Personal Electronics & Battery End-of-Life Management Guide

Steps to Effective Community Collection and Recovery

The Recycling Partnership
SOLVING FOR CIRCULARITY

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Introduction

Personal electronics (PEs)—cellphones, tablets, laptops, power tools, gaming devices, and many more products—are fixtures of modern life. These electronics also are one of the fastest-growing residential waste streams, though only a small fraction of the almost 500 million pounds of personal electronics used each year in the U.S. are recovered. Personal electronics contain valuable resources such as nickel, cobalt, cadmium, lead, zinc, manganese, silver, and mercury–but some of those metals and elements are hazardous if released into the environment and not properly recovered. **It's been estimated that while electronics account for only 2% of the waste stream in the U.S., they are responsible for a large portion of the overall toxic metals found in landfills.**[1] Further, if personal electronics and their rechargeable batteries aren't handled properly at the end of their useful lives, they can cause fires or explode in waste and recycling trucks, materials recovery facilities (MRFs), transfer stations, waste-to-energy plants, or landfills. Such incidents can harm workers and destroy property and equipment — it is creating a real crisis for the recycling industry.

Personal electronics and their rechargeable batteries must be managed safely and sustainably. Many people prefer and even expect a recycling solution for their end-of-life personal electronics and batteries instead of simple disposal.

This guide **provides communities with information to help implement an effective collection and management program** for those products and outlines steps to make it easy. This guide also offers tested best practices for educating and motivating the public to maximize recovery of their PEs and rechargeable batteries while keeping them out of the waste stream.

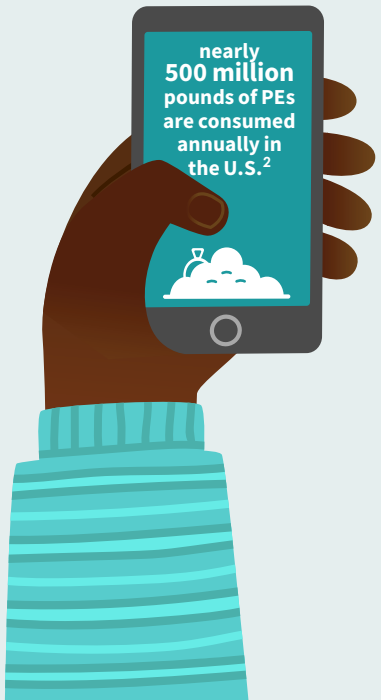
TIP

An important note for communities when talking about electronics: Don't use the terms "e-waste" or "e-cycle." Our tested best practices show the terms are too ambiguous for your average community member and people don't think of their electronics as waste – instead, use the terms listed here of "end-of-life personal electronics and batteries" or "personal electronics and batteries."

Personal electronics (PEs) and batteries have been traced to many fires at MRFs in the U.S. that provide critical processing services to community curbside recycling programs.

These incidents result in high costs and disruptions for MRFs, which then can have serious negative effects on the recycling programs they serve.

Communities are encouraged to take steps to develop and advertise PE and battery recycling options to their community to prevent MRF fires, as outlined in this document.



[1] https://www.nytimes.com/2018/07/05/magazine/e-waste-offers-an-economic-opportunity-as-well-as-toxicity.html

[2] https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/national-overview-facts-and-figures-materials

1 Reviewing the Collection Options

No two communities are exactly the same—with different populations, financial resources, personnel, expertise, technologies, and more—so there's no one-size-fits-all approach for recovering and managing PEs and their rechargeable batteries. Below are a few options for your community to consider. The options are presented in hierachical order, all of which provide safe recovery of PEs and batteries, and range downward from easiest to most difficult.

Regardless of the approach selected, it's important to establish a relationship with an electronics/battery recycling company in your area to handle your collected material, preferably one (or more) that is certified for managing PEs and batteries under the **R2**, **e-Stewards®** or **RIOS™** standards (see "Appendix B: Important Legislation, Regulations, and Certifications" on page 23).

Make sure to:

- Verify the company's certifications and references before forging an agreement and conduct due diligence—including consulting with other communities—to ensure each company responsibly manages its own vendors and downstream materials.
- Consider working with a waste management company that provides electronics-recycling services or establish your community as a collection partner with a battery stewardship program such as **Call2Recycle**, which provides a free rechargeable battery collection program for municipalities.
- Arrange for an on-site visit to determine current operating practices and environmental compliance—a look is worth a thousand words.
- Among other assistance, **Call2Recycle** offers a Bulk Shipment Bill of Lading Wizard on its website to help its collection partners generate a bill of lading for shipments to ensure they comply with U.S. Department of Transportation requirements.

And remember, though the options vary widely in terms of the demands they place on communities and those that use your programs, they have one common key element of success: public outreach and education.

TIP

The Recycling Partnership has assembled a list of current, as of spring 2020, **PE and battery collection approaches** from around the U.S. You may consider contacting one of these communities to learn more about how they started and run their program.

Evaluating Collection Program Options by Their Components

	Permanent Collection			Events	
	Curbside Collection*	Adding Batteries to HHW Site	Site for only Batteries & PEs	Drop-off Days/ Events	Curbside Days/Events
Convenience	★★★	★★	★★	★	★
Operational Cost	★★★	★	★★	★★	★★
Overhead Cost	★★	★	★★★	★★	★★
Requires Ongoing Communication*	★★★	★★	★★	★	★
Requires Education for Event Days/Times		★★	★★	★★★	★★★
Most Effective (Access & Volume/Units Collected)	★★★	★★	★★	★★	★

	Next Best Options		
	Retail Drop-off	Mail-in Options	Electronics and Battery Recyclers Drop-off
Convenience	★★★	★★	★
Lowest Staffing Support Required	★★	★	★★★
Affordability	★★★	★	★★
Requires Ongoing Communication	★★★	★★★	★★★
Most Effective (Access & Volume/Units Collected)	★★★	★	★★

KEY RATINGS:

Highest ★★★
Middle ★★
Least ★

** If your community has the resources to offer curbside battery collection programs, they are the best way for community members to manage end-of-life disposal. However, whether or not your community program offers such disposal, education is key to ensuring your community knows what to throw into the recycling cart or dispose at HHW locations.

Permanent Collection Programs

Curbside Collection Service

If your community has the resources to offer curbside battery collection programs, they are the most convenient way for the public to properly manage their end-of-life materials. In such programs, community members are instructed to place end-of-life batteries in a separate container, never in their curbside recycling, trash bin, or cart. The collection truck has a separate compartment for storing recovered batteries on its route. The community must educate the public on proper handling and preparation procedures for this method to work safely (see "Proper Handling & Preparation of PEs & Batteries for the Public" on page 19 and "Best Practices for Educating your Community" in Appendix E). To ensure safe collection, your community should consider reinforcing proper participation through noncompliance notices and rejections.

Community Collection Sites

If your community cannot safely offer a dedicated curbside collection program for batteries or wants to supplement curbside collection with additional options, it could establish one or more permanent collection sites where the public can drop off their materials.

Examples of permanent drop-off programs include:

Household Hazardous Waste and Expanded Recycling Facilities: Many communities offer one or more locations where the public can drop off their household hazardous waste (HHW) and/or hard-to-handle recycling materials (textiles, oil, etc.). Many have expanded those locations to include PEs and batteries among the accepted materials.

Operational Suggestions:

1. **Promotional Campaign:** Consider promoting the HHW facility though an education campaign to keep PEs and batteries out of the waste stream (see "Best Practices for Educating your Community" in Appendix E).
2. **Add PEs and batteries to HHW program:** If your community does provide HHW collection services either permanently or through events, but they do not currently accept PEs or batteries, consider asking your HHW service provider to price the addition of those materials.
3. **Schedule regular HHW collection days for PEs and batteries:** A variation on permanent HHW facilities is regular, periodic HHW collection days. If these are provided on a consistent basis and are well-advertised, they can provide a predictable option for PE and battery recycling.

Dedicated personal electronics/battery collection sites: Another option for your community is to establish dedicated permanent locations (see "Appendix D: Building Your Electronics Collection & Recovery Network" on page 27) specifically for collecting PEs and batteries. Ideally these sites should have regular, predictable, and advertised hours.

Regardless of the format of your battery and PE collection site, the following tips can help your efforts succeed:

1. **Make sure each collection site offers convenient access and easy-to-understand rules.** For instance, describe for the public how the process will go for them at the collection site. Also, anticipate that they can be confused by different battery types (see "Appendix A: Battery Types in Personal Electronics" on page 21), varying labels, types of waste, preparation requirements, and local rules, so offer a detailed list of materials and products that are accepted or prohibited (and why) along with an image of that material and post the list at the facility and on your community's website. Most importantly: Inform your community on how to prepare their PEs and batteries prior to bringing them to the site (see "Proper Handling & Preparation of PEs & Batteries for the Public" on page 19).
2. **Advertise each site's location and hours on your community's website** and through social media, earned media, public service announcements, nonprofit groups, and other agencies. Consider promoting the site though an education campaign to keep PEs and batteries out of the waste stream (see "Best Practices for Educating your Community" in Appendix E on page 30).
3. **Staff the collection sites with trained operators** who understand how to classify and receive materials for proper sorting, packing, and shipping (see "Training Staff" on page 15).
4. **Provide proper handling equipment and personal protective equipment** such as plastic or insulated tongs, gloves, and goggles.
5. **Install bagging stations for PEs** to ensure they are packaged with tape over batteries and in sealed storage bags as listed on page 17.
6. **Partner with local retailers** to prompt battery return at point of sale.

Collection Events

If you can't offer a permanent program, offer electronics/battery collection events like these:

1. **Electronics/battery recycling roundups:** In lieu of a permanent collection site, communities can offer periodic special recycling drop-off days for PEs and batteries. Many of the same principles and steps discussed above for permanent sites would apply to event-based collection, which will be less convenient for the public, but cheaper to operate. These events can be combined with other special material collection, such as document-shredding days, and they should be strongly supported by outreach, good planning, and adequate staffing. (Refer to "Appendix D: Building Your Electronics Collection & Recovery Network" on page 27 for questions to consider when organizing collection events.)

2. **At-home curbside collection special events:** Some communities partner with an electronics/battery recycler or waste management provider to offer at-home collection special events, which can be marketed as spring-cleaning days or one-day roundups of end-of-life electronics, bulky items, or HHW. For curbside battery-collection events, the public must be instructed how to both properly handle and prepare their batteries before setting them out in a container in front of their houses (see "Proper Handling & Preparation of PEs & Batteries for the Public" on page 19) and, equally importantly, how to notify the community that they have batteries to be collected. The collection is then completed by trained operators in trucks with appropriate storage (e.g., flatbed truck and barrels). Carefully plan such events and make sure they are advertised well in advance to be successful. If these collection events include multiple types of HHW—such as accelerants or combustibles—it's important to instruct program participants to completely separate their PEs and batteries from such fuel sources.

All special collection events can be promoted via an education campaign to keep PE and batteries out of the waste stream (see "Best Practices for Educating your Community" in Appendix E).

CASE STUDY

Seattle is one community that provides detailed "Special Item Collection" guidance on its website, covering the types of special materials eligible for collection (including sections on "Electronics and Small Appliances" and "Household Batteries"), preparation instructions, pickup costs, restrictions, and other information.

Next-Best Options

If you can't collect personal electronics and batteries, here are some next-best options. We realize communities face a number of limitations—budget, personnel, equipment, and more—that can prevent them from establishing collection programs for PEs and batteries. Fortunately, there are other options that the public can use to recycle their products. Communities can point the public to these options through education (such as posting information on the community recycling webpage or using social media platforms like NextDoor or Facebook). Even communities with collection programs should do this to give the public the full range of available services.

If your recycling program can't collect PEs and batteries itself, here are some of the most common options to consider:

1. **Drop-off bins at big-box retailers** such as **Target**, **IKEA**, and **Best Buy** for PE. Recycling programs for high-end PEs such as cellphones and laptops (and their batteries) sometimes can be found where those products are sold, with many of the locations certified for battery recycling through the **Call2Recycle** program. Call2Recycle offers a **store locator** of certified retail partners that participate in its rechargeable battery recovery program. The public can also access Call2Recycle's drop-off site locator by calling (877) 273-2925. Though Call2Recycle primarily sponsors battery collection sites, most member sites take more than batteries. **Earth911** offers another search option on battery recycling.

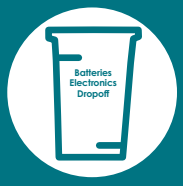
2. **Mail-in and/or pick-up service programs** through **TerraCycle**, **Waste Management**, **Republic Services**, and others, typically for a fee. Some electronics manufacturers and sellers such as **Amazon** and **Apple** offer in-store and online take-back programs as well. This can be an option for areas of the country that don't have ready access to a big box store or other retail options.

3. **Electronics and battery recycling companies,** preferably those that are certified under the R2, e-Stewards, or RIOS standard. Most electronics-recycling companies will accept computers and other PE devices and take them for free, offer a small rebate, or charge for them. Some large waste management providers also offer "recycle-at-home" services for a fee and include electronics. These services may be appropriate for people who do not have the mobility to recycle or dispose of these products properly.

Alternative recovery programs can be promoted though an education campaign to keep PE and batteries out of the waste stream (see "Best Practices for Educating your Community" in Appendix E).

CASE STUDY

Denver offers comprehensive information online on which materials can be recycled in the community, with links to guidance on recycling specialized material streams such as electronics, appliances, and potentially hazardous products such as rechargeable batteries.



Public Outreach & Education

In all instances, you'll need to provide public outreach and education. An informed public is the key to success of any community PE and rechargeable battery recovery program. That's why it's crucial to provide extensive and ongoing outreach and education. The reality is that most people don't know or are confused about the risks of tossing PEs into the garbage or recycling bin or cart, and that the types of devices and collection services change over time. They also aren't aware of where or how to store, handle, recycle, or dispose of those products properly. Many PEs bear the "chasing arrows" recycling symbol or have a recycling message, which can lead people to think they're doing the right thing by including those products in their recycling bin or cart. Regardless of the programs your community offers, taking the time to do something as simple as establishing a PE and battery page or section on your recycling website or including PE and battery information in your annual recycling mailer or calendar can help people better understand their recycling options.

Best Practice #1

The key message to the public should be what to do with their end-of-life PEs and batteries, and to NOT put them in the curbside recycling or trash. Also, instruct people not to store end-of-life PEs for long because they can degrade over time and pose fire or explosion risks. Instead, encourage them to dispose of those products properly as soon as possible in accordance with your community program.

Best Practice #2

Provide safe handling instructions (see "Educating Your Community" on page 16) and the steps people should follow for both of those options. It's especially important to describe the proper handling and preparation steps to prevent potential mishaps (see "Proper Handling & Preparation of PEs & Batteries for the Public" on page 19). Use images wherever possible to show people how to properly handle and prepare rather than telling them with words alone.

Best Practice #3

Advertise and continuously market your community's collection efforts or the available public options for properly disposing of PEs and their batteries. Again, the simplest way to do this is to include information on your community's recycling webpage. Research by The Recycling Partnership shows that the public turns to the community website more than any other source for recycling information. Also look for opportunities to prompt end-of-life disposal of PEs and batteries throughout the year by working with local retailers to provide reminders at the point of purchase.

Appendix E provides additional details, including best practices, public education assets that can be adopted to fit individual community programs, and the results of a community pilot to keep PE and batteries out of the recycling stream and prevent MRF fires.

Most Americans don't know that you can't discard electronics and batteries in their curbside trash and recycling. Follow the best practices to educate community members on how to properly dispose of end-of-life PEs and batteries.

Case Study: Chula Vista, CA

The Recycling Partnership deployed best practices as listed in this guide to raise awareness of what to do with end-of-life personal electronics (PEs) and batteries in Chula Vista, CA. Public outreach and education is essential to help citizens understand how to properly manage their end-of-life PEs and rechargeable batteries. Toward that end, The Recycling Partnership conducted an awareness campaign in Chula Vista, California, from late November 2020 through January 2021.

The campaign sought to inform Chula Vista residents about the fire and explosion hazards that PEs and batteries can pose when discarded in household trash and curbside recycling bins/carts. The campaign also provided information on safe disposal and recycling options, such as the local household hazardous waste (HHW) facility as well as retail drop-off and mail-in options through the Call2Recycle program. The Partnership disseminated this information using Chula Vista's website, social media posts, a press release, digital and bus ads, and a mailer.

To assess the campaign's effectiveness, The Partnership surveyed residents before and after the project about their knowledge of proper disposal methods for used PEs and batteries. The baseline survey showed a high level of proper disposal awareness among residents, with 71% saying they would take them to an HHW facility and 9% saying they would take them to a retail drop-off. Fourteen percent indicated that the products could be disposed in the recycling or trash stream. The post-campaign assessment showed an increase in the percentage of residents who understood the HHW drop-off option to 76% while the percentage who would discard those products in the trash or recycling stream declined from 14% to 9%.

Campaign Metrics

5.3M
Impressions of digital ads

15,128
Web visitors

161,568
Views on social

Assessing the media used in the campaign, residents had a high recollection of messaging —73%—of the mailer, which went to all single-family households (47,400) in Chula Vista. The other media elements—the city website, social media posts, digital ads, and bus ads—also were successful, with the digital ads receiving 5.3 million impressions, the city's two social media posts in December 2020 having a combined reach of 161,568, and the city's new battery webpage receiving 15,128 views.

Overall, residents who had seen messaging about what to do with used PEs and batteries nearly doubled from 29% in November 2020 to 53% in February 2021. Infrequent or non-recyclers were much more likely to recall the messaging through social media posts, digital ads, or bus ads than the frequent/always recyclers who recalled the mailer. Though the digital ads ran for almost two months, residents' recall of those ads was lower compared with the one-time mailer.

When asked what they remembered about the media messages, survey participants recalled seeing information about the location and hours of the local HHW facility (19%), the basic message that PEs and batteries require special handling and should not be discarded in the trash or recycling stream (17%), the words "spark" and/or "explode" (8%), and the caution that PEs and batteries can cause fires when discarded improperly (4%).

Overall, the campaign succeeded in raising Chula Vista residents' awareness of how to properly manage used PEs and batteries. In the end, almost three-quarters of those who remembered seeing an ad or mailing said they now know more about how to safely manage those end-of-life products.

Between December 2020 and February 2021, the City's household hazardous waste facility received two to three times batteries than the prior year. The facility continued to see significant increases in battery collection after the campaign concluded.

Case Study: Los Angeles County

In late 2021, The Recycling Partnership and Los Angeles County Public Works conducted a public awareness campaign on the proper disposal of batteries in two Los Angeles County neighborhoods—Florence-Firestone and East Compton. The campaign sought to educate residents on how to properly manage their end-of-life batteries by using designated collection sites rather than putting their batteries in waste or recycling bins.

Pre-campaign surveys were conducted to assess residents' baseline knowledge on battery disposal/recycling. The campaign then launched a multipronged media/promotion effort that included direct mail, social media, website/digital resources, billboards, and more. These efforts began with a 6-by-9-inch postcard mailed to all single-family households in the two target communities. The postcard informed residents that batteries in waste or recycling bins can spark or explode and encouraged them to dispose of those items properly at an HHW collection event or a library collection site. In particular, the campaign sited new battery-collection bins at one library in each target neighborhood, and the libraries made campaign-related bookmarks available to visitors. What's more, Los Angeles County gave away 100 mini battery-collection bins to residents at an HHW collection event in Compton in mid-October 2021.

Campaign Metrics

9,000
Web visitors

2.2M
Impressions of digital ads

The campaign's social media features included a static graphic ad and video that appeared on Facebook and Instagram. The video was viewed more on Instagram while the static graphic ad was seen more on Facebook.

The campaign also included digital ad features such as Google search ads in English and Spanish; geofenced mobile ads in the project areas in English and Spanish; a Redbox website digital banner; a YouTube video ad; and a KeyMe Kiosk video ad. These assets received 2.2 million impressions with higher-than-industry-average click-through rates. The campaign also ran ads on two billboards near the target libraries and displayed four posters in the vicinity of the libraries, including English and Spanish versions.

Los Angeles County included the awareness campaign design on its webpage that lists designated battery collection sites in the county. Los Angeles County Public Works also highlighted the battery campaign on its CleanLA webpage and included a link to the county's battery webpage. In addition, the campaign received exposure on the Los Angeles County Public Works and CleanLA Twitter accounts.

These combined media efforts boosted visits to the county's battery webpage during the campaign - from fewer than 100 views a day to 400 to 500 views a day and a total of 9,000 visits to the website during the campaign.

Post-campaign surveys were conducted to determine the effectiveness of the campaign. Among the positive results, more surveyed residents said they learned that they should take their batteries to a special drop-off location, including a local library. Regarding the media campaign, 31% of surveyed residents said they saw advertisements about what to do with used batteries—up from 21% in the pre-campaign survey. A high percentage of surveyed residents said they remembered seeing information on what to do with used batteries through the campaign's social media ad/video (29%) or the Los Angeles County website (19%). As for what the surveyed residents retained from the media they saw, 22% said they learned to drop off used batteries at a library or other specialized site/event while 19% said they learned that used batteries must be disposed of properly, not in their waste or recycling bins.

2 Funding Your Program

Collecting and managing PEs and their rechargeable batteries can be time-consuming and expensive, so consider the following potential cost-saving options:

- One way to minimize costs is to add PEs and batteries to your existing HHW program, if your community happens to offer that service.
- If that's not possible—or if your community doesn't collect HHW—check with your state and its funding mechanisms (including grant programs) for electronic-waste and battery collection programs, especially if your state has an extended producer responsibility program for those products. (Visit the **Call2Recycle** website for a map of states that have rechargeable battery recycling requirements.)
- Consider assessing your community members for proper disposal through solid waste funding mechanisms. Getting a fee in place now—while PE consumption is lower than projected in the future — will help ensure the future sustainability of your program.
- Explore options such as having your community become a collection partner with Call2Recycle, which offers no-cost advertising and education support for publicly accessible collection locations.

3 Recordkeeping & Data Evaluation

If your community has a PE and battery collection program of any kind, it's important to keep good records and data at the point of the collection activities.

That information can help you assess the program's success, identify inefficiencies and unnecessary expenses, comply with applicable local/state/federal rules, and more. Toward those ends, here are a few points to keep in mind:

- Retain PE and battery shipment manifests and other paperwork for at least three years.
- Track the weights by the type of device and the type of battery collected and reconcile with weights received from the processor.
- Know your collection/handling cost per pound by type of device and type of battery based on benchmarks and recycling service provider invoices.
- Set and adjust community member fees as needed to cover labor and recycling/disposal service costs.

4 Training Staff

At a minimum, collection staff must know how to do these tasks:

- ☐ Use proper handling and personal protective equipment such as plastic or insulated tongs, gloves, and goggles.
- ☐ Have clear signage, supplies, and staff to ensure the public handles PEs and batteries carefully during drop-off.
- ☐ Inspect inbound PEs and batteries for improper packing, damage, and general program acceptance.
- ☐ Identify types of PE (including battery types) and unit labels.
- ☐ Separate and sort inbound materials by type of PE and by market or disposal destination.
- ☐ Safely store collected materials using supplies such as buckets, drums, terminal tape, and labels.
- ☐ Separate PEs from harsh environments such as warm/hot climates, combustible materials, other wastes or materials, and metal objects.
- ☐ Label stored material by type and condition.
- ☐ Monitor inventory for smoldering and heat while minimizing the time materials remain in inventory.
- ☐ Isolate and contain damaged, defective, embedded, and improperly removed or hazardous batteries.
- ☐ Be prepared to respond to fires with appropriate procedures and equipment based on the specific characteristics of different PEs and batteries and local fire management procedures.
- ☐ Ship collected materials following protocols for each battery classification per local, state, and federal regulations and receiving-destination specifications.
- ☐ Update documents and training annually regarding fire management/response plans and emergency response plans.
- ☐ Dispose of nonrecyclable embedded or primary batteries according to HHW/Universal Waste procedures and/or have certified vendors on-call for proper disposal.
- ☐ Direct unacceptable materials to certified recycling/disposal companies.

While this list might seem intimidating and complex, properly trained staff can effectively and quickly come up to speed and be well-prepared to help communities operate PE and battery collection programs safely.

If your community operates collection sites or sponsors collection events, front-line staff must have the proper training and written rules on inbound and outbound procedures to conduct their tasks safely and efficiently.

Staff should receive U.S. Department of Transportation hazardous materials training as well as 40-hour HAZWOPER (Hazardous Waste Operations and Emergency Response) training to oversee operations. Employee safety at drop-off centers and special events is governed by OSHA Section 1910, Subparts H, I, J, K, L, N: **Training and Annual Refresher**. Programs should review these standards and provide training annually to ensure all workers know and adhere to these standards.

Whether or not your community opts to become a Call2Recycle Certified Collection Center, it can still use the organization's **basic training for collection programs**. In fact, the training is available to anyone. Call2Recycle also ensures compliance with individual state and federal regulations.

5 Educating Your Community

Educating the public and changing their behavior is critical to ensure that PEs and batteries are managed safely and sustainably. If people remember these seven points, your community is much more likely to successfully collect and recycle PEs and their rechargeable batteries.

1. There are numerous battery types, which can be confusing. You don't need to learn chemistry to be part of the solution.

Is it alkaline or rechargeable? If rechargeable, is it lithium-ion, nickel-cadmium, nickel-metal-hydride, or something else? (For help, see "Appendix A: Battery Types in Personal electronics" on page 21.) Complicating the picture, rechargeable batteries are more critical to dispose of properly given their potentially hazardous constituents and their ability to retain power and voltage even after they lose their ability to power a device. Those types include rechargeable batteries (also called "secondary" batteries) such as lithium-ion, nickel-cadmium, nickel-metal-hydride, nickel-zinc, small sealed lead-acid, handheld tool batteries, lawn equipment batteries, and automotive lead-acid batteries. Other battery types—such as "primary" (one-time use) lithium batteries—are less recyclable but ideally should be brought to HHW sites, when possible, for potential recovery. Keeping the message focused on battery recovery outside the waste stream makes communication and participation easier. Recently, industry organizations Institute of Scrap Recycling Industries, National Waste & Recycling Association, and the Solid Waste Association of North America, completed a guidance on the different types of batteries and best management practices for their disposal. See this new report **here**.

2. Keep the message simple: Batteries can spark or explode. They don't belong in trash or recycling.

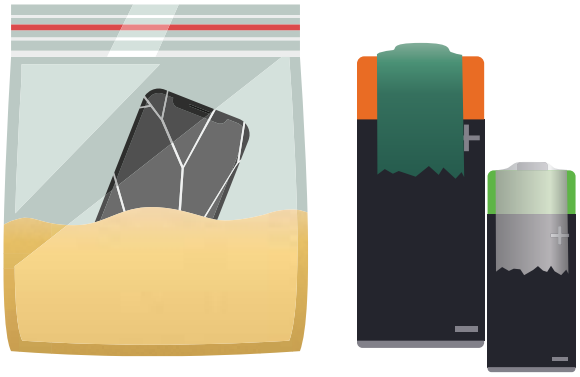
PEs and batteries can be damaged easily when mixed with other materials, compressed, punctured, dumped, or covered, which could result in fires or explosions. Based on recent message testing, the phrase "spark and explode" is more effective than messaging around "don't put batteries in the trash or recycling."

3. Don't store end-of-life personal electronics or batteries for a long time.

During storage, those products can degrade, increasing their risk of starting a fire or exploding. Instead, encourage community members to properly discard PEs and batteries as soon as possible after the products, or their removable batteries, become worn out.

4. Never remove embedded or built-in rechargeable batteries.

Some rechargeable batteries aren't designed or intended to be removed. If a battery doesn't come out easily, the public should leave the battery alone and recycle the whole device.



5. Tape and bag each battery.

To prevent sparking and ignition, residents should tape the terminals, or the place where the battery connects with the electronic, on all rechargeable batteries and put each one in a separate clear plastic bag that is sealed. This "turning off" procedure prevents battery terminals from touching each other and posing a fire or explosion risk. **For multi-part, multi-battery devices, like portable ear pods or devices with portable charging units, a separate bag would be used for each part that has its own battery.**

6. Give damaged batteries special treatment.

Damaged or defective batteries—those that are deformed, hot to the touch, or bearing burn marks—can be especially dangerous. There are risks to storing and transporting damaged batteries. Consider providing links to the Consumer Product Safety Commission to check for recalls on the battery and provide information online to clarify if damaged batteries are accepted at collection locations or advice on next steps. Damaged or defective batteries should be placed in a container with sand or kitty litter until they can be transported to a collection location. They should not be placed in the trash or recycling for any reason. **Call2Recycle** has details on handling damaged and defective batteries.

7. Don't get overwhelmed—there are recovery/disposal options.

Your community may feel confused about how to properly dispose of their end-of-life PEs and rechargeable batteries, but you can help them understand the available options available in your community and provide a simple and supporting education message. See Appendix E for sample messaging. You can outline the options on your community's website, through printed/mailed pieces, at public meetings, through a toll-free information line, though social media, and other ways.

TIP

Print out the poster on the subsequent page for facts that your community should know for safe disposal of PEs and batteries.

Did You Know: Batteries and Electronics Can Spark and Explode?

Facts About Disposal of Batteries and Personal Electronics

1. There are numerous battery types, which can be confusing. You don't need to learn chemistry to be part of the solution.

2. Don't discard your end-of-life personal electronics and batteries in the trash or recycling.

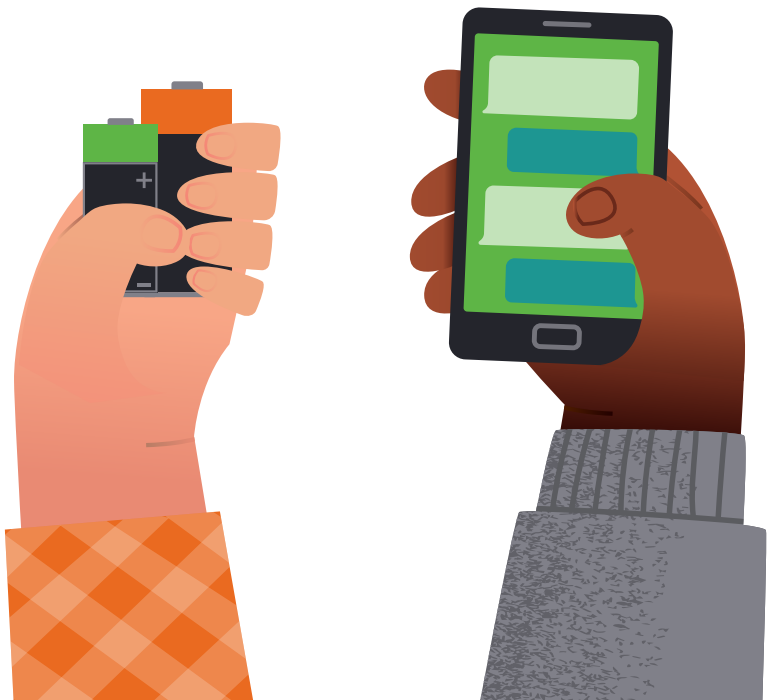
3. Don't store end-of-life personal electronics or batteries for a long time. During storage, those products can degrade, increasing their risk of starting a fire.

4. Never remove embedded or built-in rechargeable batteries. If a battery doesn't come out easily, leave the battery alone and recycle the whole device.

5. To prevent sparking and ignition, residents should tape the terminals, or the place where the battery connects with the electronic, and put each battery in a separate clear plastic bag.

6. Damaged or defective batteries should be placed in a container with sand or kitty litter until they can be transported to a collection location – they should not be placed in the trash or recycling for any reason.

7. There are recovery or disposal options. Look online to see what your options are for disposal.



6 Proper Handling and Preparation of PEs & Batteries for the Public

Rechargeable batteries, including those in PEs, are never fully discharged, even when no longer working. They retain sufficient energy that can cause extremely hot thermal reactions or electrical shorts if terminals The following information can be used with the public to minimize the risks when recycling or disposing of these products.

- When removable PE batteries no longer work, isolate each battery and tape all ends of batteries with duct tape or other nonconductive tape to prevent them from touching other battery terminals. Do not cover the battery brand name or battery chemistry label.
- Put batteries in clear plastic bags, inserting only one battery (or cellphone with battery) per bag.
- Place taped and bagged batteries and small electronics into a cardboard box or plastic bucket until you can recycle or dispose of them.
- If batteries are embedded or not easily removable from the PE, place the entire device (if possible) in a bag for recycling or disposal.
- Damaged batteries should be placed immediately in an absorbent, nonflammable material such as kitty litter, sand, or granulated crystalline glass. If the materials start to smoke or combust, call 911. Such batteries require special shipping and handling requirements, so consult your local or state authorities, **Call2Recycle**, or certified electronics/battery recyclers for guidance.
- Batteries should be placed in a cool, dry area away from potential heat sources, flammable materials, and metals. Keep stored batteries out of reach of children because they can be toxic if ingested or exposed. NOTE: Stored batteries can degrade, making them more dangerous, so bring them to a collection/disposal center as soon as possible.
- Properly dispose of end-of-life collected PEs and batteries through community collection sites/ programs, retail drop-offs, mail-in recovery programs, or electronics/battery recycling companies.

Introduction to Appendices

This guide provides best practices for public education and outreach as well as setting up programs for properly disposing of end-of-life personal electronics and batteries. Research was completed to determine what is working and what is not working in similar programs throughout the country and listed here for easy reference.

The Appendices have additional information about types of batteries, education, regulations, best practices, and collection events. The accompanying kit is meant to be used in conjunction with events and the other best practices to get the word out to your community about the best way to dispose of end-of-life personal electronics and batteries.

Remember, staff education, public information and outreach, and safety above all are key for proper disposal of end-of-life personal electronics and batteries.

Have any questions, ideas, or want to share best practices? Email us at info@recyclingpartnership.org.

Appendix A

Battery Types in Personal Electronics

Personal electronics draw their power from a variety of rechargeable batteries, most of which contain one or more of the following eight metals: cadmium, lead, zinc, manganese, nickel, silver, mercury, and lithium. While this information is important for collection programs to know and understand, remember that *you don't need residents to learn chemistry to be part of the solution*. Keeping the public message focused on battery recovery outside the waste stream makes communication and participation easier.

Here are descriptions of four of the most common types of batteries used in PEs.

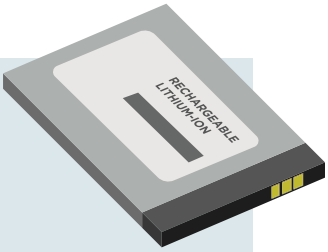
Lithium Primary (Single-Use)

What is it?
Lithium primary batteries are an EPA-designated **Universal Waste** which can be hazardous and are potentially reactive if not completely discharged.

Where is it most commonly found?
Single-use lithium batteries are becoming more prevalent in everyday electronic devices in the form of button-cell batteries commonly used in hearing aids, medical devices, watches, calculators, and cameras. They also are used in "wireless" devices such as portable car battery chargers and vapes as well as disposable devices like greeting card recorders and miniature plastic fans.

Additional Details
Lithium primary batteries now compete with alkaline single-use batteries because of their long life and multiple sizes/formats (A to AAAA and 9V). The batteries and/or their packaging are labeled as lithium batteries with a recycling chasing arrows symbol, but they resemble alkaline batteries, so most residents discard them in the trash. Programs should include these batteries in their collection efforts, but they should be separated from rechargeable recyclable batteries.

Lithium-Ion (LI) Secondary (Rechargeable)



What is it?
LI secondary batteries—typically found in cellphones, portable music players, tablets, and laptop computers—are the most common rechargeable battery used in PEs because they are extremely light and high in energy density.

Additional Details
A chemical reaction releases the battery energy in a controlled fashion; however, if the separation between the positive and negative charges is breached, the chemical reaction speeds up uncontrollably, causing runaway heat, fires, and sometimes explosions.

Nickel-Cadmium (Ni-Cd)

What is it?
The Ni-Cd battery is an older and specialty-type rechargeable battery, sustaining temperatures down to -20°C.

Additional Details
They can build up pressure, overheat, and occasionally catch fire from shorting out and should be treated like LI batteries in preparation. Though they contain cadmium (a known human toxin), Ni-Cd batteries are recyclable for their nickel and cadmium content. LI batteries have largely replaced Ni-Cd batteries because they offer higher power and a longer useful life and generally aren't considered as toxic.

Nickel-Metal-Hydride (NiMH)

What is it?
Compared with rechargeable Ni-Cd batteries, NiMH batteries have a higher energy density, but problems with charging and useful life have made these rechargeable batteries increasingly less popular.

Additional Details
NiMH batteries, which contain nickel, are recyclable and should be part of your PE/battery collection program and prepared like LI batteries. These batteries can overheat, short out, and catch fire, but neither Ni-Cd nor NiMH are as reactive as LI batteries.

Items That Must Be Treated as Hazardous or Special Waste

Some PEs and batteries require special handling. If a device can only be used once or if its battery is embedded, it should be sorted, segregated, and managed as special or Universal Waste by a licensed service provider. Locations that accept PEs or HHW may or may not accept these materials. Since the batteries in these devices can cause fires or explode, communities should accept and store these devices for proper disposal and make sure they do not get into the solid waste or recycling streams.

Below is a short list of products that require special handling.

- **Lithium primary single-use batteries.**
- **Greeting card recorders.**
- **Electronic cigarettes/vapes.** If nicotine or marijuana is in these products, they may be considered a controlled substance in some states and cannot be accepted.
- **Portable devices with embedded batteries**, including cordless toothbrushes; small, low-power hand tools; cordless headphones; fitness bands; heart monitors (some hospitals collect these in larger quantities for recycling, but batteries are left intact); and glucose monitors (some batteries can be removed).

Appendix B

Important Legislation, Regulations, & Certifications

Community program managers should know the laws and regulations governing PEs in addition to federal workplace, transportation, and environmental regulations.

Federal Laws

In the U.S., the federal Mercury-Containing and Rechargeable Battery Management Act requires, with certain exceptions, used nickel-cadmium and lead batteries (including lead-acid automotive batteries) to be managed as Universal Waste (40 CFR Part 273).

The **Universal Waste Rule** prohibits handlers (such as waste and special/universal service providers, e-recyclers and community recyclers) from disposing of waste nickel-cadmium and lead batteries and further directs that these batteries must be sent for recycling.

Household alkaline batteries no longer contain mercury, are exempt from the Universal Waste Rule, and may be safely discarded in household solid waste when local programs do not collect them for recycling.

Extended Producer Responsibility Laws

Extended producer responsibility (EPR) laws in some states generally require manufacturers to establish and finance the collection of specified products—such as rechargeable batteries—for recycling or safe disposal at the end of their useful life. Under some of these laws, retailers that sell PEs and batteries are required to take them back.

Vermont is the only state whose EPR program also includes primary, single-use batteries.

(See the Call2Recycle's **map of states** with battery recycling laws.)

Other states only have laws and collection systems for recycling lead-acid or small sealed lead-acid batteries that mirror federal laws, like the **Battery Act**.

Certifications for Operators

Offering PE and battery collection and management programs can be expensive, and doing it without expert guidance could lead to accidents and injuries. That's why it can make sense to work with established electronics/battery recycling companies. If you go this route, your due diligence can include vetting companies based on whether they're certified to industry-specific standards such as the following:

- **R2 (Responsible Recycling) or R2:2013:** The R2 standards, administered by Sustainable Electronics Recycling International, cover environmental and worker health and safety in the electronics refurbishing and recycling industry. Visit **sustainableelectronics.org** for a list of R2-certified recyclers by location, accepted materials, services, and more.

- **e-Stewards®:** The e-Stewards initiative, created by Basel Action Network, defines and promotes responsible electronics reuse and recycling best practices and conforms with all international and local e-waste laws, the group says. Visit **e-stewards.org** to search certified operators by location, services, and keyword.

- **RIOS™:** The Recycling Industry Operating Standard (RIOS) is an integrated quality, environmental, health, and safety management system certification that is designed for recyclers of all types of materials. Visit **rioscertification.org** for more information on the standard or to search for RIOS-certified recycling companies.

- **Certified Call2Recycle Collection Centers:** Many companies, organizations and other entities are Certified Call2Recycle Collection Centers or collection partners. Visit **call2recycle.org/locator** to search for drop-off or shipping locations.

- **Department of Transportation Special Permit:** A special permit authorizes the operator to use 1) specific boxes to transport certain batteries for recycling or disposal, or 2) specialized United Nations tested and certified packaging for the transport in commerce of damaged, defective, and/or recalled lithium-ion or lithium-metal batteries and provides alternative requirements for hazardous materials training and container battery limitations.

TIP

Liability insurance, which includes general liability and pollution legal liability, is required for collection and processing facilities and approved transporters using Call2Recycle or other recycling partners. This insurance provides coverage for pollution claims filed against Call2Recycle collection and processing facilities and approved transporters.

Appendix C

Best Practice Checklists for Collection Centers & Take-Back Event

How to Prepare, Handle, & Accumulate Personal Electronics & Batteries

- ☐ Proper personal protective equipment available and worn at all times (for example, gloves, safety glasses, fire-retardant clothing, and footwear that meets or exceeds ASTM F2413).
- ☐ Devices collected in a monitored location such as transfer stations, municipal public works offices, or town halls.
- ☐ Dedicated storage areas provided for PEs, batteries, and other materials. Include signage and identification/demarcation of areas.
- ☐ Crowd-control barriers and signage in good working order.
- ☐ Collection containers available to the public are separate from dedicated containers for shipping.
- ☐ Operator accepts only eligible batteries for shipping by category and packs them carefully.
- ☐ Devices are placed in individual plastic bags with terminals taped before being stored with other batteries.
- ☐ PEs are separated by type in closed, rigid containers (see shipping checklist below).
- ☐ Batteries are placed in a cool, dry area away from flammable materials.
- ☐ Battery collection containers are kept closed, out of the weather, and clearly labeled with the date that any Universal Waste was placed in the container, facility name and address, and any of the following phrases: "Universal Waste" or "Used Batteries" followed by type of battery such as lithium-ion (LI), nickel-cadmium (Ni-Cd), nickel-metal-hydride (NiMH), and so on.
- ☐ Leaking and damaged batteries are stored in structurally sound, closed containers. Refer to **Universal Waste Rule** for more information on business, transfer station, and collection center requirements.
- ☐ Adequate packing materials are available.
- ☐ Fire mitigation supplies and station are available: welding gloves, tongs, water, or other appropriate fire suppressants (e.g., sand, vermiculite, etc. if applicable), and metal drums. Store collected materials away from fuel sources.

How to Prepare Personal Electronics & Used Batteries for Compliant Shipping

How to Package the Items

Inner Packaging for all PEs (excluding alkaline, unless over 9V)

- ☐ Use **tape and/or plastic bags** to completely isolate each device or battery to prevent terminal contacts and sparks.
- ☐ Use **cushioning material** that is electrically nonconductive and nonreactive such as bubble wrap or packaging peanuts to prevent movement as needed under standard transport conditions.

Outer Packaging

Smaller Items: Use rigid, sturdy containers such as a **plastic drum** or **enforced cardboard box** to protect from impact or handling at transport facilities (container must meet strength requirements from a four-foot drop). Do not use flexible packaging or padded envelopes (see www.phmsa.dot.gov/lithiumbatteries)

Medium Items - over 300Wh (lithium-ion) or 25 g (lithium-metal) or packages over 66 pounds gross weight. Rail car/vessel meets **R2 United Nations (U.N.) specification**. To specifically contain lithium batteries, packaging protocols must follow instructions exactly, which certify that packaging has gone through U.N. testing and certification.

Larger Items (over 26.5 pounds)

- ☐ Use of strong, impact-resistant outer casing.
- ☐ Obtain special approval to transport via cargo aircraft.

How to Label/Mark What Is In the Package

Package (container) markings

- ☐ Facility (shipper) name and address.
- ☐ Specify contents as "Universal Waste" or "Used Batteries" followed by battery type.
- ☐ Date of accumulation start.

Transporter markings

- ☐ Proper placards on transport vehicle.

Shipping papers

- ☐ Handler/shipper name and address.
- ☐ Carrier/receiver name and address.
- ☐ Details for first responders.
- ☐ Shipment contents—quantity of each type.
- ☐ Date of shipment.
- ☐ Signatures of shipper and receiver.

All must be in accordance with the applicable U.S. Department of Transportation regulations.

Click below for additional carrier information.

UPS

Fedex

Appendix D

Assessing Your Electronics Collection & Recovery Network

Program managers should consider what collection systems are already in place for the most PEs to be successfully collected and recovered or disposed properly. Maximizing the private system, provided it measures up to the service, environmental, and recycling standards required for inclusion into your program, can reduce costs of supplying personal electronics collection and multiply access for residents and businesses to recycle. The ability to evaluate their effectiveness and measure their productivity can optimize your options. This assessment table can help. How does your community stack up?

Retail Store & Box Store Collection Centers

(in-store self-service & guided collection)

Infrastucture	Public Service Level	Program Design	Education and Training	Evaluation
What devices are accepted? Are containers available/visible? Do users have to pay a fee? Is it convenient? Are hours and container locations posted?	Self-service or are customers escorted through the process? Staffed with trained personnel?	Who operates the collection? Who advertises the program? Are stores on a published list? Your website/ national phone number? Uses a certified recycler?	Is advertising or consumer education available? Is staff provided training and consumer educational material? By whom, recycler? Store? Do consumers know materials accepted and how to prepare?	Is number of units and weights (by type device and battery) collected and recycled available for reporting to municipality? Can sites provide customer counts? What are the frequency and number of citizens utilizing site?

Dropoff Center or Collection Event

(transfer station, convenience centers, municipal public works office, town hall, retail centers, landfill, parks, stadiums, schools, public works)

Set Up and Infrastuture	Service Level Contamination/ Risks	Program Design	Education and Training	Evaluation
What devices are accepted? Supplies needed? Trailers, boxes, pallets, roll-offs, traffic cones, forklift, locked area? Is the site adequate for traffic? Access, buy/lease, or permission to use property? Is an investment required? Regulatory approval required? Are containers and recycling service already in place? Convenient location? Do users have to pay a fee? Hours and locations sufficient?	Is the location staffed with trained personnel? Is there security and monitoring to minimize risk & contamination? Who provides? Bagging station? Are devices bagged and arethe ends of batteries taped? Materials properly sorted and stored? Is there a risk of reaction/fire? Fire response plan? Staff trained in mitigation?	Who operates the center? Is there an agreement with a certified recycler with specifications, containers, and service frequency in place? Who provides container(s)? Your agency? HHW operator? Is the program consistent throughout the city/county? What are the service provider and program costs? Funded? Does the program have third-party certifications?	Consumer education and program advertising funded? Do consumers know materials accepted and how to prepare? Appropriate signage and consumer instructions? Bagging stations? Does the your agenc /HHW operator/ recycler provide: Staff training, proper container labels, consumer educational material?	Is number of units & weights (by type device & battery) collected and recycled available for reporting to municipality? Can sites provide customer counts? What are the frequency and number of citizens utilizing site?

Home/Small Business Collection Boxes and Mail-back Programs

Set Up and Infrastucture	Service Level Contamination/ Risks	Program Design	Education and Training	Evaluation
Is an investment required? How will consumer education and program advertising be executed?	How will consumers be educated on risk associated with storing, taping, bagging, and final prep?	Is there an agreement with a certified recycler with specifications, containers, and service frequency in place? Advertise services on your websites?	Does the your agency/HHW operator/recycler provide?	Certified program? Customer Counts - Can provide frequency and number of customers utilizing site?

Appendix E

Best Practices for Educating Your Community

Easy-to-Implement Messaging Assets

The materials provided are not intended to replace any existing education campaigns, but rather to supplement and enhance them. Messaging focuses on no batteries or small electronics in recycling and therefore, where to bring these items after they are finished. Below is a list of the assets in the **online toolkit** that can be customized and used in your community to help keep batteries and small electronics out of curbside recycling containers:

- 15 sec No Batteries video
- Digital Ads
- Social Posts - images and text
- Template Yes/No Mailers
- Templated Cart Tag
- Templated Bill Stuffer

Campaign Deliverables

The materials within the **online toolkit** have been designed so that communities of any size can utilize them. Included are materials for social media, videos, and print collateral. A community should assess which materials will be of greatest use within their communities based on previous successes and staffing expertise. Communities are welcome to use all of the materials, or to select the ones that work best for them. In order to support communities in the successful implementation of this campaign, the following recommendations outline preparation and implementation.

Campaign Preparation

There are several steps that communities can take to prepare for the launch of the campaign. These steps include: informing and equipping stakeholders, updating website information, and securing ad space or printers.

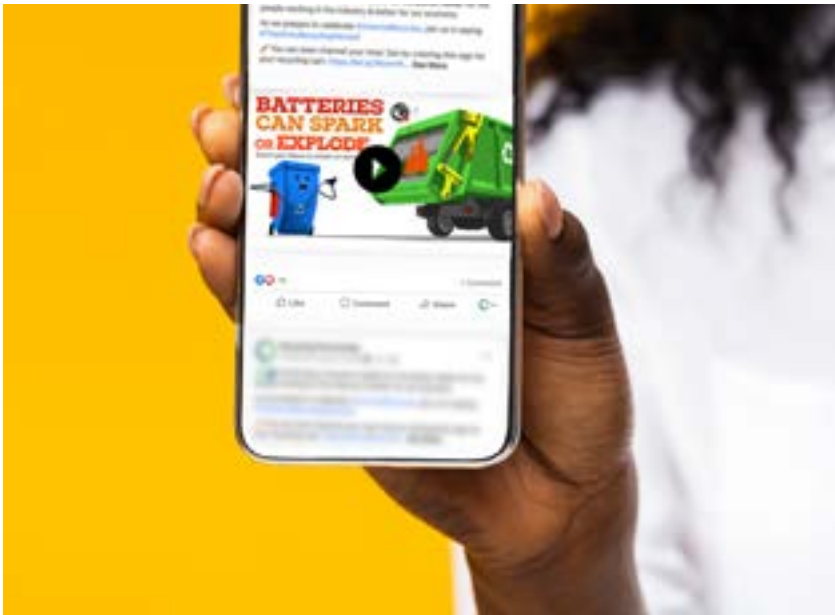
Follow The Recycling Partnership social feeds:

Twitter

Facebook

Instagram

LinkedIn



Inform & Equip Stakeholders

Keeping your external and internal stakeholders informed of the campaign before its release is a great way to build ambassadors and community buy-in. Each community will have their own external and internal stakeholders to inform about the campaign. Communities should think through their internal and external stakeholders that may have an interest in or be impacted by this campaign. Below is a list of potential stakeholders:

External

- Neighborhood Associations
- Local Nonprofits or Citizen Engagement Groups
- Recycle Application Provider (e.g., ReCollect, RecycleCoach) Neighboring Communities (not already involved in the campaign)

Internal

- All Municipal Staff (employee newsletters are a great way to do this!)
- Customer Service or Call Center
- IT Departments
- Local Officials

A document to support informing Stakeholders can be found in the **online toolkit**. This document includes all of the high-level information needed to inform stakeholders about the campaign.

Audit and Update Your Website and App Information as Needed

In preparation for the launch of this campaign, update your recycling webpage with up-to-date information about disposal sites for batteries and small electronics as well as the main "no" messages. This landing page will need to be added to all of the assets. In order to prepare for the potential additional traffic, member communities should ensure their webpages are up-to-date and as user-friendly as possible.

Recommended webpage updates:

- Remove any outdated or unnecessary content.
- As needed, include a link or tab that takes users directly to the recycling page from the homepage.
- Use prominent visuals of your accepted materials on the page.
- Downloadable PDFs are great, but they should not be the only location for the accepted materials list.
- If a recycle search bar or application is available, place it at the top of the page.
- Make sure all information on your webpage is consistent across materials and pages.
- Include asset images in slide shows or other locations.

Informing your IT Department of the campaign in advance will help them prepare for potential edits they will need to make, help you track the traffic on your webpages, and alert them that there should be an increase in traffic to your webpage.

Secure Ad Space and Printers

Securing ad space in local papers or publications requires advance notification. We recommend exploring local publication options and determining the necessary lead times needed to secure space. Large print job require advance notification and we recommend a proof for all jobs. New vendor setup can also extend lead time.

Metrics/Measurement

Capturing metrics from the campaign is key to understanding the campaign's success and developing best management practices. Metrics can be captured for both the reach of communications and quantitative changes in the recycling stream. Communications metrics are often measured by reach or interaction and should be included with any form of paid advertising or social media post. Member communities can utilize several tools and tactics to capture these metrics.

Recommendations for capturing communication metrics:

- Coordinate with your IT Department or utilize Google Analytics to measure webpage and app traffic.
- Set a schedule to review your social media insights and create a tracking method for them.
- Continuously check-in with ad providers for a metrics report.

Recycling stream metrics includes quantitative measurements of the types of material, including contamination, that is in your recycling stream and is generally done by weight. There are several tools and tactics that member communities can utilize to collect follow-up metrics.

Recommendations for capturing recycling stream metrics:

- Utilize the MRF survey available in the Online Toolkit to get a qualitative understanding of your contamination if quantitative numbers are not available.
- Use the MRF survey in the Online Toolkit for follow-up as well.
- Track your data and metrics using the free **Municipal Measurement Program** Tool.

Appendix F

Testing Awareness and Messaging in Southern California

Following The Recycling Partnership's 2019 West Coast Contamination Initiative Research, we identified batteries as a top issue of concern for MRFs in California.[3] In 2020, California's Statewide Commission on Recycling Markets and Curbside Recycling submitted its policy recommendations to CalRecycle and the state legislature. Their first recommendation was to focus on policies to reduce "risk of fire and other hazards in discarded materials and associated risks to workers and communities," citing major fires that not only have disrupted the operation of waste and recycling collection and processing but also have posed dangers to nearby communities, natural resources, and the future of the industry to ensure its facilities.[2]

Fires caused by lithium-ion batteries in trash and recycling collection trucks, sorting facilities, and processing facilities are growing. California's Statewide Commission on Recycling Markets and Curbside Recycling estimates that more than 1,800 waste and recycling facilities, or more than 40% of such facilities in North America, experienced fires annually in recent years.[4] With more than 5.5 billion lithium-ion battery cells manufactured worldwide per year as estimated by the Portable Rechargeable Battery Association[5], this problem will persist without intervention at all parts of the system.

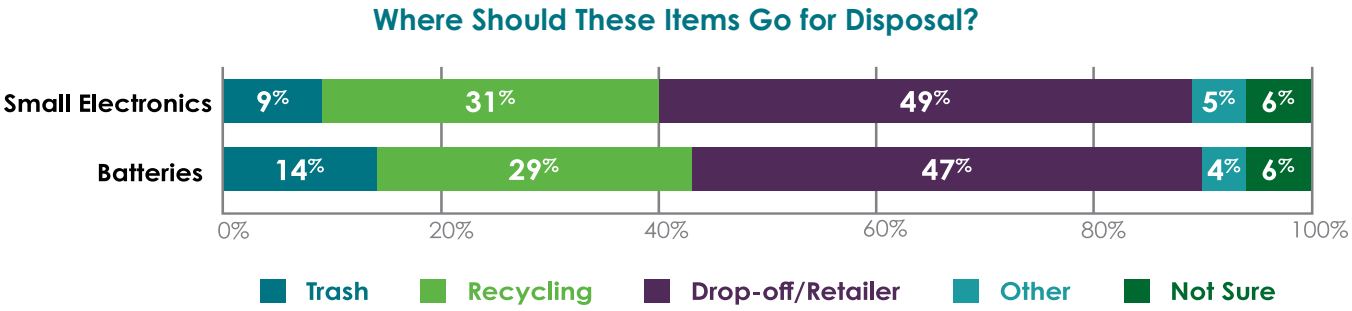
[3] The Recycling Partnership. 2020. 2019 West Coast Contamination Initiative Research Report. April. https://recyclingpartnership.org/download/30718/

[4] California Statewide Commission on Recycling Markets and Curbside Recycling. 2020. Policy Recommendations. December 21. https://www2.calrecycle.ca.gov/Docs/Web/118611

[5] Colin Staub. 2020. Handle with care. Resource Recycling. May 14. https://resource-recycling.com/recycling/2020/05/14/handle-with-care/

Household Behavior Regarding the Disposal of Batteries and Personal Electronics

A survey of 1,600 residents in California, Oregon, and Washington conducted for The Recycling Partnership's West Coast Contamination Initiative in 2019 revealed that 45% of survey participants put batteries in their recycling or trash carts.[6] A year later, in a survey of 1,236 Southern California residents, almost half thought that batteries and personal electronics should be discarded in recycling or trash or were not sure, even though 69% of the survey respondents recognized that batteries can cause fires when not disposed of properly. Those results drive home the need to reinforce awareness that end-of-life personal electronics and batteries can cause fires and inform residents how to handle them differently than other trash or recyclables.



The Recycling Partnership Batteries and Personal Electronic Online Survey, 2020, Southern California, (1,236 survey respondents)

To dig deeper into people's understanding and behavior about proper disposal of batteries and personal electronics and what messaging may be most effective, The Recycling Partnership assessed in the same 2020 survey of Southern California residents:

- Their knowledge of different battery types;
- Whether they already take materials to a household hazardous waste (HHW) drop-off site or a retail drop-off location;
- What they do specifically with used batteries and personal electronics; and
- The videos, images, and messages they found most motivating and that best described the call to action on proper handling of used personal electronics and batteries.

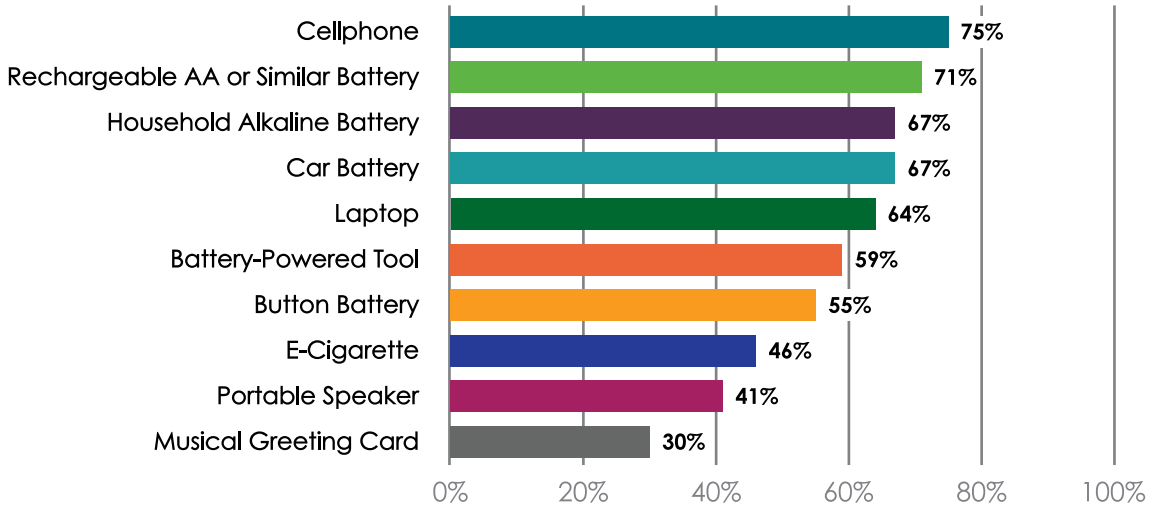
This survey was conducted online in English and Spanish.

[6] The Recycling Partnership. 2020. 2019 West Coast Contamination Initiative Research Report. April. https://recyclingpartnership.org/download/30718/

Understanding of Different Types of Batteries and Personal Electronics

Most people (61%) claimed that they know the difference between alkaline and lithium-ion batteries. Although it is comforting to know that many can distinguish between those two major battery types, there are many other battery types that can look similar causing confusion about which type of battery can be disposed where. There are also many different products that contain batteries. A quarter of the survey respondents did not respond that they would handle cellphones and rechargeable batteries differently even after seeing the message that batteries can cause fires. Awareness of other items that contain batteries and therefore require special handling drops off dramatically from laptops (64%) and battery-powered tools (59%) to e-cigarettes (46%), and musical greeting cards (30%).

Do These Items Require Special Handling?



The Recycling Partnership Batteries and Personal Electronic Online Survey, 2020, Southern California, (1,236 survey respondents)

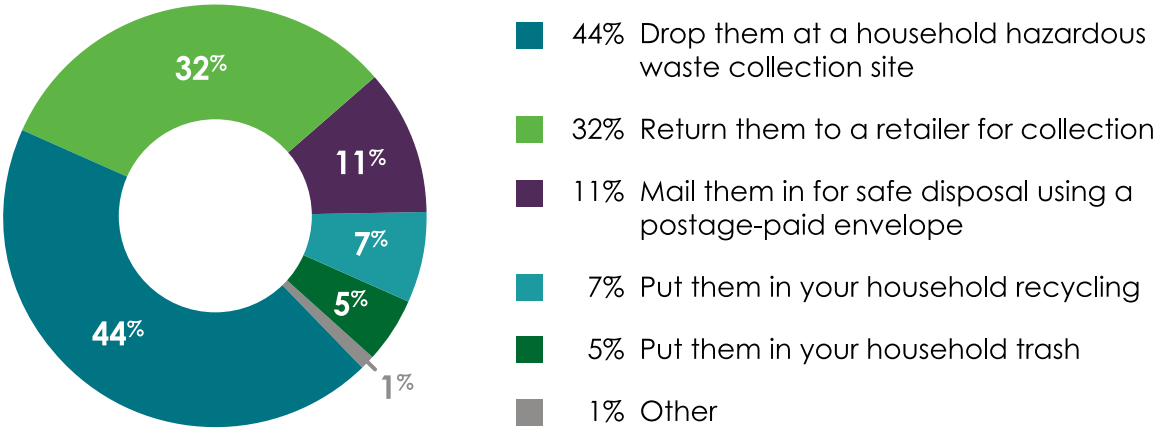
Existing Drop-off Site Use and Disposal Behavior

Of the survey respondents, 61% reported using HHW drop-off sites and 45% said they take items to drop-off locations at retailers. Of those people who use the HHW sites, more than one-third said they take batteries and personal electronics to those facilities and the total percentage rises to almost one half when you add the number of drop-off visitors who said they take electronics to other drop-off sites such as retail locations. It should be noted that the electronics reported to be returned may include both small personal electronics and larger items such as computers and TVs. A quarter of the retail drop-off users said they use retailers' collection services for electronics.

When asked specifically about what they do with used batteries or rechargeable electronics, about one-quarter said they would take those items to an HHW facility or to a special collection site or event hosted by their local jurisdiction. Using a retail drop-off site or reusing/reselling the item also were popular alternatives for personal electronics; but for used batteries, survey respondents would discard them in the trash at the same level as they would take them to an HHW facility. Many also used the word "recycle," but it is not clear whether they meant the curbside recycling container or a location that would handle batteries and rechargeable devices separately from common household recycling.

At the end of the survey, after participants were shown advertisements and test messages that spoke about batteries causing fires, more than three-quarters said they would most likely drop off used batteries and rechargeable devices at an HHW facility or return them to a retailer for collection. One-tenth of them said they would mail them in for safe disposal using a prepaid-postage envelope if that option were available to them. Still, 12% said they would put the items in their household trash or recycling container.

Knowing that batteries can cause fires, what are you most likely to do with used batteries and rechargeable devices if these options were available to you?



The Recycling Partnership Batteries and Personal Electronic Online Survey, 2020, Southern California, (1,236 survey respondents)

Terminology

Now that we've looked at people's knowledge and behavior, how can we best talk about the issue?

Phrases for where used batteries should be taken

- "Drop off for hazardous waste disposal" (59%)
- "Safe battery return" (50%)
- "Drop off for special collection" (46%)
- "Return to the retailer" (39%)
- "Take back to the store" (33%)

Other phrases

- A quarter of the participants liked the words "e-cycle" and "recycle," but these terms can imply curbside recycling, so programs should be wary of their use.
- To describe different types of batteries, tablets, and cellphones, participants chose the terms "personal electronics," "rechargeable devices," and "small electronics."

Several options of videos, images, and phrases also were tested to determine the most effective messages.

Participants preferred messaging that contained the words "spark or explode."

- When messages were tested independent of images, "batteries can spark or explode" again jumped out as the most motivating. Lower scoring messaging included the phrases "batteries can cause fires", "battery fires can be avoided," "the power is in your hands," and "safely dispose of batteries".
- A poster featuring an image of a fire in a recycling collection truck with the message "batteries can spark or explode" was the most motivating.
- When messages were tested independently of images, "batteries can spark or explode" again scored as the most motivating. Lower-scoring messaging included the phrases "batteries can cause fires," "battery fires can be avoided," "the power is in your hands," and "safely dispose of batteries."
- Seven informational sentences also were tested on how well they motivated respondents to take used batteries back to a special location. Again, "batteries can spark or explode in recycling or trash" scored highest. The lowest-scoring sentences spoke of the scale of the problem (generation and disposal).

The **online toolkit** contains materials for social media, videos, and print collateral that reflect the findings from this survey.

Chula Vista Battery and Personal Electronics Disposal Awareness Pilot

Taking what we learned from the quantitative message testing survey described above, we launched an awareness campaign in Chula Vista, California, from late November 2020 through January 2021. Chula Vista is the second-largest city in San Diego County, with a population of about 268,000, located south of the San Diego and a few miles north of the Mexico border.

Campaign Design

The goal of the campaign was to increase awareness that batteries and personal electronics can cause fires when placed in household trash or recycling carts and that there are safe local disposal locations available to residents. This information was disseminated using the city's website, social media posts, press release, digital and bus ads, and a mailer. Before and after the awareness campaign, residents of Chula Vista were surveyed regarding their knowledge of proper disposal of batteries and personal electronics. The survey was conducted during the end-of-year holiday season to reach residents at the height of the holiday shopping season, when batteries and electronic devices are often replaced and discarded.

To prepare for the campaign, the city first built a web page on proper battery disposal, with a link to find a participating retail location on Call2Recycle's website and instructions on how to access the South Bay Household Hazardous Waste Collection Facility. All other ads, posts, and collateral pointed to this website. The city then posted two boosted Facebook posts from Nov. 30 through Dec. 31, 2020, and published a press release in early December. Digital ads in English and Spanish, including geofenced mobile ads, video and display ads on streaming TV and online publications, and Google search ads, ran from Nov. 23-Dec. 31, 2020 and Jan. 15-31, 2021. During the same period, five San Diego Municipal Transit buses on routes in Chula Vista ran an ad on their back panel. A 6"x9" oversized postcard was sent to all single-family households in Chula Vista at the beginning of January 2021. Due to the limited hours at the HHW collection facility and retail shops as a result of the COVID-19 pandemic, 200 mail-back kits also were made available through Call2Recycle during the campaign as an alternative to the physical drop-off locations.

City's Facebook Post

Bus Ad on Routes in Chula Vista

Digital Ads

Mailer sent to single-family households

Customizable files are available and free to help prevent fires from batteries and personal electronics.
Signup here: recyclingpartnership.org/electronics

Campaign Reach

The mailer was sent to 47,400 single-family households in the city, representing the majority of households in Chula Vista. Although multifamily households did not receive a mailer, they were not excluded from digital ads.

The City's two social posts in December resulted in high engagement with nearly 162,000 community members reached. The links to more information were clicked on by nearly 3,800 people.

Post	Batteries Can Spark or Explode Animated Ad	Batteries Can Spark or Explode Animated Video
Duration	Nov. 30 - Dec. 15, 2020	Dec. 17 - Dec. 31, 2020
Post Reactions	1,978	273
Post Clicks	663	3,143
Post Shares	292	59
Comments	69	39
Reach	87,232	74,336
Cost per Post Engagement	$1.08	$0.06 ($1.59 per link click)

Note: Engagement includes all shared reactions, clicks, shares, comments, and 3-second video plays. A single user may engage in multiple activities, resulting in an engagement number exceeding reach.

The digital ads resulted in 5.3 million total impressions. Almost 2 million impressions came from English and Spanish mobile ads geofenced at bus/transit stops and at big-box stores like Walmart and Home Depot. Google search and display ads in English and Spanish delivered another 1.7 million impressions. The highest display ad engagement resulted from geofenced ads with a click-through rate of over 0.3% (benchmark is 0.15%). Google search ads also resulted in a click-through rate of over 4.5% in English and 2.3% in Spanish (benchmark 1.91%).

All digital ads, social posts, and collateral directed residents to visit the City's battery web page. Traffic to the website steadily increased from the beginning of the campaign at the end of November, fluctuating around 200 to 300 views per day in December, with the majority of sessions originating from the geofenced mobile ads. In January, after the mailer was sent out, website traffic reached more than 500 views in a day and remained between 300 and 400 views for the remainder of the month.

Call2Recycle's Chula Vista landing page was visited by over 500 unique users, and residents ordered 188 free mail-back kits through the page. However, as of the end of April 2021, only 20 kits had been mailed back to Call2Recycle, and most of the returned batteries were alkaline or carbon zinc. Many of the kits also were not prepared correctly, indicating the need for better education and instructions on the kits. It appears that this type of program would require long-term monitoring to give households a chance to collect enough batteries and small devices to ship back.

Before–and-After Campaign Survey Assessment

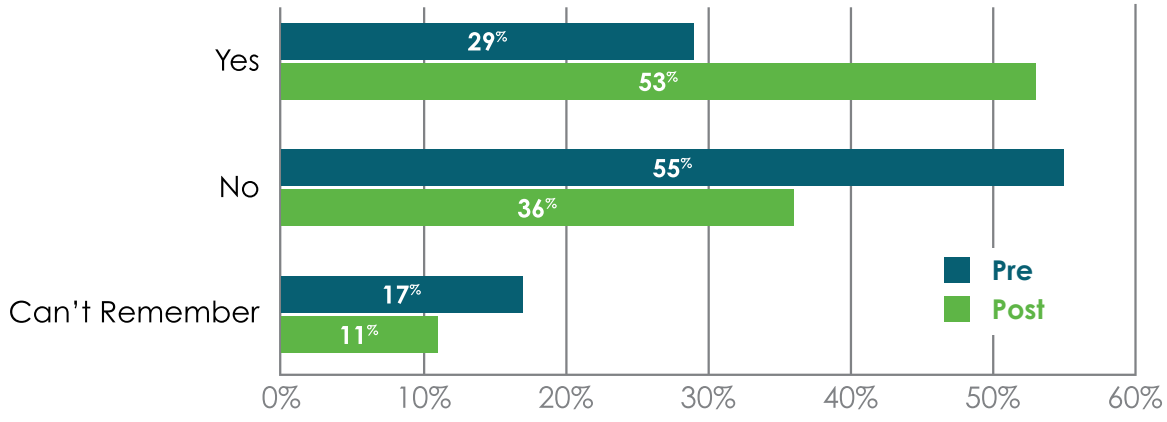
In November 2020 and February 2021, Chula Vista residents were surveyed to measure their awareness of proper disposal methods for used batteries and personal electronics, with 669 residents participating in the baseline assessment and 993 residents participating in the post-campaign assessment. Surveys were conducted via online consumer panels, phone interviews by live market-research interviewers, and a mailed survey questionnaire (which also offered the option to take the survey online) sent to a random cross-section of single-family households in Chula Vista. The baseline assessment also was available through Facebook ads targeted to Chula Vista residents, but only about 10% of the participants responded through this platform so it was not used for the post-campaign assessment. For the post-campaign assessment, residents who participated in the baseline survey were asked to participate again via e-mail. Basic demographics (age, race and ethnicity, and gender identity), housing types, how much the survey participant household recycles, and use of a special drop-off site for household hazardous waste were similar between the two surveys.

The baseline survey showed a high level of awareness in the community about where to take used batteries and personal electronics; 71% said those items should be taken to an HHW drop-off facility, while 9% said they should be returned to a retail drop-off location. There were 14% who were wrong in thinking that those products should be placed in their curbside recycling bin (9%) or be thrown in the trash (5%).

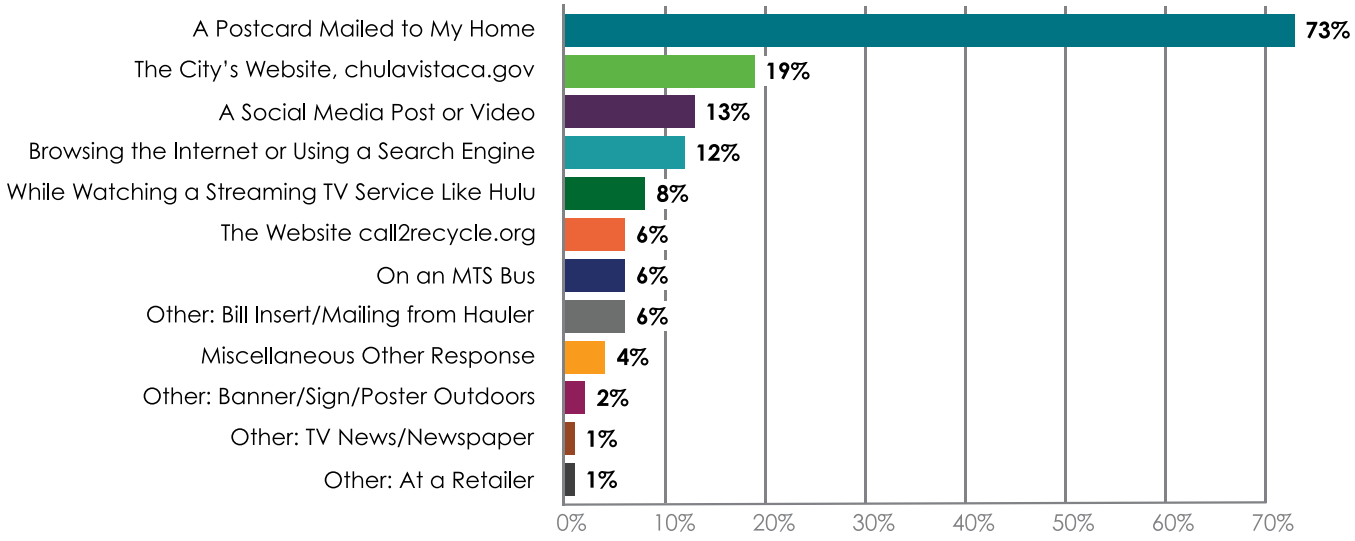
Despite the high baseline awareness, after the campaign the people who responded that used batteries should go in the trash or recycling carts decreased from 14% to 9% total, while the household hazardous waste drop-off group increased.

The survey also measured residents' recall of this specific campaign. People who had seen messaging about what to do with used batteries and small rechargeable devices nearly doubled from 29% in November 2020 to 53% in February 2021. This increase in recall happened across all demographics, housing type, and level of household recycling participation. Responses suggest that there were other ads about batteries circulating during or near the time of this awareness campaign. However, campaign results showed high recall of the mailer (73%) and other media elements, such as the city website, social media posts, digital ads, and bus ads. Furthermore, when asked for what they remembered about the ads or mailing, survey participants recalled seeing information about the location and hours of the HHW facility (19%), the basic message that batteries and personal electronics require special handling and should not be placed in trash or recycling carts (17%), the words "spark" and/or "explode" (8%), and that batteries and personal electronics can cause fires when discarded improperly (4%), showing that many recalled this specific campaign.

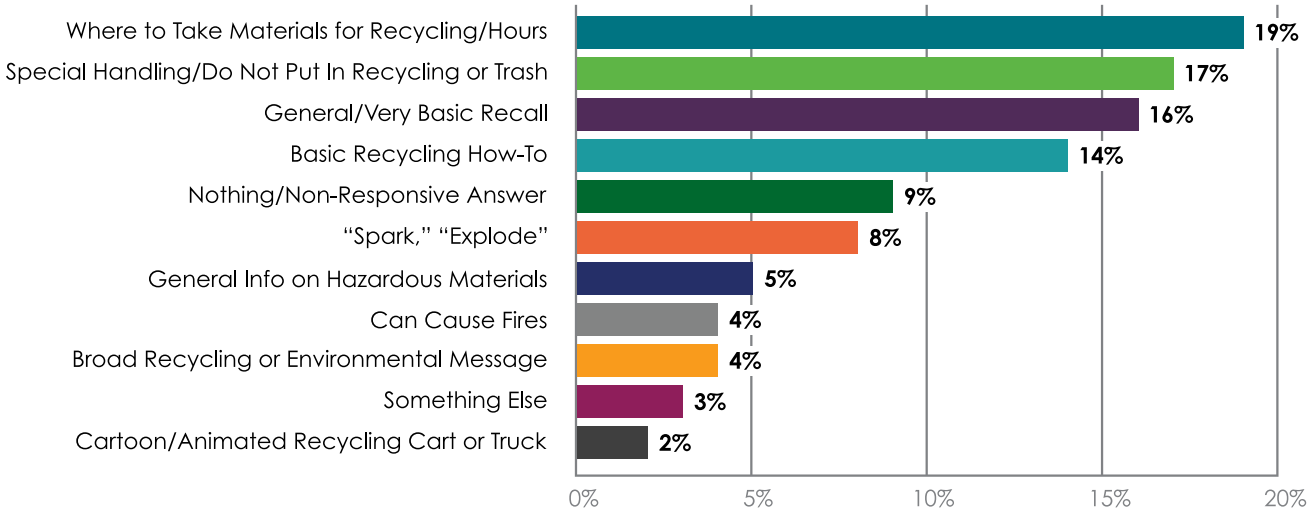
Seen Ads or Mailings Lately about Used Batteries and Personal Electronics



Places People Remember Seeing an Ad or Mailing, Post-Campaign Survey



What People Remember About the Ad or Mailing, Post-Campaign Survey



The Recycling Partnership Batteries and Personal Electronic Online Survey, 2020, Southern California, (1,236 survey respondents)

Finally, an interesting finding from this study was that the group of residents who said their household recycles only "some of the time" or "never" responded differently to the campaign. Those infrequent or nonrecyclers were much more likely to recall the messaging through social media posts, digital ads, or bus ads than the frequent/always recyclers who recalled the mailer. This may speak to the power of ads that people are exposed to during the course of everyday life as they browse the internet or watch a TV streaming service, even if the topic may not be of high interest. However, digital campaigns are expensive; more than 90% of the approximately $140,000 campaign budget was spent on social, digital, and bus ads. These digital ads ran for almost two months, yet the recall was lower compared with the mailer. This higher effectiveness and recall of the mailer is in line with what The Recycling Partnership has seen in previous campaigns.

Differences in Where Active and Less Active Recyclers Saw the Campagin

Where They Saw the Campaign	Household Recycles All of the Time	Household Recycles Most of the Time	Household Recycles Sometimes or Never
A Postcard Mailed to My Home	76%	71%	48%
ChulaVistaCA.gov	21%	11%	26%
Social Media Post or Video	11%	12%	39%
Browsing the Internet	10%	14%	23%
Streaming TV Service	6%	8%	29%
Call2Recycle.org	5%	8%	3%
MTS Bus	5%	1%	23%
Some Other Place	16%	17%	13%
Can't Remember	7%	8%	3%

Conclusion and Next Steps

As a result of message testing and assessing knowledge prior to running the campaign, assessments showed that the campaign was successful in raising awareness of how to properly dispose of used batteries and small rechargeable electronics. Almost three-quarters of the residents who remembered seeing an ad or mailing said they now know about what to do with those end-of-life personal electronics as a result of the ads or mailers. Moreover, the success of this campaign is reflected in the amount of batteries that were collected at Chula Vista's HHW facility during and immediately after the campaign. Between December 2020 and February 2021, the City's HHW facility received two to three times more batteries than the prior year.

Los Angeles County Battery Disposal Awareness Campaign

As a complement to its public awareness campaign in Chula Vista, California, on the proper disposal of batteries and personal electronics (see the related Case Study and Appendix F description in this guide), The Recycling Partnership conducted a similar campaign in Los Angeles County in late 2021.

Campaign Design

The Partnership and Los Angeles County Public Works joined forces on the campaign, which focused on the neighborhoods of Florence-Firestone and East Compton. Those areas were selected based on their history of low participation in temporary household hazardous waste (HHW) collection events and because no libraries in those areas offered battery-collection bins.

The campaign sought to increase residents' knowledge of how and where to properly manage their end-of-life batteries, encouraging them to use designated collection sites rather than putting their batteries in waste or recycling bins. The desired results would be fewer batteries in the waste and recycling streams and, in turn, fewer battery-caused fires in waste/recycling collection trucks and materials recovery facilities.

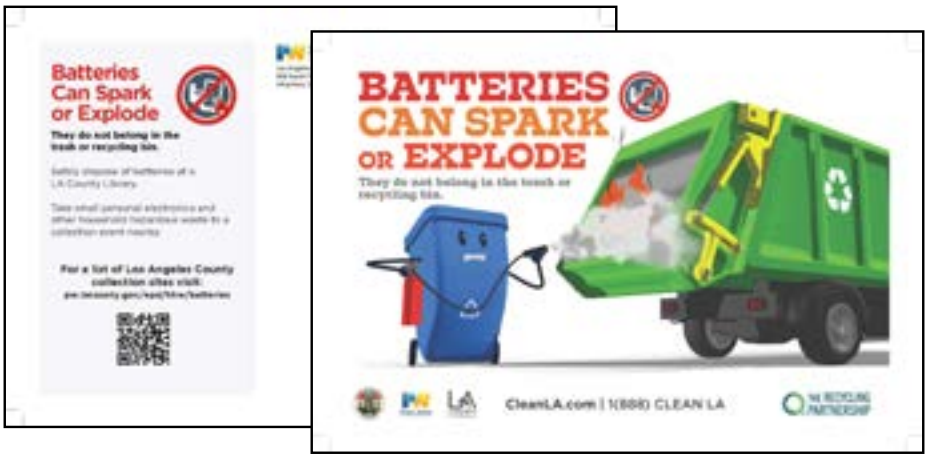
To ascertain residents' baseline knowledge on battery disposal/recycling, the campaign conducted pre-campaign surveys of residents via phone, mail, mail-to-online, online panels, and email-to-online.

Multi-Pronged Media Effort

The campaign then launched a multipronged media/promotion campaign that included direct mail, social media, website/digital resources, billboards, and more.

A 6-by-9-inch postcard was delivered to all 30,034 single-family households in Florence-Firestone and East Compton. The postcard informed residents that batteries in waste or recycling bins can spark or explode and encouraged residents to dispose of batteries properly at an HHW collection event or a library collection site. (To encourage the latter option, the campaign sited new battery-collection bins at one library in each neighborhood—the Florence Library at Roosevelt Park and the East Rancho Dominguez Library—and the libraries made campaign-related bookmarks available to visitors. On a related collection note, Los Angeles County gave away 100 mini battery-collection bins to residents who participated in an HHW collection event in Compton in mid-October 2021.)

Postcard Mailer



On the social media front, the campaign created a static graphic ad and video that appeared on Facebook and Instagram. Overall, the ad received 398,855 impressions and 2,876 clicks, while the video received 392,189 impressions, 300,783 views, 9,023 completions, and 1,049 clicks. The video was viewed more on Instagram while the static graphic ad was seen more on Facebook.

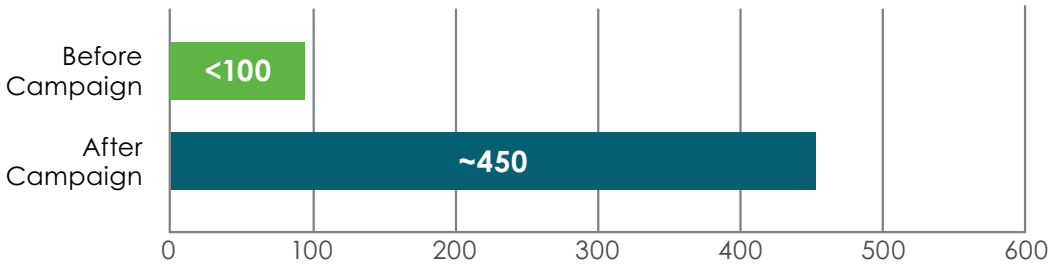
A related digital ad campaign included Google search ads in English and Spanish; geofenced mobile ads in the project areas in English and Spanish; a Redbox website digital banner; a YouTube video ad; and a KeyMe Kiosk video ad. These assets received 2.2 million impressions with higher-than-industry-average click-through rates.

In the same time period, the campaign ran ads on two billboards near the target libraries and displayed four posters in the vicinity of the libraries. Those assets, which included English and Spanish versions, gleaned an estimated 1,346,888 impressions.

In addition, Los Angeles County included the awareness campaign design on its webpage that lists designated battery collection sites in the county. CleanLA.com—the main page of Los Angeles County Public Works—also highlighted the battery campaign, with a link to the county's battery webpage. Plus, the CleanLA and Los Angeles County Public Works Twitter accounts promoted the campaign.

Thanks to the above media efforts, visits to Los Angeles County's battery webpage increased significantly during the campaign, especially after the social and digital ads went live, rising from fewer than 100 views a day to 400 to 500 views a day and a total of 9,000 visits to the website during the campaign.

Los Angeles County Battery Webpage Views Per Day



Campaign Results and Takeaways

Post-campaign surveys were conducted to determine the effectiveness of the campaign. The participants in the pre- and post-campaign surveys had similar demographics in terms of age, race/ethnicity, and gender identity), housing type, and self-assessment of recycling frequency. Among the most positive results, the percentage of residents who said they would take their batteries to a special drop-off location increased from 63% before the campaign to 66% after the campaign. Also, the percentage of residents who learned that they could dispose of their batteries at a local library increased from 22% before the campaign to 25% after the campaign.

Regarding the media campaign, 31% of post-campaign survey residents said they saw advertisements about what to do with used batteries—up from 21% in the pre-campaign survey. As for where surveyed residents remembered seeing information on what to do with used batteries, 29% noted the campaign's social media ad/video while 19% mentioned the Los Angeles County website. As for what the surveyed residents retained from the media they saw, 22% said they learned to drop off used batteries at a library or other specialized site/event while 19% said they learned that used batteries must be disposed of properly, not in their waste or recycling bins.

All resources are available for communities and organizations to use for free that would like to raise awareness around the right way to dispose of used batteries and personal electronics on our open source portal.

Free customizable file, social media assets, and videos are available to help prevent fires from batteries and personal electronics. Signup here: recyclingpartnership.org/electronics

The Recycling Partnership
SOLVING FOR CIRCULARITY

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