Emergency Responders Guide to Alternatively Fuelled Vehicles

Hazard

The term 'alternatively fuelled vehicle' (AFV) refers to vehicles powered by fuels other than petrol or diesel. The hazards and control measures for incidents involving AFVs should be considered with those that apply to other road vehicles.

When two or more fuel sources power a vehicle, it is referred to as a hybrid. The term most commonly refers to hybrid electric vehicles, which combine an internal combustion engine and one or more electric motors. However, this term includes other mechanisms to capture and use energy.

AFVs can be powered by:

- High voltage fuel cells (batteries)
- Compressed natural gas (CNG)
- Liquid natural gas (LNG)
- Biofuels
- Hydrogen fuel cells
- Rechargeable batteries

AFVs may be difficult to identify. They have limited exterior markings that may be damaged in a collision and can be engaged with no signs that the engine is running, such as engine noise or exhaust gases emitting, particularly when stationary. Although these hazards are not unique to AFVs, they are more likely to be present than in older vehicles or those powered by a single fuel source of petrol or diesel.

AFVs affected by collision, fire or submersion may present hazards including:

- Uncontrolled or unpredictable vehicle movements
- The release of flammable and toxic gases
- High-voltage systems – the residual charge in these systems may remain for sustained periods after isolation
- Fuel cell or battery explosion
- Hazardous materials, including liquid petroleum gas (LPG), hydrogen and lithium-ion cells
- Electrolytes leaking from fuel cells
- Pressurised systems

These hazards may also result from operational activities.

Rechargeable batteries in alternatively fuelled vehicles

New style rechargeable batteries are often found in alternatively fuelled vehicles: refer to Rechargeable batteries for more information. Vehicle markings vary and can be misleading, especially if they have been modified. Designs and locations of batteries also vary, so it is not possible to provide a guide here to all the different types.

Many vehicles contain interchangeable trays of batteries, so the type of battery itself can be changed; for example, a battery pack could be changed from nickel-cadmium to lithium-ion, which may form part of a vehicle manufacture upgrade. Battery cells can be present in their thousands, usually located under a vehicle's floor and, weigh more than 500kg.

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Access to battery trays in a vehicle that is damaged may be limited. Before handling or dealing with incidents involving high voltage batteries, personnel should seek specialist advice or consider manufacturer's guidelines for information about appropriate firefighting media, access and isolation.

The presence of reactive metals, such as lithium, can cause the release of explosive and toxic gases and alkaline solution, caused by chemical reaction to water, for example, lithium hydroxide (LiOH) and hydrogen (H2). This can appear like steam.

In a collision, batteries may be subject to overheating due to thermal runaway or leaking electrolytes. It will be difficult to identify which individual battery, or group of batteries, are involved.

Thermal runaway is an accelerating increase in temperature caused by chemical reactions, which can lead to fire, explosion, the release of highly flammable organic electrolyte which is released under pressure, and unpredictable fire behaviour. This can be the result of temperature variations limited to only one or a small number of damaged cells and can cause ignition that occurs spontaneously over varying time frames.

Sensitivity to charging and discharging regimes, mechanical shock, and localised temperature gradients can lead to thermal runaway. This means that the impact or movement of a rechargeable battery during the stabilising of a vehicle or releasing a trapped casualty can lead to thermal runaway or deterioration in the condition of an already damaged battery.

The reignition of batteries is possible after prolonged periods, after mechanical shock, heating or battery faults. They may require extended periods of cooling and monitoring after a fire or collision. Damaged batteries can be too sensitive to move, and personnel may have to consider cordoning off a vehicle and handing it over to a responsible person.

Control measures - identification

Identifying the presence and type of AFV should form part of information gathering. It should be assumed that all vehicles involved in an incident are alternatively fuelled until otherwise confirmed, as they may present additional hazards.

Sources that may assist with identifying an AFV include:

- The driver or passengers
- Information gathered by control rooms
- Vehicle markings, such as the use of the term 'hybrid'
- Bright orange cabling
- Information stored on systems such as mobile data terminals
- Vehicle documents or handbooks

Control measure - immobilise alternative fuel vehicles

- AFV's can use silent drive systems such as electric motors and may start or move without warning when the accelerator is depressed or brake released. This should be considered when approaching and immobilising an AFV.

  It is also necessary chock the wheels, front and rear and to establish:

  - The fuel types
  - The ignition mode
  - How the vehicle is activated, for example, proximity keys, smart keys or keyless entry fobs.

Personnel should consider placing the vehicle in neutral to prevent accidental activation and apply the parking brake, referring to manufacturer's guidance if necessary.

Control measure - Isolate high-voltage systems.

This control measure should be read in conjunction with Isolate high-voltage systems in alternative fuel vehicles. Personnel should isolate high-voltage systems to reduce the risk of accidental activation or electrocution.

Information sources such as the driver, manufacturer's guidance, or information stored on mobile data terminals may assist in identifying the appropriate method of isolating an AFV. Common methods of isolating the high voltage systems include:

- Disconnecting the 12-volt battery. Note that some vehicles may have more than one
- Removing the main vehicle fuse
- Removing the emergency shut-off plug

Some alternative fuel vehicles have sensors in the engine compartment that automatically isolate the high-voltage supply in a collision.

Control measure - Stabilise and access alternative fuel vehicles

- Stabilising or accessing AFV's may compromise, damage or result in contact with fuel lines, high-voltage cables or fuel cells. These components are typically sited in protected areas under the vehicle or within the vehicle panels; however, they may become detached during a collision.
- The resting position of an AFV after a collision may be unconventional due to its weight distribution. This should be considered when attempting to stabilise an AFV.
- Using conventional techniques may cause damage to fuel cells or other components. Therefore, the techniques used should be tailored, considering the position of the additional hazards present in an AFV.

Source: National Fire Chiefs Council (NFCC) - National Operational Guidance – Hazards, Roadways, AFV

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