



U.S. Department
of Transportation
**Pipeline and Hazardous
Materials Safety
Administration**

1200 New Jersey Avenue, SE
Washington, DC 20590

Safety Advisory Notice¹ – Transportation of Electric Vehicles Containing Lithium Batteries Damaged by Extreme Weather Events

I. Summary and Purpose

The U.S. Department of Transportation’s Pipeline and Hazardous Materials Safety Administration (PHMSA) is issuing this safety advisory notice to inform the public and raise awareness of the risks involved in the transportation of electric vehicles (EVs) powered by installed lithium batteries that may have been damaged due to submersion in waters during extreme weather events. When transported in commerce, EVs containing these damaged batteries may present particularly significant hazards to the public, including property damage, injury, and even death. Our intention with this notice is to prevent those things from happening. Furthermore, PHMSA wishes to remind potential shippers of EVs—including vehicle owners, salvage companies, and vehicle transport companies—that they have a responsibility to assess EVs for potential damage to their installed lithium batteries and to observe the specific requirements in the Hazardous Materials Regulations (HMR; 49 CFR Parts 171-180) for both the transportation of EVs containing lithium batteries, and for the transportation of damaged and/or defective lithium batteries in commerce.

II. Supplementary Information

PHMSA’s mission is to protect people and the environment by advancing the safe transportation of hazardous materials in commerce. To achieve this mission, PHMSA works with its modal partner agencies to establish national policy, set and enforce regulations (published in the HMR), educate stakeholders, and conduct research to prevent hazardous materials incidents.

Additionally, federal hazardous materials law authorizes the Secretary of Transportation (the Secretary) to “prescribe regulations for the safe transportation, including security, of hazardous materials in intrastate, interstate, and foreign commerce” 49 U.S.C. 5103(b)(1). The Secretary has delegated this authority to PHMSA in 49 CFR 1.97(b). PHMSA’s regulations (i.e., the HMR) are designed to achieve three primary goals:

1. Ensure that hazardous materials are packaged and handled safely and securely during transportation.

¹ *This document contains guidance provided to help the regulated community understand how to comply with regulations but its contents are not substantive rules themselves and do not create legally enforceable rights, assign duties, or impose new obligations not otherwise contained in the existing regulations and standards.*

2. Effectively communicate the hazards of the materials being transported to transportation workers and emergency responders.
3. Minimize the consequences of an accident or incident should one occur.

As part of its safety mission, PHMSA regulates the transportation of lithium batteries, including those that are installed in or are intended for use in EVs.² Lithium batteries pose a risk in transportation, and the HMR contain provisions³ intended to address the risk in transport and ensure safety of the public whether the lithium batteries are installed in an EV being transported or are transported separately. Damaged or defective lithium batteries pose a unique risk because they are more likely to experience thermal runaway and ignite during transportation.⁴ Consequently, shipments of damaged or defective lithium batteries have additional restrictions—*see* 49 CFR 173.185(f)—compared to newly manufactured, used, or undamaged/properly functioning batteries. It should also be noted that damaged, defective, or recalled lithium batteries must be prepared for shipment in accordance with the relevant provisions of the HMR and may be shipped only by highway, rail, or vessel transportation and are *strictly forbidden for commercial transportation by aircraft*.

There have been fires associated with lithium batteries installed in EVs that were submerged in floodwaters following extreme weather events. Saltwater is especially harmful to lithium batteries as residual salt within the battery or battery components can form conductive bridges that can lead to short circuit and self-heating of the battery, resulting in fires. The time frame in which a damaged battery can ignite varies, from days to weeks, and EV battery fires can be extremely time- and resource-intensive for responders. In addition, responders face safety risks related to the emission of toxic and flammable gases from damaged lithium batteries, and the unpredictability of thermal runaway and reignition. As such, lithium batteries from EVs that have experienced flooding or other exposure to the elements in a manner other than designed are at significant risk of damage, resulting in elevated potential for producing a dangerous evolution of heat, fire, or short circuit.

PHMSA understands that assessing whether a battery is damaged may require input from the manufacturer and recommends that shippers consult with the manufacturer of the battery to assist in such a determination. However, it is ultimately the shipper's responsibility to determine when a battery is damaged and therefore requires additional consideration for packaging and transportation. Specifically, in accordance with 49 CFR 173.22(a), the shipper must properly class and describe the hazardous material being offered for transportation and determine whether the packaging or container is an authorized packaging. In addition, shippers are forbidden from offering for transportation or transporting electrical devices, such as batteries and battery-powered devices—including EVs—that are likely to create sparks or generate a dangerous evolution of heat, unless packaged in a manner which precludes such an occurrence. *See* 49 CFR 173.21(c).

² 49 C.F.R. 173.220(d).

³ *See* §§ 173.185; 173.220; 176.905; and 177.823

⁴ *See* “Safety issues of defective lithium-ion batteries: identification and risk evaluation (osti.gov)” at: <https://www.osti.gov/pages/biblio/1660162>

Lastly, when movement of an EV with a damaged lithium battery on a motor vehicle is necessary to protect life or property in an emergency, certain requirements of the HMR are waived. *See* 49 CFR 177.823(a)(3). Additionally, the National Highway Traffic Safety Administration has published guidance on their website⁵ for towing and recovery operators and vehicle storage facilities that describes how to properly handle EVs in the event of damage, fire, or flooding.

What are the packaging and marking requirements to transport damaged, defective, and recalled lithium batteries? *See* 49 CFR 173.185(f):

- **Place** the battery in an individual, non-metallic inner packaging that completely encloses the battery.
- **Surround** the inner packaging with non-combustible, electrically non-conductive, and absorbent cushioning material.
- **Place** each inner packaging into its own specification outer packaging rated to the Packing Group I performance level. This means only one damaged, defective, or recalled battery per inner packaging, and only one inner packaging per outer packaging.
- **Mark** the outer packaging as “Damaged/defective” and identify the battery type. The marking—reading “Damaged/defective lithium-ion battery” or “Damaged/defective lithium metal battery”—must be in characters at least 12 mm (0.47 inches) high.

What are the packaging requirements to transport EVs powered by lithium batteries that have not been damaged? *See* 49 CFR 173.220(d):

- EVs with their batteries installed are **forbidden** for transport aboard passenger-carrying aircraft.
- Lithium batteries contained in vehicles, engines, or mechanical equipment must be **securely fastened** in the battery holder of the vehicle, engine, or mechanical equipment, and be **protected** in such a manner as to prevent damage and short circuits (*e.g.*, by using non-conductive caps that cover the terminals entirely).
- Except for vehicles, engines, or machinery transported by highway, rail, or vessel with prototype or low production lithium batteries securely installed, each lithium battery must be of a type that has **successfully passed** each test in the United Nations (UN) Manual of Tests and Criteria, as specified in 49 CFR 173.185, unless approved by PHMSA’s Associate Administrator.
- Where a vehicle could possibly be handled in other than an upright position, the vehicle must be **secured** in a strong, rigid outer packaging. The vehicle must be secured by means capable of restraining the vehicle in the outer packaging to **prevent** any shifting during transport that would change the orientation or cause the vehicle to be damaged.
- Where the lithium battery is removed from the vehicle and is packed separate from the vehicle in the same outer packaging, the package must be **classified** as “UN3481, Lithium-ion batteries packed with equipment” or “UN3091, Lithium metal batteries

⁵ *See* “Interim Guidance for Electric and Hybrid-Electric Vehicles Equipped with High-Voltage Batteries” at: https://www.nhtsa.gov/sites/nhtsa.gov/files/811576-interimguidehev-hv-batt_towing-recovery-storage-v2.pdf

packed with equipment” and prepared in accordance with the requirements specified in 49 CFR 173.185.

What are the additional stowage requirements to transport EV’s powered by lithium batteries when carried on a vessel? See 49 CFR 176.905(a):

- For vehicles with batteries installed, the batteries shall be protected from damage, short circuit, and accidental activation during transport.
- Each lithium battery must be of a type that has successfully passed each test in the UN Manual of Tests and Criteria unless approved by PHMSA’s Associate Administrator.
- A vehicle showing **any signs of leakage or electrical fault**—such as inability to start or move under its own power—or signs of prolonged exposure to water, is forbidden for transportation onboard a vessel.
- Where a lithium battery installed in a vehicle is damaged or defective, the battery must be removed and transported according to 49 CFR 173.185(f), unless otherwise approved by PHMSA’s Associate Administrator.

Please note, this is not an exhaustive list of regulatory requirements to ship damaged or defective lithium batteries, or EVs powered by lithium batteries. Depending on shipping scenarios, stakeholders may need to comply with other conditions such as training or shipping paper requirements. See “Section III. Additional Lithium Battery Resources from PHMSA” for more details.

III. Additional Lithium Battery Resources from PHMSA

PHMSA has created additional resources on lithium battery regulations that complement this safety advisory notice. These resources include:

- PHMSA’s website: <https://www.phmsa.dot.gov/lithiumbatteries>
- PHMSA’s [Lithium Battery Guide for Shippers](#)
- PHMSA’s [recorded presentation on how to use the Lithium Battery Guide for Shippers](#)
- PHMSA’s Hazardous Materials Information Center (HMIC)
 - Telephone number: 1-800-467-4922
 - E-mail: infocntr@dot.gov
 - The HMIC is staffed Monday through Friday, 9:00 a.m. to 5:00 p.m. EST. If you contact the HMIC outside of normal business hours, leave a message and someone will return your call the next business day.
- PHMSA’s [Online CFR tool \(oCFR\)](#)
 - You can click the link labeled “oCFR Tool” in the menu on the left under “Related Links.”

IV. Future Plans

PHMSA will continue to work with our safety partners to more fully understand the risks of flooded EV batteries. As such, we plan to conduct research and issue updated guidance when additional information is available.

Issued in Washington, D.C. on April 7, 2023.

A handwritten signature in blue ink, appearing to read "William S. Schoonover".

William S. Schoonover
*Associate Administrator for Hazardous Materials Safety
Pipeline and Hazardous Materials Safety Administration*