

HAZARDOUS MATERIALS PROGRAM ENVIRONMENTAL FACT SHEET

Managing Spent Batteries

Batteries are a common waste stream for most hazardous waste generators in Vermont. The type of battery and the generator's approach to management determine the applicable requirements of the Vermont Hazardous Waste Management Regulations (VHWMR). This fact sheet is intended to provide guidance on how batteries are regulated, management requirements and best management practices, and where to look for additional information. If you have any questions, please refer to the contact information for the Hazardous Materials Program (Program) at the end of the fact sheet.

What types of batteries are regulated by the VHWMR?

As defined in the regulations, a "battery" is a device consisting of one or more electrically connected electrochemical cells which is designed to receive, store, and deliver electric energy. An electrochemical cell is a system consisting of an anode, cathode, and an electrolyte, plus such connections (electrical and mechanical) as may be needed to allow the cell to deliver or receive electrical energy. The term battery also includes an intact, unbroken battery from which the electrolyte has been removed.

Other than one notable exception for the recycling of lead-acid batteries (covered later in this fact sheet), all business-generated batteries that meet hazardous waste criteria as defined in Subchapter 2 are regulated as either *hazardous waste* per the requirements in Subchapters 1 through 7, or as *universal waste* per the requirements in Subchapter 9. While there is tremendous variety in battery design and application, this fact sheet covers the regulatory applicability and management considerations for:

- Lead-acid batteries;
- Primary batteries; and
- Lithium-ion batteries.

The universal waste management standards may be applicable to each battery type listed above, and a summary of the standards is provided in the next section of this fact sheet. Each battery type is then explained further later in the fact sheet, along with considerations specific to that type of battery.

Note: The Program encourages businesses to *recycle* non-hazardous waste batteries (e.g., some types of primary batteries) through the Vermont Battery Stewardship Program. For more information on recycling batteries, refer to the resources at the bottom of this fact sheet. Note that all household-generated wastes, including batteries, are exempt from regulation as hazardous waste under VHWMR section 7-203(a).

What are the requirements for managing batteries as universal waste?

Batteries that have certain characteristics (e.g., ignitibility or reactivity) are considered hazardous waste; however, batteries may be managed under alternative management standards as “universal waste” in lieu of the hazardous waste management standards set forth in Subchapters 1 through 7. Universal waste standards are provided in Subchapter 9 and allow for a more flexible approach to the management of certain common hazardous waste streams. In order to manage spent batteries as universal waste, each generator must ensure that the following standards are met:

- Handlers of universal waste store any battery that shows evidence of leakage or damage in a container. The container must be closed, structurally sound, compatible with the contents of the battery, and must lack evidence of leakage or damage.
- Handlers of universal waste may do the following, as long as the casing of each individual battery cell is not breached and remains intact and closed (except that cells may be opened to remove electrolyte but must be immediately closed after removal):
 - Sorting batteries by type.
 - Mixing battery types in one container.
 - Discharging batteries to remove the electric charge.
 - Regenerating used batteries.
 - Disassembling batteries or battery packs into individual batteries or cells.
 - Removing batteries from consumer products.
 - Removing electrolyte from batteries.
- Handlers of universal waste who remove electrolyte from batteries, or who generate other solid waste (e.g., battery pack materials, discarded consumer products) as a result of the activities listed above, must determine whether the electrolyte and/or other solid waste exhibit a characteristic of hazardous waste:
 - If the electrolyte and/or other solid waste exhibit a characteristic of hazardous waste, it is regulated as hazardous waste subject to the requirements of Subchapters 1 through 7.
 - If the electrolyte or other solid waste is not hazardous, the handler may manage the waste as solid waste.

Note: The management requirements above are specific to *small quantity handlers* of universal waste. Small quantity handlers accumulate less than 11,000 pounds total of universal waste other than CRTs, and less than 40 tons of CRTs, at any time. Not to be confused with generator category, virtually all handlers of universal waste in Vermont are small quantity handlers. For more information on the requirements that apply to the handling of all universal waste, including batteries, please refer to the Program’s [Universal Waste Fact Sheet](#). Also note that while the universal waste management standards allow for the mixing battery types in one container, the Program advises against mixing lithium-ion batteries with others due to increased risk of fire.

What are lead-acid batteries, and what are my options for managing spent lead-acid batteries?

Lead-acid batteries are a rechargeable type of battery most commonly used in motor vehicles, where they provide the high current necessary for starter motors. Such batteries contain lead that is

submerged in sulfuric acid. This design allows for a controlled chemical reaction that produces electricity; the reaction is reversed to recharge the battery. The requirements for managing spent lead-acid batteries depend on whether the generator is managing them under the recycling exemption, as hazardous waste, or as universal waste. Spent lead-acid batteries meet hazardous waste criteria due in part to the corrosivity and toxicity characteristics (waste codes D002 and D008, respectively).

Managing Spent Lead-Acid Batteries Under the Recycling Exemption

Spent lead-acid batteries that are reclaimed or regenerated and ultimately recycled are exempt from regulation as hazardous waste so long as they are:

- Stored under cover on an impervious surface.
- Transported in compliance with the federal transportation regulations in [49 CFR Parts 171 through 177](#).
- Handled in compliance with the federal universal waste regulations in [40 CFR Part 266.80](#).

Managing Spent Lead-Acid Batteries as Universal Waste

The Program strongly encourages generators to recycle spent lead-acid batteries according to the recycling exemption. However, spent lead-acid batteries that are not managed according to the recycling exemption may be managed under alternative standards as universal waste. See the section earlier in the fact sheet about managing batteries as universal waste.

Managing Spent Lead-Acid Batteries as Hazardous Waste

If being managed as hazardous waste, the requirements in Subchapters 1 through 7 of the VHWMR would apply. However, generators are strongly encouraged to manage spent lead-acid batteries under the recycling exemption, or as universal waste, whenever possible.

What are primary batteries, and what are my options for managing spent primary batteries?

Primary batteries are *not* rechargeable; they are designed to be used and discarded. When the chemicals that generate power in a primary battery are spent, the battery stops producing electricity. Primary batteries are used to power small electronic items such as cameras, toys, flashlights, radios, and appliances. Examples include but are not limited to alkaline, zinc carbon, button cell, and lithium metal (not to be confused with lithium-ion). Lithium metal primary batteries have increasingly replaced other types of primary batteries over time. The requirements for managing primary batteries depend on whether the generator is managing them as solid waste, universal waste, or hazardous waste. Many primary batteries do not meet hazardous waste criteria. Alkaline and zinc carbon batteries, for instance, may likely be managed as solid waste; those purchased prior to 2000 should be evaluated to confirm that they do not contain mercury. The Program encourages businesses to recycle spent batteries that are non-hazardous. However, some primary battery types, like button cell and lithium metal, may meet hazardous waste criteria due in part to the toxicity and reactivity characteristics, respectively.

Managing Primary Batteries as Universal Waste

Primary batteries that meet hazardous waste criteria may be managed under alternative standards as universal waste. See the section earlier in the fact sheet about managing batteries as universal waste.

Managing Primary Batteries as Hazardous Waste

If being managed as hazardous waste, the requirements in Subchapters 1 through 7 of the VHWMR would apply. However, generators are strongly encouraged to manage primary batteries that are determined to be hazardous as universal waste whenever possible.

What are lithium-ion batteries, and what are my options for managing spent lithium-ion batteries?

Lithium-ion batteries are a type of secondary cell (i.e., rechargeable) battery that uses the reversible reduction of lithium ions to store energy. The design and chemistry of these batteries vary greatly depending on their application, but materials that are typically used include lithium, nickel, cobalt, manganese, graphite, iron, copper and aluminum foils, and an electrolyte. The electrolyte is typically a lithium salt in an organic solvent. In recent years, lithium-ion batteries have experienced a rapid increase in demand, and they have replaced both primary batteries and other types of secondary cell batteries (e.g., nickel cadmium, nickel-metal hydride) in many applications. They are very energy dense, storing high amounts of energy in a battery that is smaller and lighter than other types. This makes them particularly useful for consumer electronics, electric vehicles and bikes, and stationary storage applications.

Due to wide variety in design, chemistry, and application, it can be difficult to identify which spent lithium-ion batteries are hazardous waste at end of life. Generators are responsible for determining whether their spent lithium-ion batteries are hazardous. As with the other battery types covered in this fact sheet, the requirements for managing lithium-ion batteries depend on whether the generator is managing them as hazardous waste or as universal waste.

Most lithium-ion batteries on today's market are hazardous waste when they are disposed of, due in part to the ignitability and reactivity characteristics (waste codes D001 and D003, respectively). In addition to making accurate waste determinations and following the applicable regulations, generators should be extremely mindful of safety when it comes to handling and storing spent lithium-ion batteries—particularly those that have been identified as damaged, defective, or recalled (DDR), as DDR batteries pose an increased risk of fire.

Note: Secondary cell batteries other than lithium-ion batteries, such as nickel cadmium, may meet hazardous waste criteria. Such batteries must be managed as either hazardous waste or universal waste.

Requirements for Managing Lithium-Ion Batteries as Universal Waste

Lithium-ion batteries that meet hazardous waste criteria may be managed under alternative standards as universal waste. See the section earlier in the fact sheet about managing batteries as universal waste.

Requirements for Managing Lithium-Ion Batteries as Hazardous Waste

If being managed as hazardous waste, the requirements in Subchapters 1 through 7 of the VHWMR would apply. However, generators are strongly encouraged to manage lithium-ion batteries as universal waste whenever possible.

Best Management Practices for Lithium-Ion Batteries

Fires at end of life are common when dealing with lithium-ion batteries, and mismanagement and damage to batteries makes them more likely. Beyond following the universal waste standards, handlers of end-of-life lithium-ion batteries should take additional precautions to protect against the chance of thermal runaway and fire. These include:

- Safety training for all employees removing, disassembling, or handling the batteries;
- Isolating the terminals of the batteries with non-conductive tape, plastic bags, or other separation techniques, keeping the label legible;
- Preventing damage to batteries;
- Storing batteries in climate-controlled spaces with good ventilation;
- Storing batteries in a separate building away from other flammable materials and occupied spaces when possible;
- Storing batteries that have been identified as damaged, defective, or recalled (DDR) separately from non-DDR batteries in appropriate containers;
- Installing advanced fire detection and suppression equipment;
- Conducting frequent visual and thermal inspections of batteries;
- Having ongoing communications with local fire marshals and first responders about materials and processes happening on site; and
- Maintaining a plan for how to respond and evacuate in case of an emergency.

Are there any additional resources on managing batteries?

- For information about recycling batteries, refer to the [VT DEC Battery Recycling Page](#) and the Call2Recycle website for Vermont.
- To learn more about the design, regulatory applicability, and management of lithium-ion batteries, refer to the U.S. Environmental Protection Agency's (EPA) memo from May 24, 2023: ["Lithium Battery Recycling Regulatory Status and Frequently Asked Questions."](#)

For more information regarding managing waste batteries, or if you have other hazardous waste management questions, please contact:

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