

# E-bike Battery Safety

Q&A with Mike Fritz; Scott Chapin; and Dr. Ash Lovell

**Q: Is "always be present when charging devices using lithium-ion batteries; never charge them while sleeping" reasonable? Why are electric vehicles usually being charged overnight and unattended?**

A: While we are not aware of any research on exactly "why" this occurs, a reasonable assumption might be that the EV battery was discharged from use during the day, and the user wanted the battery to be fully charged the following day. In the case of NYC, the delivery workers use their vehicles continuously and require multiple batteries through the course of their workday, which appears to lead to unattended charging.

**Q: Can anyone review safe shared charging programs in a public setting? Considering the risks of people using unapproved chargers and on a variety of devices, certified and not, it seems too risky for a public entity to embrace but is something we must address in our climate future.**

A: Other than for bike and scooter share systems, shared charging programs are in their infancy and have multiple issues to address, including charger and battery compatibility and minimizing fire risk in the charging facility. These issues are by no means insurmountable as can be seen from the tens of thousands of gas stations dispensing highly

flammable and toxic fossil fuels every day, everywhere.

**Q: Why do the panelists consider NYC e-bike fire problems unique? Aren't the factors that have led to many of these fires simply a combination of lower-income owners buying cheaper products to operate their e-bikes to the limits? Why wouldn't lower income owners anywhere in the country be tempted to save money by buying sketchy batteries, get their battery packs remanufactured/use non-matching chargers with their battery packs? On large university campuses like ours, the student market is well known to go for the lowest cost options for anything and everything they need and purchase. We also have large, dense housing both on and off campus, so why shouldn't we be concerned like NYC officials?**

A: The hundreds of fires that have occurred in NYC far outnumber the few fires that have occurred in the rest of the country. NYC is not representative of what is generally happening in the rest of the country, because the way that batteries are treated by deliveristas in NYC is a unique way to treat batteries, including pushing them to their very limits; using them 12-16 hours or more a day non-stop in all kinds of weather; and having a large collection of battery packs all charging at once. NYC has also seen numerous fires attributed

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to the growth of underground repair facilities that refurbish or remanufacture batteries.

**Q: I'm going to be getting a new e-bike soon. What exact questions should I ask of the retailer and what answers are good?**

A: We recommend going to your local bike retailer and asking about brands that are third party-tested. This can be UL 2849 or EN15194 (from Europe), but there are others. You are generally safe with most of the well known brands. So if you are eyeing a brand you never heard of, you should definitely check to find out if it has any third party testing certification. This is especially important the cheaper you go. Be very skeptical if any bike under say, \$800 because a good battery alone can cost that much, without the bike.

**Q: Are there popular brands of consumer direct e-bikes that are known for poor testing or battery quality?**

A: There is no current requirement that e-mobility sellers conduct battery testing or make their test results available to a government regulator or the public. The CPSC recently encouraged such testing and certification and will be enforcing that expectation on a case by case basis. When the CPSC finds that a particular e-bike model represents a substantial hazard, they can require the manufacturer to conduct a recall, and several such recalls have occurred. Unfortunately a foreign-based consumer direct brand can easily create a new brand and continue selling the product under a new name. This is why it is important to buy e-bikes from well-known manufacturers with an established presence in the United States.

**Q: Do you recommend a laser thermometer to monitor battery heat? If so, how would you gauge a hot battery event to a scalable scientific metric which could be used in fleet management of charging fleet batteries? (We only use UL 2849 Certified batteries and chargers which are compatible.)**

A: Regarding the use of an optical thermometer, we're on the fence. To our knowledge, no one has studied this to determine when the heat radiated by a battery pack signals danger. A battery pack will get warm to the touch when charging and/or after a hard ride. That is a natural consequence of the internal resistance of the cells. But how hot is too hot? We don't know for sure. Perhaps a simpler method can be more effective. If it's too hot to touch, then it may be approaching a catastrophic failure. Certainly if there is smoke or flame visible, or visible deformation of the pack's housing, if possible to do so safely, get the pack outdoors away from flammable materials and call 911. If it seems just abnormally hot, unplug the charger, and monitor the pack to make sure it doesn't continue to heat. Store it in a safe place and return it to your servicing dealer to be checked before further use. Using UL2849 e-bikes (and thus UL2271 certified battery packs) is absolutely the best strategy to assure yourself that the e-bike and its battery pack will provide safe and reliable service. But remember the caveat that even the best battery pack, even those that are UL certified, can fail if damaged or improperly used and/or maintained.

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**Q: Are EN-15194 and UL 2849 equally good enough? Do they allow charging overnight? Safe charging overnight would seem to be a normal expectation of a consumer — like with computer laptops, smart phones, and electric motor vehicles.**

A: Yes, these two standards are very similar and use many of the same tests for batteries and chargers and should be regarded as providing an equivalent standard of safety. However, these standards evaluate the design and quality of the new e-bike at the time it is sold and cannot fully account for the use and abuse the e-bike may experience over its useful life or provide a 100% guarantee that nothing will ever go wrong. Consumers should therefore always follow safe charging procedures with all lithium ion batteries to lessen the risk of a thermal runaway and fire. Other devices and electric motor vehicles with their much larger batteries have not been immune from these incidents despite undergoing testing and certification.

**Q: Is that 65,000 delivery workers in NYC alone?**

A: Yes. That number is specific to NYC, which is far more than any other market.

**Q: Are other states instituting similar requirements like UL 2271/72. What is California doing?**

A: No. There are currently no state laws requiring testing or certification of lithium ion batteries for e-mobility devices. A bill is pending in the New York legislature, as well as federal legislation that would direct the CPSC to create battery testing regulations. PeopleForBikes is not aware of any pending legislation in California.

**Q: How can anyone identify whether an e-bike is UL certified or UL 2849 certified? Who in a community is going to be expected to check whether a given e-bike is properly certified?**

A: A reputable manufacturer or retailer can provide information about the testing and certification of their e-bikes. There is no legal requirement that an e-bike be "UL certified" which is a very specific form of certification performed by Underwriters Laboratories. Many e-bikes are "certified to UL 2849" by other accredited testing laboratories. Often the certification appears on the e-bike or battery along with the name or logo of the testing laboratory.

**Q: There are bags for the batteries that are purported to minimize fire risk that they can be charged in. Are those recommended?**

A: Assuming the battery bag is well engineered and manufactured, yes, a battery bag can contain a lithium ion battery fire until the fire department arrives. We do not have any recommendations for fire proof bag suppliers, but will study.

**Q: Can an outlet timer-plug be used to control charging rather than unplugging chargers**

A: Yes. But using a timer to shut off the charging process does not eliminate the need to monitor the battery pack during the charging process. The Cardinal Rule: **NEVER CHARGE A LITHIUM ION BATTERY UNATTENDED.**

**Q: Yet EV's contain hugely more battery power yet those are also charged overnight!**

A: Lithium ion battery packs in electric cars incorporate significantly more safety features than

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those used in e-bikes. Primarily, they are water cooled which significantly reduces the stress on the cells. Plus, EV makers use the best cells available. These are significantly less likely to fail than the cheap, poorly made cells used in the sub-par battery packs that are at the heart of the New York problem.

**Q: Is there a danger when the battery is not charging? Is it safe to leave it on a shelf in the home?**

A: There is always a risk that a lithium ion battery can fail, even when not being charged or discharged. However, these occurrences are extremely rare, especially when quality cells are used in the assembly of the pack. But we always recommend that packs be stored (and charged) away from flammable materials, in an area where working smoke detectors are installed.

**Q: Are the fire risks only applicable during charging? Or do batteries combust when they are not charging as well (i.e. if the bike is stored in a garage with the battery attached, is that a risk? Or is there a risk while riding?)**

A: There are mechanisms that can cause a cell to fail even when not under charge. The most common is called 'dendritic cell growth'. A dendrite is a crystal with very sharp points that grow when elements precipitate out of solution in the electrolyte. These dendrites can penetrate the separator causing a short circuit and potential thermal runaway. However, dendritic cell growth occurs most often in battery packs that have been overcharged during their service life. Proper care and maintenance of a quality battery pack significantly reduces the occurrence of dendritic cell growth. Nevertheless, it is always

recommended that battery packs be stored (and charged) away from flammable materials in an area where working smoke detectors are installed.

**Q: What about storage outside in a secure bike shelter, who is liable if a fire happens?**

A: Questions about potential liability are usually highly fact-specific and are difficult to answer with any certainty. Perceived risk may be minimized with proper risk management techniques such as a rental agreement for the locker that assigns risk appropriately.

**Q: Do e-scooters have the same battery and safety issues as e-bikes?**

A: Yes. Keep in mind other micromobility devices like e-scooters and hoverboards fall under a different UL certification, namely UL 2272. Many of the fires that have occurred in NYC were associated with e-scooters or electric mopeds, and there are a wide range of products being used.

**Q: I've consulted in the waste management sector ... many fires at municipal sorting stations. please talk about proper disposal of end of life batteries**

A: Please visit [www.call2recycle.org/ebikes](http://www.call2recycle.org/ebikes) where you can get information on where to properly recycle e-bike batteries. If you are a retailer or manufacturer, you can also sign up to be an official recycling location.

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**Q: Would love to be able to point a tenant/ property management member towards those fire proof boxes mentioned. Folks I know who work in advanced robotics deal with these fire code safety steps, but there doesn't seem to be one product I can point our membership towards on the general consumer market.**

A: There are a number of battery storage systems suitable for the storage and charging of lithium ion battery packs currently in development. There are suitable cabinets currently available from CellBlock (<https://cellblockfcs.com/battery-cabinets/>).

**Q: I work for a university, and we work hard to encourage students to bike and scoot and leave their cars at home. Currently we don't allow campus residents to store electric micromobility devices in the residence halls, which means they can't bring e-bikes with them to get around campus. What type of policy could the university put in place to safely allow students to bring e-bikes and e-scooters with them to college?**

A: Most universities provide ample and expensive facilities for motor vehicles such as surface parking lots and concrete parking structures (equipped with sprinkler systems to address the risk of motor vehicle fires) as well as numerous bike racks for conventional bicycles. The best way to encourage e-mobility is to create similar facilities that enable their use, such as charging stations within parking structures where electric bicycles can be protected from the elements and safely charged. Bonus: E-bikes and scooters take up a lot less valuable campus real estate than motor vehicles.

**Q: What have you heard from colleges and universities on how they are producing or changing their policies for batteries on campuses and in their buildings?**

A: We has not had any such inquiries.

**Q: Do we know if any of the fires have been caused by an EV battery charging with its matched charger?**

A: Unfortunately there is very little data on *which* specific brands of mobility devices have been involved in these fires or the exact *cause* of the fire. Investigations conducted by the NYC fire department and the CPSC have resulted in only a handful of recalls. Very little other information is publicly available. Often the device at fault and its charger are unlabeled or the markings are simply destroyed in the fire. In some cases devices are modified or "conversion" electric bicycles with no real manufacturer. What we do know is that a properly designed battery and matching charger that are designed and tested to one of the recognized safety standards for these devices have a battery management system (BMS) with circuitry that is specifically designed to address many of the causes of thermal runaway such as overcharging and short circuits. Some newer technology can even detect a mismatch between the charger and battery and stop the charging. Poor quality devices can lack these important safeguards.

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**Q: The recently stated precautions for charging e-bike batteries defeat many of the conveniences of riding a bike. I, for one, leave my bike in my garage and turn the charger on when I arrive home. Following the recommendations will require \*many\* inconvenient changes to my routine and home. I do note that my charger turns off when the battery reaches full charge. Are some manufacturers working on technology that will make the necessary precautions more automatically and conveniently? What should we expect? How can we help in this process?**

A: In our opinion, it is unsafe to rely on the charger to turn off at the completion of a charge cycle. A malfunction could allow the charger to continue charging the pack indefinitely. It's far safer to disconnect the charger from the wall outlet after charging is complete by either physically disconnecting the charger or by using a timer to do so.

**Q: Do you think having charger outlets on an automatic shut off timer in a community bike cage could be a solution? If so, what would be the max amount of time you would want the timer to charge for?**

A: Yes. Setting a timer for the battery charger to turn off the charger after a preset time is one way to avoid possible overcharging of the battery pack. The amount of time that the charger is on is dependent on the state-of-charge of the pack when charging begins. Check your e-bike owner's manual for specific recommendations.

**Q: Do you have battery waste thoughts? We had an e-bike battery that required a key. Key fell out (Lectric) and a locksmith and company cannot remedy without replacing a perfectly good battery.**

A: We can't really address specific issues with a particular brand, that is best left to the manufacturer. For questions about battery waste and handling, you can email: [e-bikeprogram@call2recycle.org](mailto:e-bikeprogram@call2recycle.org)

**Q: Can you please provide the link to the PFB e-bike battery pack owners manual?**

A: The PFB Owner's Manual for electric bikes is still in development and has not yet been published. Once it is published, PFB charges a licensing fee for its reproduction and use by manufacturers, who are required by the CPSC to provide an Owner's Manual with each new bicycle. We expect that many manufacturers will also make their version of the e-bike Owner's Manual available on their company websites.