

**Ministry of Health and
Long-Term Care**

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**Ministère de la Santé et des
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June 14, 2005

MEMORANDUM TO: Municipal EMS Directors and Managers

FROM: Malcolm Bates
Director
Emergency Health Services Branch

RE: **Safety Bulletin, Issue Number 8 – version 1.0
Hybrid Vehicles**

Over the past several years, automobile manufacturers have introduced vehicles (cars, vans, sport utility vehicles and trucks) that utilize a combination of internal combustion engines and electric motors to power them. These vehicles have become known across the industry as “hybrids”.

Attached you will find a copy of a safety bulletin in PDF format. This bulletin has been developed to provide paramedics with current information on the technology behind hybrid vehicles as well as to provide information on how to safely work in and around these types of vehicles when providing patient care. Please ensure that this safety bulletin is made available to your staff for their review.

If you require additional information, please contact Ms. Cathy Francis, Manager of Education and Patient Care Standards, at (416) 327-7843.

A handwritten signature in black ink that reads "M. Bates".

Malcolm Bates

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- c: D. Brown, Senior Manager, Operations and Quality Management (A)
- F. FitzGerald, Senior Manager, Technical Services Unit
- T. Campeau, Manager, Land Ambulance Programs (A)
- Senior Field Managers/Field Managers, EHSB
- C. Francis, Manager, Education and Patient Care Standards
- W. Murphy, Manager, Fleet and Equipment Services
- R. Nishman, Manager, Air Ambulance
- J. Van Pelt, Manager, Investigations, Certifications and Regulatory Compliance
- Dr. M. Welsford, Chair, OBHG
- L. Lofquist, Office of the Fire Marshal
- Regional Training Coordinators
- Paramedic Program Coordinators

Encl.

Safety Bulletin

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June 2005

Issue Number 8 – version 1.0

Emergency Health Services Branch
Ministry of Health and Long-Term Care

Safety Bulletin, Issue Number 8

Hybrid Vehicles

Introduction

Over the past several years, automobile manufacturers have introduced vehicles (cars, vans, sport utility vehicles and trucks) that utilize a combination of internal combustion engines and electric motors to power them. These vehicles have become known across the industry as “hybrids”. Since the inception of these hybrid vehicles, manufacturers have been steadily increasing production. By 2007, most major automotive manufacturers will add hybrids to their product line, either as a stand-alone model or as an option with pre-existing models. Because of the increased production, paramedics may come in contact with these vehicles on a more frequent basis. This bulletin has been developed to provide paramedics with information on the technology behind hybrid vehicles as well as to provide information on how to safely work in and around these types of vehicles when providing patient care.

Hybrid Vehicle Technology

Automotive manufacturers have introduced hybrid vehicles in an effort to decrease exhaust emissions and improve overall fuel economy. To achieve these goals, a combination of a smaller internal combustion engine, an electric motor and lightweight vehicle design is utilized.

The interplay between the internal combustion engine and the electric motor is the technology that gives hybrid vehicles their advantage of fuel economy and fewer emissions. The power sources may work in series and switch between the two depending on driving needs or in parallel where the electric motor supplements the power provided by the internal combustion engine. This allows some models for example, to turn off the combustion engine while idling at an intersection or braking, thus reducing fuel consumption and emissions.

Manufacturers have engineered a number of controls into their hybrid vehicles to minimize the potential for injury to the occupants of the vehicles and to emergency personnel who respond to situations where hybrid vehicles are involved in accidents. As well, the Federal Government has amended the *Motor Vehicle Safety Act* to ensure that hybrid vehicles sold in Canada meet specific safety standards.

The standard approach to these vehicles remains much the same as with all vehicles involved in an accident however, further consideration must be given to the potential of unexpected vehicle movement, electrical shock from the high voltage batteries and cables and the possibility of chemical burns from the electrolytes contained within the batteries.

Batteries

Hybrid vehicles are equipped with two (2) different types of batteries. As is the case with all standard internal combustion vehicles, hybrid vehicles are equipped with low-voltage, lead-acid type 12 volt batteries. This battery powers all standard electronics such as lights, audio systems,

engine ignition and fuel injection. The location of the 12 volt battery may differ from the conventional under the hood position in some hybrid vehicle (e.g. may be located in the trunk compartment).

In addition to the 12 volt battery, hybrid vehicles are also equipped with high-voltage battery packs that provide power to the vehicle's electric motor. The high-voltage battery packs consist of a number of nickel metal hydride (Ni-MH) batteries that are connected together in series, sealed and housed in a leak-proof protective container. The high-voltage battery packs are usually located in the trunk compartment of the vehicle although they may be located under the rear seat in pick-up truck models. The high voltage batteries are recharged as required by a generator connected to the internal combustion engine and do not require external sources of electricity to accomplish this task.

Injury resulting from contact with the highly caustic materials contained within the high-voltage battery packs is unlikely. The gel-like liquid is predominantly absorbed back into the cell plates and will not normally leak even when the battery pack is damaged. Furthermore, the battery packs are encased in a protective metal box for additional safety. If however, a patient or rescuer comes in contact with the extremely alkaline substance (pH 13.5) contained in the battery packs, paramedics should follow the standard for the management of chemical injuries in the Basic Life Support Patient Care Standards, version 1.1.

Electrical Cables

Electrical cables routed from the two types of batteries found in hybrid vehicles can be identified by the colour of their shielding. The cables running from the low-voltage batteries to the components they power can be identified by their conventional black and red shielding. All electrical cables from the high-voltage battery packs are shielded in a bright orange plastic for easy identification.

Paramedics must avoid contacting the orange cables of the high-voltage system, particularly if they are damaged and under no circumstances should they attempt to cut them.

The risk of electrical injury is minimized in hybrid vehicles due to the design of the vehicles. Several safety features prevent accidental shocks including shielding of the electrical components and relays that shut down the system if any faults are detected. The risk is reduced even further by simply turning the vehicle off and removing the keys. Paramedics should be aware however, that power may be maintained for up to for 90 seconds in the Supplemental Restraint System (airbags) and 5 minutes in the high voltage system after disabling the vehicle.

If paramedics have any concerns about the safety of the occupants of a vehicle or themselves at an accident scene, they should, consistent with existing procedures, take direction from fire department personnel at the scene. Fire department staff receive additional training in the assessment of risk and the stabilization of all types of vehicles to ensure scene safety.

Recommended Procedures When Working Around Hybrid Vehicles

Paramedics should follow the scene survey approach outlined in the Basic Life Support Patient Care Standards (version 1.1) when managing any motor vehicle accident scene including those involving hybrid vehicles. Extra caution should be used when entering any type of small, lighter vehicle as slight movement may be transferred to the occupants inside and could exacerbate injuries.

During their scene survey, paramedics should attempt to identify a hybrid vehicle from a conventional vehicle by looking for external indications and identifiers such as name plates and decals. If a vehicle involved in an accident is identified as a hybrid, paramedics must consider the increased risk of sudden vehicle movement and electrical shock when managing the scene.

As with all accidents involving motor vehicles, paramedics should place the vehicle in park (neutral, in vehicles equipped with a manual transmission), turn off the ignition and remove the keys if this has not been done already. These are important steps particularly with hybrid vehicles, as accidental pressure on the accelerator or the clutch can “wake up” the electric motor and cause the vehicle to move unexpectedly in situations where the vehicle has not been completely immobilized.

Placing the vehicle in park or neutral may vary for different makes and models. Most hybrid vehicles employ a conventional type gear selector mounted either on the steering column or on the floor between the front seats. At least one model however, utilizes an electronic gear selector button mounted on the dash.

The procedure for turning a vehicle off and removing the keys may also vary depending on the make and model of the vehicle. The keys on most models are standard and can be simply removed and placed on the dash to alert responding agencies that the vehicle has been immobilized. At least one manufacturer has “smart key” technology that allows the car to recognize the key’s proximity allowing the starting sequence without the key being physically inserted into the key slot found in the dash. This smart key should be removed a minimum of 5 meters (16 feet) away to prevent accidental starting of the vehicle. Vehicles equipped with the optional “smart key” have a disabling button located beneath the steering column. When the button is depressed, the vehicle can only be started if the “smart key” module is inserted into the appropriate slot in the dash. Paramedics should consider the possibility that a vehicle is equipped with the “smart key” option if a conventional looking key slot is not visible on the steering column. The “smart key” module is similar in appearance to the remote door lock or remote starter found with some conventional vehicles. If it is suspected that the vehicle has a “smart key” attempt to locate the disabling button under the steering column and ensure that it is depressed.

It is important that paramedics become familiar with and maintain current knowledge regarding the different makes and models of hybrid vehicles on the market as the operator of a vehicle involved in an accident may not be able to provide assistance on immobilizing the vehicle.

Summary

As automotive manufacturers increase their production of hybrid vehicles, paramedics will be more likely to respond to situations involving these types of vehicles. Paramedics need to educate themselves on the makes and models currently in production, how to identify these types of vehicles and what precautions they need to take when working around these vehicles while providing patient care. A references list has been included at the end of this bulletin to assist paramedics in gaining additional information on hybrid vehicles and the operating procedures for specific makes and models. As manufacturers are continually adding new hybrid vehicles to their product line, paramedics are advised to conduct their own regular research to maintain current knowledge of this quickly growing segment of the vehicle industry.

References

Basic Life Support Patient Care Standards, version 1.1
Ministry of Health and Long-Term Care, September 1999

Special Feature – Hybrid Vehicles Parts 1, 2 and 3 University of Extrication
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Honda Gasoline-Electric Hybrid Vehicle
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Toyota Motor Corporation
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