

# Flood waters can cause electric vehicles to catch on fire—and some did after Ian. Why experts aren't alarmed

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Credit: Unsplash/CC0 Public Domain

A small number of electric vehicles in Florida burst into flame during flooding caused by Hurricane Ian, and the fires are raising awareness

about a previously little-known safety issue for the millions of Americans who have bought or are thinking of buying an EV.

They are also generating political heat, with some Florida Republican lawmakers calling for more regulatory oversight for electric vehicles.

Florida's State Fire Marshal Jimmy Patronis tweeted, "there's a science experiment taking place in Florida with EVs and salty storm surge waters."

But experts note all vehicles use concentrated power sources—whether gasoline, diesel or electricity—making them all vulnerable to ignition.

Statistics compiled by AutoInsuranceEZ found that for every 100,000 EVs there are about 25 fires, compared with 1,530 car fires in the same number of gas-powered vehicles. Gas-powered cars typically catch [fire](#) due to fuel leaks or crashes.

Here's what to know about the fires in Florida:

## **What happened to flooded EVs in Florida?**

Hurricane Ian struck Florida's Gulf Coast on Sept. 28, killing at least 136 people, causing catastrophic damage worth more than \$50 billion and flooding large areas.

The storm's floodwaters also caused at least 11 electric vehicles to catch fire.

As of Oct. 26, U.S. TODAY has been able to confirm 11 cases in which EVs caught fire in Florida after flooding from Ian, all believed to be due to the cars' battery packs shorting out after being submerged in saltwater or physical damage to the batteries during the flooding.

Six of the fires were reported by the North Collier Fire Rescue District based in Naples, Florida, and another four by other Collier County fire departments, said Heather Mazurkiewicz, public information officer with the North Collier Fire Control Rescue District. One additional fire was reported in Sanibel Island by the Sanibel Island Fire and Rescue District.

No deaths have been linked to the fires. The Sanibel Island incident caused a fire that gutted the house the car was parked in and the one next door. There have been no reports of electrocutions linked to flooded electric vehicles.

While the danger of fire due to flooding in EVs has been known to experts since at least Superstorm Sandy in 2012, Hurricane Ian has put the issue front and center for the public.

"This is really the first time we had flooding in an area with a lot of electric cars," said John Linkov, deputy auto editor for Consumer Reports. Florida has the second-highest number of EVs in the nation after California.

Americans have had more than 100 years to get used to the safety issues gas-powered vehicles can pose. Now there is a learning curve for vehicles powered by batteries, said Thomas Barth, chief of the special investigations branch of highway safety at the National Transportation Safety Board.

"I don't want to give the impression the sky is falling," he said. "But they have their own set of dangers."

## **Why do flooded EVs catch fire?**

If an electric [vehicle](#)'s battery is damaged by a collision or water

intrusion from a flood, a [short circuit](#) can occur, which causes the cell to discharge energy and heat up. This can lead to an event called "thermal runaway," in which the heat propagates from one cell to the next, causing them to burn.

In a small number of cases when an EV is submerged in water, contaminants or salt in the water can cause short-circuiting, especially after the water drains from the battery.

Vehicles or batteries that have been damaged also have the potential for short-circuiting to occur due to movement of the vehicle or battery, for example when it's being loaded or unloaded from a tow truck.

Heat generated from a fire, thermal runaway of an adjacent cell, or shorting of the battery can melt the porous membrane between the battery's cathode and anode, causing this cell to go into thermal runaway. The heat causes the cell to vent flammable gas, which can ignite and catch fire.

"That heat can get transferred to the next cell and it can become a chain reaction," said Barth.

"If you have a damaged lithium-ion battery and it has energy which remains in the battery pack, we call that stranded energy," he said. "If you initiate a thermal runaway or venting of the flammable gas, the battery can ignite."

## **Did a high percentage of the EVs in Florida burn?**

Social media posts claiming EVs catch fire "often" overstate the problem, say experts.

Collier county, which includes the city of Naples, had 2,490 electric

vehicles registered as of July 2021, said Stan Cross, electric transportation policy director for the Southern Alliance for Clean Energy.

That would mean a fraction of a percent of the EVs in the county caught fire after the flooding.

In Lee county, where Sanibel Island is located, there were 2,683 EVs registered last year. The one EV that burned there would mean less than 0.04% of the electric vehicles in the county caught fire.

There was also a report by the local paper, the Island Reporter, that several flooded electric golf carts at The Dunes Golf & Tennis Club also caught fire, on Oct. 16.

## **What should I do with a flooded EV?**

Electrical corrosion may not be visible, and an EV can experience thermal runaway hours or even days after [flood waters](#) recede.

This means flooded EVs parked in garages or carports next to homes should be moved away from buildings. These cars should not be driven but must be towed. Experts cautioned that no car, whether electric or gas-powered, should be driven after flooding until it has been checked out by a professional.

"No road vehicle should be considered roadworthy after saltwater flooding, whether it's an EV or anything else," said Haresh Kamath, director of distributed energy resources at the Electric Power Research Institute in Palo Alto, Calif. "If you've experienced saltwater flooding, you should not be driving or trying to drive or even start that vehicle. You shouldn't be getting into the vehicle."

On Sanibel Island, which was heavily damaged by Ian, Sanibel Fire Rescue District crews have towed between 20 and 25 electric vehicles from garages or under residences to prevent possible structure fires, the agency said in a Facebook post.

The cars are being moved at least 15 feet away from buildings.

## **Are EV fires hard to put out?**

EV fires are more difficult to put out than ones in gasoline-powered cars and require different firefighting techniques, say experts.

Firefighters are already training on how to deal with EV battery fires, said Andrew Klock, senior manager of product and development for the National Fire Protection Association.

The biggest difference is that an EV fire cannot be put out with the type of firefighting foam used to smother other fires. Instead, the battery must be cooled to stop the fire and end thermal runaway, he said.

"Lithium-ion batteries generate their own heat and oxygen," said Klock. To stop the fire requires putting water on the battery case to cool it.

Most EV batteries are underneath the vehicle, so pouring water on top of the car or in the engine compartment is not helpful, he said.

"You need to get the water underneath," said Klock, whose organization provides training materials for fire departments on how to deal with all types of fires.

All car and truck manufacturers are already required to create emergency response guides for first responders on how to deal with everything from safely extricating someone from a crashed car to high-



voltage disconnect instructions.

A 2020 report by the National Transportation Safety Board found that more information about dealing with battery fires was needed.

"We've had excellent response from that guidance, a lot of the vehicle manufacturers have rewritten their emergency response guides or are in the process of doing that," Barth said.

In addition, a group of federal, state and private company experts has come together to address the issue of EVs and hurricanes and are working on it now, he said.

## **Aren't there protections built into the batteries?**

EV batteries are specifically engineered to make thermal runaway "very, very rare," said Kamath.

"The [safety systems](#) inside a lithium-ion battery generally prevent that type of thing happening unless there is some significant [physical damage](#) to that battery," said Kamath, who has worked on battery issues for more than 20 years.

In the case of a crash, modern electric cars are designed with fuses that are triggered if the airbags deploy, said Barth.

"Essentially, they're cutting the high voltage lines to the motor that turns the wheel," he said. "If you crash, you don't want the high voltage lines powered up that could energize the chassis and shock someone."

EV batteries are designed with seals to protect against water intrusion, said Stu Fowle, a communications director with General Motors.

"Our tests include extremely dry conditions and water submersions to simulate flooding, validating the safety and isolation of systems," he said in a statement to U.S. TODAY.

The fact that only eleven EV fires have been associated with Hurricane Ian is telling, said Marc Geller, with the Electric Vehicle Association.

"If a ton of flooded EVs were catching fire, we'd certainly hear about it," he said.

## **Is it safe to charge an EV in a flooded area?**

If the car itself wasn't flooded, then yes, it is safe to charge.

If the charging station flooded, it shouldn't be used—and will not work, said experts. The safety mechanisms built into any system that flooded should have automatically shut it off, said Kamath.

"They have done a lot of engineering to make sure that in the event of flooding or something that would interfere with the operation, the system shuts down," he said.

## **Are flooded conventional cars ok?**

No vehicle, whether powered by gasoline or a battery, is safe to drive after being flooded, multiple experts warned.

"Just like flooding is the end of the road for a gasoline-powered car, it's the end for electric cars too," said Brian Moody, executive editor for Autotrader.

"Many of the same problems that plague a gasoline-powered car are an



issue no matter how the car is powered. The dash, gauges, heating system, brakes, wiring, seats, radio, touchscreen, all those components will be ruined by water, especially salt water," he said.

## **Better driver education for EV owners**

Electric vehicles are increasingly popular in the United States, reaching a record 5.6% of all new cars sold in the United States in the third quarter of 2022, according to Kelley Blue Book. In 2021, there were 321,546 EVs sold in the U.S. So far this year the number stands at 546,664, according to Kelley Blue Book.

Estimates put the number of electric vehicles on U.S. roads at somewhere between one and two million. That's a far cry from the 286 million total cars registered, but does mean an increasing number of Americans are driving battery-powered vehicles. There's a learning curve, say experts.

Florida has the second-highest concentration of electric vehicles after California, said Cross. As the state, and the nation, face the possibility of more floods, getting new EV owners up to speed will be necessary.

Most Americans grew up with gas-powered vehicles and have at least some understanding of their dangers—even if it's only having seen movies where a gas leak from the tank of a damaged car precedes a billowing cloud of flame.

With so many new EVs on the road, and drivers new to [electric vehicles](#), learning about their differences is important.

"With all new technologies, there will be problems to work out. With EVs, though the problems are few, they are headline-catching and life and property-threatening," said Cross. "You can't hide from that. It's a

problem, it needs to be addressed."

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