CIRSA HAZARD ALERT

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Hazard Alert - EV Transit Fleet Concerns

Electric vehicles (EVs) are becoming a mainstay in many organizations. The CIRSA Risk Control Department is seeing among our members increasing numbers of EVs for both light and heavy-duty transit fleets. This hazard alert is the third in a series of articles designed to bring attention to potential hazards and risk management strategies related to the operation of EV fleets. Previous hazard alerts discussed Lithium-Ion Battery Safety and Public EV Charging Stations. This article will highlight three areas that pose unique risk management challenges for EV transit fleets:

- High Voltage Systems
- Lithium-Ion Battery Charging
- Charging Station Fire Protection

High Voltage Systems

High voltage (HV) systems - including energy storage systems - operate at dangerous levels. Many EV buses operate at 700 to 800 volts and 350 amps. There are several unique high voltage systems that must be used to maintain and operate these vehicles safely, and it is important that workers are familiar with and properly trained on these systems. Some unique components of HV systems include:

- **HV Cabling** - The outer jackets of high-voltage cables are colored orange to make this danger easily identifiable to technicians and first responders.
- **HV Isometer** - An isometer is part of the HV isolation system used to monitor potential between high voltage components and ground. If an isometer fault is triggered, some type of high voltage fault indicator light on the operators panel will be illuminated.
- **HV Junction Box** - This device contains components such as fuses, contactors, and sensors that allow for the safe control of HV energy. Access requires special training and specific personal protective equipment.

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EV Transit Fleet Concerns (cont.)

Lithium-Ion Battery Charging

Lithium-ion batteries contain a flammable electrolyte that can vent, ignite, and produce sparks when damaged and subjected to elevated temperatures. Burning batteries can ignite other batteries that are close by. Fire will produce toxic and irritating gases. Exposure of the lithium battery electrolyte to water may result in the generation of flammable hydrogen gas and toxic/corrosive hydrogen fluoride. The following precautions are suggested to ensure safe handling and use:

- Store in a cool, well-ventilated area, away from moisture, sources of heat, open flames, food, and drink.
- Temperatures above 150°F may result in battery leakage and rupture.
- Keep adequate clearance between walls and batteries.
- Keep batteries in original packaging until use.
- Preferred storage at 50% of nominal battery capacity.
- A fire alarm is recommended in case of storage of large amounts.
- Do not mix batteries of different types and brands.
- Do not mix new and used batteries.
- Do not disassemble, mutilate, or mechanically abuse cells and batteries.
- Avoid deep discharge.
- Follow manufacturers recommendations regarding maximum recommended currents and operating temperature range.

Charging Station Fire Protection

EVs present different safety risks requiring mitigation strategies that differ from diesel and gasoline fueled vehicles. Ensuring continued safe operation of EV transit vehicles will require EV-specific facility design and staff training. A hazard analysis should be conducted on all fleet EV charging stations. The following items should be considered:

- Vehicle fire sensors interfaced with charging equipment and other fire and life safety systems.
- Know the chemistry of your lithium-ion battery. Different chemistries pose different hazards regarding stability, temperature, and life span.
- Battery thermal detectors interfaced with building fire alarm systems and battery management systems.
- Charging system emergency stops interfaced with batteries and building fire and life safety systems.
- Commissioning and testing of battery and charging safety interlocks onboard the EV and as part of the charging equipment.
- Onboard EV fire suppression directly applied to the battery modules and thermal management systems to ensure battery modules remain cool.
- Overdesigned sprinkler system. A sprinkler design can be set as an Extra Hazard Group 1 or 2, the highest identified prescriptively in NFPA 13.
- Extreme physical separation. Instituting fleet storage guidelines with significant minimum storage distances between EVs or groups of vehicles can minimize the spread of fire.
- Developing standard operating procedures specific to EVs and the related charging infrastructure that clearly determine the roles and responsibilities for personnel during emergency situations.
- Systems, including chargers and buses, could be affected by a successful cyberattack. Charging stations/networks must be designed with adequate IT security protocols.

If your entity has installed or is considering installing EV fleet charging stations at your transit facility, implement the controls discussed above to minimize the risk to your operation. Additional information can be found on the following page.

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EV Transit Fleet Concerns (cont.)

Resources

Inflation Reduction Act, Clean Heavy-Duty Vehicle Program

https://www.epa.gov/inflation-reduction-act/clean-heavy-duty-vehicle-program

Fleet ZERO-Emission Resource Opportunity (Fleet Zero)

https://energyoffice.colorado.gov/fleet-zero

NFPA First Responder Training and Additional Resources

https://www.nfpa.org/for-professionals/training-for-me/alternative-fuel-vehicles-training/electric-vehicles?l=106

ANSI/ASSE Z15.1-2012 - Safe Practices for Motor Vehicle Operations

https://webstore.ansi.org/standards/asse/ansiassez152012

ISO 17840: The First Worldwide Firefighters' Standard

https://www.ctif.org/commissions-and-groups/iso-17840-first-worldwide-firefighters-standard