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Firefighter Hell: When an Electric Car Bursts Into Flames

With the clean-energy transition accelerating, firefighters want better information about EV safety risks and hazards.

BY GABRIELLE GURLEY JANUARY 26, 2023

ORANGE COUNTY SHERIFF'S DEPARTMENT/NATIONAL TRANSPORTATION S AFETY BOARD VIA AP

The Orange County Fire Authority battles a fire in a burning vehicle inside a garage in Orange County, California. Firefighters later identified the fuel source as the SUV's high-voltage battery pack.

Last week, a car crashed on Interstate 95 in Wakefield, Massachusetts, north of Boston, at around midnight as a heavy snowstorm moved in. The town fire department arrived to find the vehicle up on two wheels on a guardrail. The driver, who had escaped the wreck, told them it was an electric vehicle. That changed the department's calculus. Wakefield fire officials, who had not fought an EV fire before, scrambled reinforcements to the scene from five more towns. The attempt to move the EV forced the guardrail into the bottom of the car and it burst into flames.

Luckily for firefighters, they could spray water directly on the bottom of the car to cool down and

directly on the bottom of the car to cool down and help extinguish the burning batteries located there. More than two hours and 20,000 gallons of water later, the firefighters put out the blaze. "It was like a building fire on a highway," Wakefield Provisional Fire Chief Tom Purcell told the *Prospect*.

The Biden administration has embarked on a historic transition, pumping nearly $3 billion into its push to ramp up domestic battery production and mining of the necessary minerals and other materials. EV infrastructure charging stations will get a boost through the $5 billion National Electric Vehicle Infrastructure state programs. The challenges of dealing with the fire risks inherent in this shift, however, are only slowly being resolved.

More from Gabrielle Gurley

Electric-vehicle stalwarts stand firm in their belief that the fire risk is far less than it is with gasoline-powered cars: There are 25 fires per 100,000 sold, according to one auto insurance study. Hybrid cars experience a higher rate of fires than both EVs and gasoline-powered cars.

Electric-vehicle technology follows a typical pattern that plagues new technologies: Market prerogatives outpace regulation and public-safety issues, overwhelming, in this case, the first responders who

deal with the life-threatening consequences. According to Rich MacKinnon, the president of the Professional Fire Fighters of Massachusetts, while Bay State firefighters receive specialized training for larger electric vehicles like the buses that a transit agency might use, the communications between fire companies and the manufacturers of electric cars has lagged.

The high-voltage lithium-ion batteries that power the dozens of makes and models of electric vehicles pose special dangers that fire departments do not encounter with cars powered by internal-combustion engines. Last summer, Sacramento Metropolitan Fire District firefighters dunked a Tesla in a makeshift "pond" since the car kept reigniting (yes, they actually dug a hole and filled it with water). Florida officials went ballistic after electric vehicles caught fire while sitting in saltwater in communities hit by Hurricane Ian, plaguing local fire departments already overtaxed by recovery work (and raising new questions about EV use in places susceptible to floods and severe tropical storms). As in Wakefield, these fires were the firefighters' first experiences with EV blazes.

In vehicles powered by internal-combustion engines, many fires start under the hood and burn the vehicle from front to back. In EVs, the lithium-ion batteries

from front to back. In EVs, the lithium-ion batteries are stored beneath the floorboards of a car. Fire erupts when the chemical reaction inside a battery causes a catastrophic increase in heat and pressure that produces a "thermal runaway." The resulting fire spreads between the individual battery cells. Water helps to cool down the chemical reaction, but a fire will continue as long as there is consumable energy in the batteries.

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In its November 2020 report, "Safety Risks to Emergency Responders from Lithium-Ion Battery Fires in Electric Vehicles," the National Transportation Safety Board documented three high-energy high-severity crashes (two had fatalities), and one non-crash fire and studied manufacturers' instructions for first and second responders like firefighters and tow truck operators. They found that the companies' emergency guidance instructions for fighting high-voltage lithium-ion battery fires lacked the necessary vehicle-specific details on how to suppress fires and handle other risks like "stranded energy," the energy that can remain in a battery after a crash and cause reignition.

To conduct rescue efforts and handle components strewn across a roadway, people need to know how to approach a vehicle and handle intact and damaged car fragments. “As they’re moving that vehicle or if they pass a chain over that vehicle that could create new electrical connections that may transfer energy from one place to another that’s not intended, [that could] cause a fire again,” says Kristin Poland, the deputy director of the NTSB’s Office of Highway Safety.

There are electrocution risks stemming from high-voltage connections in the damaged batteries. These fires also burn much hotter and longer than a gasoline fire and release highly toxic chemicals like hydrogen fluoride, so a firefighter must don protective gear including a self-contained breathing apparatus. Given the time involved in controlling the fire, the Wakefield department had to shuttle in extra air tanks so that firefighters had plenty of “new air” to continue battling the blaze.

There were no standpipes (hydrants) on the highway, so to come up with 20,000 gallons of water, the Massachusetts fire companies lay supply lines down an exit ramp to get water from a continuous shuttle of fire engines, which, in turn, had to go to hydrants in residential neighborhoods to get more water. (A

typical vehicle fire can be extinguished by several people in less than a half an hour, with perhaps up to 1,000 gallons of water.)

Electric-vehicle fires are labor-intensive. The Wakefield one-car fire required between 30 and 40 firefighters. Each of the towns that provided assistance (through a mutual aid pact of several dozen Boston-area municipalities) had to secure backup coverage for their own towns in case a different fire broke out at the same time. "It's not free," says Purcell, "someone is paying for it somewhere."

The NTSB's Poland indicates that most of the car manufacturers identified in the report have since responded to the agency's recommendations by standardizing their emergency response guides, so that they are available in a uniform manner for emergency responders as well as the major professional associations and unions. After learning that firefighters were more likely to rely on social media and YouTube for EV firefighting information rather than read a 69-page report, the agency produced a short video summarizing the major findings.

"If I'm pulling my vehicle onto my tow truck and I start to see the temperature increase, I can apply water to decrease the temperature as it's being moved on there," Poland says. "I can see I have a potential risk and I can mitigate that. That's the type of information that we're seeing manufacturers including now in their emergency response guides."

Uneven dissemination of EV fire information and research remains a problem, especially in the context of the additional risks that come with electrification. Wakefield's Purcell stresses that manufacturers should be more proactive, by coordinating with state public-safety agencies and education institutions like firefighting academies to establish standards and protocols and to ensure their wider dissemination to local communities.

On top of vehicle fires, electric-vehicle home charging stations are a special concern for Purcell. "There have been cases where they have been just parked and charged and they light up," he says. "If you are going to put one of these charging stations in your garage, it plugs into the wall. If that gets going, your house is history."

On the new-technologies front, solid state batteries may have the potential to displace lithium batteries; theoretically, they pose a lower fire risk. But *Forbes* reports that although some manufacturers may offer the batteries in the next five years, the technology is not expected to be widely available until the 2030s or as late as 2040. In the short term, other new tools like EV "emergency plugs" that New York and Newton, Massachusetts, fire departments (among the first in the country to have them) have obtained can help firefighters put vehicles involved in crashes into a type of standby mode, so that they can safely assess an incident.

"The industry is going to change," Purcell says. "But for now, this is what we have to deal with."

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