Frequently Asked Questions: Electric Vehicle Fire Safety

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As electric vehicles (EVs) have grown in popularity and awareness, so have concerns about their fire risks. This fact sheet addresses common questions and developments in EV fire prevention and response measures. The notes included provide further resources for those who wish to explore the topic in more detail.

Key takeaways

- Despite the media's focus on rare incidents, EVs are less likely to catch fire than gasoline-powered vehicles.
- Practicing safe driving habits, performing regular maintenance, and using proper charging equipment are key to significantly reducing the fire risks of EVs.
- EVs have advanced safety features like battery management systems, sensors, and fire-resistant enclosures to monitor fire risks and mitigate fire spread.
- Fire departments are adapting with specialized training, updated policies, and modern equipment to contain and extinguish EV fires quickly.
- Innovations, including safer battery chemistries, advanced detection, suppression systems, and new charger safety technologies, further reduce EV fire risks.

Can EVs catch fire? How common are EV fires?

All vehicles carry some fire risk due to the energy they use to move. Still, EVs have significantly lower risks compared to gas-powered vehicles.

Excessive heat generated by friction between components is one of the most common causes of vehicle fires. In contrast to gas-powered vehicles, EVs have far fewer moving parts and do not carry gasoline, produce hot exhaust fumes, or rely on controlled explosions, all of which reduce the ways and likelihood of a fire starting.[1] According to the study *Gas vs. Electric Car Fire in 2024* by AutoinsuranceEZ, which analyzed data from the National Transportation Safety Board, EVs in the US are 60 times less likely to catch fire than gas-powered vehicles.[2]

Studies from national agencies in several other countries, including Sweden, Norway, and Australia, have also found that gas- and diesel-powered passenger vehicles are more likely to catch fire.[3] However, because EVs are still a relatively new technology, the media tends to highlight fires involving their batteries, creating the perception that they have a high fire risk.[4]



What causes EV fires, and how can I prevent them?

Electric vehicle fires, though rare, can occur from various causes. The most common cause is damage to a vehicle's batteries is a serious crash.[5] Practicing safe driving habits, such as adhering to speed limits, avoiding aggressive maneuvers, and staying alert, can significantly reduce the likelihood of severe collisions that might damage the battery. When a battery's cell, which is its basic unit that stores and releases energy, is damaged—whether from an accident, overcharging, or rupture—it can lead to short-circuiting and heating rapidly. The excess heat and reduced internal resistance can ignite a cell, spreading to other cells and releasing stored energy. This process is called thermal runaway.

However, unlike gas-powered vehicles that can explode instantly, thermal runaway spreads more slowly, allowing more time for internal safety measures to be implemented and warning systems to alert passengers to evacuate and avoid injury.[6]

Additionally, most EVs come equipped with advanced battery management systems that monitor conditions, including battery voltage and temperature, to prevent fire risks from overcharging and alert drivers about possible malfunctions or risks before a critical failure causing a fire occurs.[7]

Like traditional gas-powered vehicles, the risk of an EV fire can be minimized with regular inspection and maintenance of the vehicle, battery, and charging cord. If you notice any damage or irregularities, stop using the vehicle or charging cord and have it inspected as soon as possible.

Use proper charging equipment to reduce EV fire risk, ideally from your vehicle manufacturer. If you use charging equipment from a different manufacturer than the EV you are operating, ensure that the charger is certified by a US Occupational Safety and Health Administration nationally recognized testing laboratory like Underwriters Laboratories, Intertek Testing, or FM Approvals.[8] Do not use non-manufacturer-approved adapters, as some third-party models can be faulty or bypass safety features installed in manufacturer-approved chargers.[9]

When installing home chargers, have a qualified and certified electrician inspect your electrical system and install the charging equipment.[10] For added safety, have an electrician install a residual current device or isolation switch that turns off the power to the unit if a fault is detected. This can reduce the risks of fires caused by equipment failure or overcharging.[11]

What happens if my EV catches fire?

If you find yourself in or near a burning vehicle, the best thing you can do is get as far away as possible and call the fire department. Most EVs have technologies to isolate the damage and prevent further escalation, such as reinforced and fire-resistant battery pack enclosures.

Current models also include sensors and safety systems that detect damaged cells in the battery pack and isolate them from other cells.[12] Still, it's safest to let the first responders put out vehicle fires, as fires are unpredictable.

Fire departments are adapting to the growing number of EVs on the road by updating their policies, training, and equipment. They are developing a better understanding of the unique challenges of EV fires, the behavior of lithium-ion batteries, and the risks associated with thermal runaway.

Many fire departments use the fire isolator concept, which combines EV fire blankets, water mist lances, aerosol units, and thermal imaging cameras. This multi-pronged approach quickly extinguishes or contains the fire while minimizing collateral damage.[13]

Manufacturers like General Motors have developed nationwide training programs and campaigns to aid in first responder training.[14]

What is the industry doing to reduce EV fires?

Researchers are exploring sodium-ion batteries as a safer, more affordable alternative to lithium-ion batteries. They possess a lower risk of thermal runaway and can be transported without any energy stored in them, reducing the risk of fire during their transport and assembly.[15]

Solid-state battery technology is another promising innovation that holds more charge than the common liquid-state electrolytes in traditional batteries and has a better operating temperature range, making them less likely to overheat.[16]

In addition to new battery chemistries, researchers are also exploring new architectures and casing materials with improved electrical and thermal isolation to reduce the risk of thermal runaway occurring and spreading to adjacent battery cells.[17]

Manufacturers are also exploring advanced detection methods incorporating technologies like infrared cameras to notify drivers if any part of their vehicle's battery is damaged or overheating. In the case of an EV fire starting, manufacturers are testing advanced internal battery isolation and suppression systems that use advanced blaze-dousing chemicals.[18]



Charger manufacturers are working to reduce fire risk during EV charging by implementing automatic systems that monitor heat, smoke, and chemicals associated with fires that can activate response measures once a potential fire hazard is identified.

Charging station manufacturers are starting to incorporate integrated response systems that can automatically shut down a station if a fire risk is detected. This helps prevent electric feedback, reducing the risk of a fire starting or spreading. Additionally, new automatic systems are being implemented to detect fires in real time and promptly alert station operators, enabling faster responses and potential fire mitigation before emergency services arrive.[19]

As electric vehicles become more common on Minnesota roads, it's crucial to understand the facts surrounding their fire safety and risks. Contrary to common misconceptions, EVs are less likely to catch fire than gas-powered vehicles thanks to advanced safety features designed to prevent such incidents. Additionally, there are steps drivers can take to minimize fire risks. In the rare event of an EV fire, vehicles, chargers, and fire departments are equipping themselves with effective strategies to quickly detect and address incidents. As newer vehicle models incorporate new innovations in safety technology, EVs will continue to be a safe and reliable transportation option.

To learn more about EVs, their benefits, purchasing tips, and more, visit the Drive Electric Minnesota website at https://driveelectricmn.org/.

Facilitated by the Great Plains Institute, Drive Electric Minnesota is a partnership of electric vehicle (EV) champions, including automakers and auto dealers, utilities, charging companies, environmental groups, and state and local government. The coalition paves the way for the deployment of EVs and charging infrastructure through public-private partnerships, financial incentives, education, technical support, and public policy. Visit us at www.DriveElectricMN.org. Contact us at driveelectricmn@gpisd.net.

Endnotes

1 Ryan Lugo, "You're Wrong About EV Fires," MotorTrend, July 11, 2023, https://www.motortrend.com/features/you-are-wrong-about-ev-fires/.
2 Lauren Kuhl, "Gas vs. Electric Car Fires in 2024," AutoinsuranceEZ, September 6, 2023, https://www.autoinsuranceez.com/gas-vs-electric-car-fires/.
3 Jasper Jolly, "Do electric cars pose a greater fire risk than petrol or diesel vehicles?," The Guardian, November 20, 2023, https://www.theguardian.com/business/2023/nov/20/do-electric-cars-pose-a-greater-fire-risk-than-petrol-or-diesel-vehicles.
4 Willie Jones, "Extinguishing the EV Battery Fire Hype," IEEE Spectrum, December 4, 2023, https://spectrum.ieee.org/lithium-ion-battery-fires.
5 Kyle Hyatt, "Electric Car Fires: What You Should Know," Edmunds, March 5, 2024, https://www.edmunds.com/electric-car/articles/electric-car-fires.html.
6 Alexander Börger, "Thermal runaway and thermal runaway propagation in batteries: What do we talk about?," Journal of Energy Storage 40 (August 2019), https://www.researchgate.net/publication/334841050_Thermal_runaway_and_thermal_runaway_propagation_in_batteries_What_do_we_talk_about.
7 Yu Yang, Renjie Wang, Zhaojie Shen, Quanqing Yu, Rui Xiong, and Weixiang Shen, "Towards a safer lithium-ion batteries: A critical review on cause, characteristics, warning and disposal strategy for thermal runaway," Advances in Applied Energy 11 (September 2023), https://www.sciencedirect.com/science/article/pii/S2666792423000252.
8 "Understanding Electric Vehicles," Electrical Safety Foundation, accessed July 22, 2024, https://www.esfi.org/understanding-electric-vehicles/.
9 "Avoid Non-Approved Electric Vehicle Adapters – Video Short," Electrical Safety Foundation, accessed April 25, 2024, https://www.esfi.org/avoid-non-approved-electric-vehicle-adapters-video-short/.
10 "Understanding Electric Vehicles," Electrical Safety Foundation, accessed July 22, 2024, https://www.esfi.org/understanding-electric-vehicles/.
11 U.S. Fire Administration, Electric Vehicle Charging Safety Tips (Federal Emergency Management Agency), https://www.usfa.fema.gov/downloads/pdf/publications/electric-vehicle-safety-handout.pdf.
12 Will Davis, "The Innovative Technology Behind Near-Fireproof Electric Vehicle Batteries," TNGlobal, September 28, 2023, https://technode.global/2023/09/28/the-innovative-technology-behind-near-fireproof-electric-vehicle-batteries/.
13 Jan Verheuvel, "Contain electric car fires: How Fire Isolator works," Innovation News Network, January 11, 2024, https://www.innovationnewsnetwork.com/containing-electric-car-fires-how-a-fire-isolator-works/39588/.
14 Andres Gutierrez, "GM offers training to first responders on EVs," CBS News, June 2, 2023, https://www.cbsnews.com/detroit/news/gm-offers-training-to-first-responders-on-electric-vehicle/.
15 Lily-Rose Schutt, "Safety in Electric Vehicles – Exploring Fire Protection Materials," IDTechEx, April 2024, https://www.idtechex.com/en/research-article/safety-in-electric-vehicles-exploring-fire-protection-materials/30866.
16 Aarian Marshall, "The Auto Industry Finally Has a Plan to Stop Electric Vehicle Fires," Wired, September 15, 2024, https://www.wired.com/story/the-auto-industry-finally-has-a-plan-to-stop-electric-vehicle-fires/.
17 Lily-Rose Schuett, "Safety in Electric Vehicles – Exploring Fire Protection Materials," IDTechEx, April 10, 2024, https://www.idtechex.com/en/research-article/safety-in-electric-vehicles-exploring-fire-protection-materials/30866.
18 Rick Kazmer, "Scientists make breakthrough in EV battery technology with self-extinguishing capabilities — here's how it could revolutionize auto industry," The Cool Down, June 7, 2024, https://www.thecooldown.com/green-tech/nonflammable-batteries-lithium-ion-technology/.
19 "Protecting Electric Vehicle Infrastructure: Fire Suppression for Charging Stations," Control Fire Systems, March 28, 2024, https://www.controlfiresystems.com/news/protecting-electric-vehicle-infrastructure-for-charging-stations/.