CHARGING AHEAD
How to Find Powerful Rechargeable Batteries

RPN Webinar
September 28, 2016
RPN

Nonprofit network

Members/Partners:

• States
• Local governments
• Federal agencies
• Colleges and universities
• School districts
• Businesses
• Nonprofits

Our Mission

“Promote and practice responsible purchasing by identifying best practices, developing effective purchasing tools, educating the market, and using our collective purchasing power to maximize environmental stewardship, protect human health, and support local and global sustainability.”
RPN Resources

- **Responsible Purchasing Guides**
- Webinars
- RPN newsletter
- Model specifications
- Technical assistance
- Model purchasing policies
- Calculators and other tools
Audio and Recordings

• Participants are muted. Communicate technical questions (about sound, etc.) through the CHAT BOX in your GoToWebinar application.

• This presentation will be recorded, and shared through email and online.
Questions?

Submit questions at any time by typing them into the GoToWebinar QUESTION BOX.

We will compile and answer them…

• After each presenter and
• At the end of the webinar with discussion.
Presenters

• *Chris Geiger*, San Francisco Dept. of the Environment

• *Alicia Culver*, Executive Director, RPN

• *Susan Kinsella*, Senior Analyst, RPN
Overview

• Why rechargeable batteries are needed
• Strategies to reduce battery use
• How to find high-performance rechargeable batteries
• Tips for purchasing chargers
• How to pilot test rechargeable batteries
• How to recycle rechargeables – for free!
How to Find Powerful Rechargeable Batteries

Chris Geiger
San Francisco Department of the Environment
San Francisco EPP Program Structure

City Purchasers

Green Teams

Dept. of the Environment

Cost

Performance

Impacts
- Worker health
- Environmental
- Social
San Francisco’s Rechargeable Battery Law

A City department that purchases or contracts to purchase batteries or products that include or incorporate batteries or battery packs, shall purchase...

• Rechargeable nickel-metal-hydride batteries
• Another rechargeable battery type identified by the Director of the Department of the Environment
• Only from vendors that collect spent batteries and recycle them in accordance with applicable laws
• Products accompanied by detailed recycling instructions
• Products in which battery packs are easily removable
SF Precautionary Purchasing Ordinance Requirements

- City agencies only
- Purchases restricted to “approved list”
- Prioritization
- Reporting
- Waivers
- Training & outreach
Welcome to SF APPROVED. Explore green products & services that meet San Francisco's health & environmental requirements.

What would you like to get?

Search: batteries, cleaners, LED lights

Advanced Search

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People should be sure to use green products, for safety and for the environment.

Cliff Hsiung, Custodial Supervisor, Recreation & Parks Department

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News

- SF Approved Green Product Specifications for Your Contracts, April 15, 2016
- Tools for Safer Graffiti Control, May 1, 2016
Info on this product category: Batteries

Why Go Green

Criteria for Batteries

Specifications for AA Rechargeable Batteries

- Nickel-metal hydride (NiMH) chemistry
- Minimum 2000 mAh capacity
- Low self-discharge (LSD): Maintains a minimum of 80% capacity after 1 year in storage, or 75% after 3 years in storage

Specifications for AAA Rechargeable Batteries

- Nickel-metal hydride (NiMH) chemistry
- Minimum 800 mAh capacity
- Low Self-Discharge: Maintains a minimum of 80% capacity after 1 year storage, or 75% after 3 years storage

Specifications for D Rechargeable Batteries

- NiMH chemistry
- Minimum 8000 mAh capacity
- Low Self-Discharge: Maintains a minimum of 80% capacity after 1 year in storage, or 75% after 3 years in storage

Non-rechargeable alkaline batteries are acceptable for precision electronic equipment that is voltage sensitive, for emergency use equipment, or for other applications requiring longevity and slow power drain.

Last updated: July 1, 2016

Regulation Adopting an Approved Alternatives List - #SFE-05-01-PPO. July 18, 2005
Polling Question #1

How often does your organization use rechargeable batteries?

VOTE NOW
CHARGING AHEAD:
How to Find Powerful Rechargeable Batteries
That Go On and On…and On

A Report by the Responsible Purchasing Network
to San Francisco Department of the Environment
Recommending Specifications for AA, AAA and D-Sized
Rechargeable Batteries for San Francisco’s SF Approved Program

Authors:
Susan Kinsella
Alicia Culver

July 2016

Alicia Culver
and
Susan Kinsella
RPN

How to Find Powerful Rechargeable Batteries

**Single-Use Alkaline Batteries**

- Widely available
- Low initial cost
- Expensive to replace in high-usage equipment (50 cents – $2/battery)
- Need special handling at end-of life (Universal Waste)
Why are Single-Use Batteries a Problem?

- Energy-intensive and polluting to manufacture (via smelting)
- Heavy to transport (~20 AAs per pound)
- Rapidly disposable (250 million pounds/year)
- Hazardous (corrosive, heavy metals)
US Battery Consumption is Growing

![Graph showing demand for primary batteries over years from 1995 to 2015.](chart.png)

- **Primary Alkaline**
- **Primary Other**
- **Primary Primary**
What Types of Equipment Use Batteries?

• **Hardware** (flashlights, power tools, emergency lighting)

• **Communications equipment** (pagers, cell phones, hand-held radios, walkie-talkies)

• **Office supplies** (calculators, clocks)

• **Janitorial equipment** (hands-free towel/soap dispensers)
Sustainable Battery Procurement Goals

• Use fewer batteries
• Purchase environmentally preferable rechargeable batteries
  – High performance rechargeables
  – Less toxic rechargeables
• Improve labeling of batteries
• Create efficient & safe battery collection and recycling system
How to Find Powerful Rechargeable Batteries

How Can You Reduce Battery Consumption?

Choose products that eliminate/minimize battery use

- Manual paper towel and hand soap dispensers
- LED flashlights
- Cameras/other products with built-in rechargeable battery

Choose rechargeable batteries (whenever practical)

- Specify high-performance rechargeable batteries
- Pilot test rechargeable batteries in targeted equipment
- Add compliant products to bid lists
How are Batteries Purchased?

Contracts for:

- Batteries
- Facility MRO Supplies
- Office Supplies
- Janitorial supplies
- IT Equipment
Battery Recycling

• Require or give preference to vendors that agree to collect (takeback) and recycle batteries free of charge

• Request recycling plan to be included with bids
How to Find Powerful Rechargeable Batteries

Call2Recycle Program

FIND A DROP-OFF LOCATION: Enter Postal Code REGION

What Can I Recycle?

- Rechargeable Batteries
- Single-Use Batteries*
- Cellphones

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Polling Question #2

What do you think are the biggest barriers to using rechargeable batteries?

VOTE NOW
Research Methods

1. Literature review

2. Interviews with battery suppliers

3. Interviews with government agencies about their pilot tests of rechargeable batteries

4. Market assessment of rechargeable batteries
“After comparing available rechargeable battery technologies, RPN concluded that nickel-metal hydride (NiMH) batteries with low-self discharge technology are the best drop-in replacement for single-use, alkaline consumer batteries.”
Why Nickel-Metal Hydride?

- Available in standard sizes (AAA, AA, C, D, 9V)
- Same voltage (1.2V) as alkaline batteries = direct replacement
- More powerful than in the past; some = alkaline batteries
- No “Memory Effect”
- Low-self discharge (LSD) products widely available
- Many pre-charged = can use right away
- Affordable; opportunity for cost savings
Other Types of Rechargeables

• Nickel Cadmium
  – Less capacity and cadmium is highly toxic
  – Suffers from the “Memory Effect”

• Rechargeable Alkalines
  – Can only be charged ~50X

• Nickel-Zinc
  – Less capacity and longevity than NiMH

• Lithium Ion
  – Operate at higher voltage
  – Available mostly in non-standard sizes
Sample Specifications

Recommended Specifications for AA Rechargeable Batteries

- Nickel-metal hydride (NiMH) chemistry
- Minimum 2000 mAh
- Low self-discharge (LSD): Maintains a minimum of 80% capacity after 1 year in storage, or 75% after 3 years in storage
Power Rating

• Capacity of the battery when fully charged
• Measured in milli-Amp-hours (mAh)
• Varies among brands
How to Find Powerful Rechargeable Batteries

Some NiMH Rechargeable Batteries Far More Powerful Than Others

**AA:** 1000 – 2800 mAh (~3X difference)
**AAA:** 500 – 1100 mAh (~2X difference)
**D:** 2200 – 12,000 mAh (~5X difference)
How to Find Powerful Rechargeable Batteries

Low-Self Discharge (LSD)

- Maintain 80% of their charge for 1 year (or 75% for 3 years)
- Non-LSD rechargeables lose ~4% of their charge/day
- Some products clearly label discharge rate, others do not
- No standard definition
## Labeling Important

**eneloop pro™**

| AA size Batteries: Up to 2,550 mAh | AAA size Batteries: Up to 950 mAh |

<table>
<thead>
<tr>
<th><strong>Huge 2,550 mAh capacity for long life in high-drain devices</strong></th>
<th><strong>Retains 85% capacity after one year in storage</strong></th>
<th><strong>Twice the number of external camera strobe flashes*¹</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Capacity up to 2550 mAh (AA)" /></td>
<td><img src="image" alt="100% after 1 Year" /></td>
<td><img src="image" alt="About 800 Flashes" /></td>
</tr>
<tr>
<td><img src="image" alt="About 400 Flashes" /></td>
<td><img src="image" alt="Dry-Cell Batteries" /></td>
<td></td>
</tr>
</tbody>
</table>

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**RPN**

[www.ResponsiblePurchasing.org](http://www.ResponsiblePurchasing.org)
# How to Find Powerful Rechargeable Batteries

## AA Power Rating + LSD (Pass)

<table>
<thead>
<tr>
<th>Brand</th>
<th>Product Name</th>
<th>Capacity (mAh)</th>
<th>LSD Claim</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Aibocn</td>
<td>EBL High-Capacity AA NiMH Precharged Rechargeable Batteries, 1500 Cycle</td>
<td>2800</td>
<td>Can maintain 75% of capacity after 3 years of non-use</td>
</tr>
<tr>
<td>2. Panasonic</td>
<td>Eneloop Pro AA High Capacity New Ni-MH Pre-Charged Rechargeable Batteries (Black label)</td>
<td>2550</td>
<td>Retains 85% of charge for 1 year when not in use</td>
</tr>
<tr>
<td>3. Sanyo</td>
<td>Eneloop 1.2V, 2500 mAh Rechargeable Batteries</td>
<td>2500</td>
<td>Maintains 75% charge after 1 year of non-use</td>
</tr>
<tr>
<td>4. PowerEx</td>
<td>Imedion Low Self-Discharge AA 2400 mAh Rechargeable Batteries</td>
<td>2400</td>
<td>Keeps up to 85% of charge after 1 year of storage</td>
</tr>
<tr>
<td>5. Duracell</td>
<td>Rechargeable Staycharged/Duralock AA Batteries</td>
<td>2400</td>
<td>Retains 80% of its charge after 12 months of storage</td>
</tr>
<tr>
<td>6. Amazon</td>
<td>AA High-Capacity Pre-charged Rechargeable Batteries</td>
<td>2400</td>
<td>Stays 80% charged even after a full year of non-use</td>
</tr>
<tr>
<td>Basics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Sanyo</td>
<td>Eneloop AA Rechargeable Batteries</td>
<td>2000</td>
<td>Retains 85% of its charge for 1 year when not in use</td>
</tr>
<tr>
<td>8. Panasonic</td>
<td>Eneloop AA New 2100 Cycle Rechargeable Batteries (White label)</td>
<td>2000</td>
<td>Retains 90% of its charge for 1 year</td>
</tr>
<tr>
<td>9. Tenergy</td>
<td>Centura Low Self-Discharge AA Nickel-Metal Hydride Rechargeable Batteries</td>
<td>2000</td>
<td>Very slow self-discharge; maintains 85% capacity after 1 year of storage and 70% residual capacity after 2 years of storage</td>
</tr>
<tr>
<td>10. Amazon</td>
<td>AA Rechargeable Batteries</td>
<td>2000</td>
<td>Maintains 75% after 3 years</td>
</tr>
<tr>
<td>Basics</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## AA Power Rating + LSD (Fail)

<table>
<thead>
<tr>
<th>Brand</th>
<th>Product Name</th>
<th>Capacity (mAh)</th>
<th>LSD Claim</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Energizer</td>
<td>Recharge Universal Batteries</td>
<td>1400</td>
<td>Charge lasts up to 12 months in storage</td>
</tr>
<tr>
<td>2. Rayovac</td>
<td>Recharge Rechargeable Batteries</td>
<td>1350</td>
<td>Not enough information provided about ability of battery to maintain charge over time</td>
</tr>
<tr>
<td>3. Eveready</td>
<td>Rechargeable AA Batteries</td>
<td>1300</td>
<td>Ready to use for up to 1 year</td>
</tr>
<tr>
<td>4. Panasonic</td>
<td>Eneloop Lite AA Rechargeable Batteries (Blue label)</td>
<td>1000</td>
<td>Retains 65–70% capacity after 5 years in storage</td>
</tr>
</tbody>
</table>
Other Performance Criteria (Not in Specification)

# of charges/battery

- Information not reliably or consistently reported

“Pre-charged”

- Some pre-charged batteries are LSD, while others are not (unreliable indicator of LSD technology)
- Beware most pre-charged batteries are only partially charged
How to Find Powerful Rechargeable Batteries

Which Equipment is Best for Rechargeables

- Wireless mice
- Telephone head sets
- Radios
- Pagers
- Calculators
- Non-emergency flash lights
- Paper towel/soap dispensers
- Touchless faucets, toilet flush units
Which Equipment is Challenging for Rechargeables

- Emergency equipment
- Medical devices
- Smoke detectors

- Some applications (e.g., clocks) may not be cost-effective if batteries are replaced infrequently
Most emergency equipment gauges are designed for alkaline batteries’ sloping voltage discharge curve (not for rechargeable batteries)
Polling Question #3

Would you be interested in pilot testing high-performance rechargeable batteries?

VOTE NOW
How to Performance Test Rechargeable Batteries

Assess current battery usage
• Battery types, #s used
• Cost for purchasing single-use batteries
• Frequency of battery replacement

Identify best applications for rechargeables
• Equipment with frequent battery replacement
• Pick brand(s) of rechargeable batteries to pilot test
• Submit your results: length of charge, cost savings
### How to Performance Test Rechargeable Batteries

<table>
<thead>
<tr>
<th><strong>Date</strong></th>
<th><strong>BATTERY USAGE AND WASTE MANAGEMENT SURVEY</strong></th>
<th><strong>Page</strong></th>
<th><strong>Agency/Office</strong></th>
<th><strong>Contact Name</strong></th>
<th><strong>Surveyor Name</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Phone Number</strong></td>
<td><strong>Contact Email Address</strong></td>
<td><strong>Surveyor Email Address</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 1. Type of Battery-Powered Equipment

<table>
<thead>
<tr>
<th><strong>Battery Size</strong></th>
<th><strong>Number of Batteries Required/Unit</strong></th>
<th><strong>Purchase Cost per Battery</strong></th>
<th><strong>Type of Battery</strong></th>
<th><strong>Battery Chemistry</strong></th>
<th><strong>Primary Vendor(s) for this Type of Battery</strong></th>
<th><strong>How do you Usually Purchase this Type of Battery?</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ AAA</td>
<td>□ AA</td>
<td>□ C</td>
<td>□ D</td>
<td>□ 9-volt</td>
<td>□ Button</td>
<td>□ Other</td>
</tr>
<tr>
<td>□ Button</td>
<td>□ Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Battery Change Frequency

<table>
<thead>
<tr>
<th><strong>How is this battery handled when spent?</strong></th>
<th><strong>Total Number of this Type of Battery Discarded</strong></th>
<th><strong>Favorable to Rechargeables for this Equipment?</strong></th>
<th><strong>Experience Using Rechargeable Batteries for this Application</strong></th>
<th><strong>Additional Information</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Recycle/City</td>
<td>□ Recycle/RBRC</td>
<td>□ Yes</td>
<td>□ No opinion</td>
<td></td>
</tr>
<tr>
<td>□ Trash</td>
<td>□ Month</td>
<td>□ No</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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www.ResponsiblePurchasing.org
Chargers

- ENERGY STAR no longer certifies chargers
- Beware of charge-battery combo packs
  - Batteries often not high-performance, less labeling
- Choose battery chargers that:
  - Work with all battery sizes needed
  - Hold the number of batteries needed
  - Are designed for your battery chemistry
  - Charge each battery independently, as needed
  - Have LED indicator lights
- Consider in-vehicle chargers and equipment with built-in chargers
How to Find Powerful Rechargeable Batteries

Some Innovative Rechargeable Batteries
Thank You!

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