess of 1000°C
- Hydrogen gases burn with an invisible flame
- When involved in fire, Li-ion batteries will produce Hydrofluoric Acid in fire water run-off and in the smoke/ gas plume

Ni-MH nickel-metal hybrid

- This type of high voltage battery can be found in all hybrid cars.
- The cells of the battery contain electrolyte made from potassium hydroxide, which is absorbed into a special paper.
- The battery (module) is then sealed and will not leak even if the module is tilted sideways or develops a crack. However it may then leak if the battery is badly crushed/ damaged

Lead acid/ nickel iron batteries – When correctly installed & maintained these batteries present little fire risk, but the unsuitable conditions under which they are sometimes recharged can frequently lead to a fire

- Hydrogen is released during the charging process and concentration levels of only 4% are sufficient to create an explosive atmosphere. Furthermore if a source of ignition is introduced into the charging area there is the risk of an explosion.
- If batteries are involved in fire then the products of combustion will contain droplets of electrolyte (dilute sulphuric acid), which is both corrosive and poisonous. Salt water should not be used on fires involving lead acid batteries since, under certain conditions free chlorine may be generated.

Sodium sulphur batteries – Due to the size and weight of the batteries these are in the main restricted to commercial vehicles

- If battery is damaged sufficiently and the backup systems fail to limit over temperature or over charge, active materials (sulphur dioxide and hydrogen sulphide) may be released
- If involved in fire will give off toxic sulphur dioxide and hydrogen sulphide fumes

- A fire originating inside this type of battery can take up to 30 minutes to become apparent and be very difficult to extinguish as the reactive products needed to sustain the fire are contained in the battery
- If a fire does occur it can burn for up to 2 hours


Sodium nickel chloride batteries

- It is believed that this type of battery does not produce any corrosive products or generate high pressures


SERVICE SPECIFICS

No comments

Document References

	<p>NOG – Utilities & Fuels – Hazard/ Control measures – Rechargeable batteries</p> <p>NOG – Learning materials – Lithium ion batteries eLearn package</p>
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Partnership Relevant References

	<p>AHIS 08 – Batteries and Energy Storage Systems</p>
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Other Related Guidance

	
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Document Audit Information

Senior Officer Accountable	Authorised By	Implementation Date	Review Date
		07/10/2022	07/11/2023

Version Control

Section	Version no.	Reason for update	Date updated	Updated by
All	1.0	Approved to publish	04/07/2022	