Dry Cell Batteries and the Environment

Household batteries can be either single-use or rechargeable “dry cell” batteries. These batteries are used for power tools, cameras, two-way radios, flashlights, hearing aids and many other everyday applications (Table 1). Over 3 billion household batteries are sold and discarded in the U.S. each year, an amount that represents 12 batteries per person or more than 125,000 tons of waste per year. 

The term “dry cell” refers to the type of electrolyte utilized in the battery. In “wet cell” batteries such as those used in automobiles, the electrolyte is in the form of a liquid bath. In dry cell batteries, the electrolyte is absorbed in the other materials or exists as a gel rather than as a separate body of liquid.

Several types of household batteries have or still utilize heavy metals as electrodes or to increase the lifespan. These metals include mercury and cadmium. The U.S. Environmental Protection Agency (EPA) has identified both mercury and cadmium as characteristically toxic materials under the Resource Conservation and Recovery Act (RCRA). Even at low concentrations, mercury can adversely affect a range of bodily functions including the central nervous system. Mercury also has the capability to bioaccumulate in natural food chains, thus exposing species at the top of the food chain to the highest and most dangerous concentrations. Exposure to elevated levels of cadmium can cause damage to the kidneys, liver, respiratory tract and the lungs.

Some types of dry cell batteries, if discarded as common trash, contribute heavy metals, (such as mercury and cadmium) to the municipal solid waste (MSW) stream. In 1989, spent household batteries accounted for 88 percent of the mercury entering the MSW stream. In 1994, 98.5 percent of North Carolina’s non-recycled MSW was landfilled, and 1.5 percent was incinerated. With any battery disposal method, the potential exists to release heavy metals into the environment through landfill leachate or incinerator stack gases. To minimize this risk, North Carolina Solid Waste Management Law has established a waste management hierarchy that encourages source reduction and recycling prior to landfiling or incineration. The pollution prevention options presented in this fact sheet can help reduce the potential for releases of mercury and other heavy metals to the environment.

Trends in the Battery Industry

In response to these environmental issues, battery manufacturers have substantially reduced the quantity of mercury in batteries or phased out those batteries with the highest mercury concentrations. Between 1988 and 1992, mercury consumption by battery manufacturers dropped 96 percent. Alkaline and carbon zinc batteries, which represent about 83 percent of the household battery market, formerly contained significant quantities of mercury. In 1992, several states introduced legislation requiring that these types of batteries contain no more than 0.025 percent mercury by weight; and since January, 1996, many states require that alkaline and carbon zinc batteries contain no added mercury. In order to preempt the 1996 regulations, battery manufacturers produced alkaline and carbon zinc batteries soon after 1992 that contained no added mercury (Figure 1).
Zinc Oxide and Zinc Air Batteries

Mercury oxide batteries, now being replaced by less toxic zinc oxide and zinc air batteries, will not be sold for commercial use in some states after 1996. Also, zinc air batteries now fulfill roles formerly dominated by silver and mercury oxide button cell batteries in such items as hearing aids, pagers, and watches.

Recyclable Ni-Cad Batteries

As noted, EPA studies indicate that household batteries accounted for an estimated 88 percent of the mercury in the MSW in 1989. This percentage is expected to decrease to 50 percent by the year 2000 as battery manufacturers phase out the mercury ingredients. However, EPA predicts that this reduction in mercury consumption will be offset by a 50-percent rise in the quantity of cadmium in the MSW stream from batteries. The cadmium is contained primarily in rechargeable nickel-cadmium (Ni-cad) batteries used in appliances such as telephones, vacuum cleaners, and power tools.

Ni-cad batteries are recyclable. In the past, these batteries were difficult to recycle because they were sealed in the appliances and could not be removed. As a result of recent legislation in several states, most products containing batteries are now designed to allow removal of the batteries for recycling.

Recent Developments in Rechargeable Batteries

Since 1994 rechargeable alkaline batteries have been available to consumers. These batteries contain no added regulated toxic metals. Two other relatively new rechargeable batteries have recently come on the market. Nickel metal hydride (NiMH) and lithium ion batteries are designed for use in personal computers, cellular phones, and video cameras.

Manufacturers claim that these batteries have a higher energy density and longer lifetime than existing Ni-cad rechargeables. These new batteries also do not contain the cadmium used in Ni-cad batteries.

Pollution Prevention and Waste Management Options

A hierarchy of waste management options is presented in Figure 2. Below are options that can contribute significantly to reducing the effects of spent batteries on the environment.

✔️ Reduce Battery Usage

- Consider purchasing plug-in products that may work just as well or better than battery-powered products for the desired application.
- Where possible, operate appliances such as radios and other equipment from outlets instead of by batteries.
- When possible, buy batteries that contain less hazardous ingredients. For example, purchase zinc air batteries instead of mercury button cells.
Recharge Reusable Batteries

- Use rechargeable batteries or devices containing these batteries when possible. Rechargeable batteries are a true source reduction option since they reduce the quality of batteries consumed and disposed over a given period of time. Since some rechargeables can be reused and recharged as many as one thousand times, they potentially represent a substantial reduction in the disposal of spent batteries. After the initial investment in the batteries and recharger, rechargeable batteries will be much less expensive than periodic purchases of new batteries, even after the price of the recharger is factored in.

Rechargeable alkaline, Ni-cad, NiMH, and lithium ion batteries are available. The alkaline and lithium ion batteries contain no added toxic heavy metals and, thus, pose no threat to the environment at disposal. However, proper waste management of spent NiMH and Ni-cad batteries is important since the potential exists for nickel or cadmium releases to the environment.

Recycle Spent Batteries

- Purchasers of a battery-containing product or a battery should ask if the retailer will take the spent battery back for recycling. Several retail chains and power tool outlets currently offer battery recycling, and many other facilities plan to offer this service in the near future.

- Consumers should take spent Ni-cad, button cell, and pre-1992 alkaline batteries to a household hazardous waste collection site. These sites are maintained continuously or periodically in many North Carolina counties. Table 2 provides a list of permanent facilities. The city or county recycling coordinator can provide information about local programs and collection dates, and some counties have already or are planning to set up battery collection sites at local drug, department, or electronics stores. Call the Office of Waste Reduction or look in the utilities/public works section of the telephone directory for telephone numbers of recycling coordinators.

Other Tips

- Remove batteries from items that will be stored for long periods of time. The battery terminals may corrode, leak, and rum the equipment if the battery is left unused in place.

- Look for hidden button cell batteries in items before you dispose them. Remove and recycle batteries from disposables or items with a short lifetime such as toys, cards, watches, calculators, and even picture frames before discarding the products.
### Table 1: Battery Identification

<table>
<thead>
<tr>
<th>Battery Type</th>
<th>Description</th>
<th>Application</th>
<th>Regulated Toxic Constituents*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkaline</td>
<td>Alkaline, copper top, energizer</td>
<td>Radios, flashlights, portable personal stereos, smoke alarms, toys, remote controls, cameras, electronic games, pagers.</td>
<td>None added</td>
</tr>
<tr>
<td>Nickel metal hydride</td>
<td>Special purpose battery</td>
<td>Computers, cellular telephones, video cameras.</td>
<td>None added</td>
</tr>
<tr>
<td>Lithium ion</td>
<td>Special purpose battery</td>
<td>Computers, cellular telephones, video cameras.</td>
<td>None added</td>
</tr>
<tr>
<td>Carbon zinc/zinc chloride</td>
<td>“Classic,” heavy duty, general purpose, all purpose, power cell</td>
<td>Flashlights, calculators, toys, clocks, smoke alarms, remote controls</td>
<td>None added</td>
</tr>
<tr>
<td>Nickel-cadmium</td>
<td>Rechargeable or labeled “Ni-Cd”</td>
<td>Portable tools, cordless telephones, vacuums and appliances, camcorders, and other rechargeable applications.</td>
<td>Cadmium</td>
</tr>
<tr>
<td>Mercuric oxide/Silver oxide</td>
<td>Button cells: mercuric oxide, silver oxide.</td>
<td>Watches, calculators, hearing aids, cameras, electric thermometers</td>
<td>Mercury, silver</td>
</tr>
<tr>
<td>Lead acid batteries (sealed)</td>
<td>Gel, VRB, AGM, Cyclone</td>
<td>Video cameras, power tools, wheelchairs, cameras, metal detectors.</td>
<td>Lead</td>
</tr>
</tbody>
</table>

*Toxic constituents are those substances regulated by the NC Division of Solid Waste Management under the Resource Conservation and Recovery Act (RCRA).

### Table 2: North Carolina Permanent Household Hazardous Waste Collection Sites

<table>
<thead>
<tr>
<th>County</th>
<th>Landfill</th>
<th>Address</th>
<th>Telephone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chatham</td>
<td>Land Clearing and Inert Debris Landfill</td>
<td>County Landfill Road, Pittsboro</td>
<td>(919) 549-0551</td>
</tr>
<tr>
<td>Cumberland</td>
<td>Household Hazardous Materials Collection Center</td>
<td>Wilkes Road, Fayetteville</td>
<td>(910) 433-0978</td>
</tr>
<tr>
<td>Durham</td>
<td>Durham City/County Landfill</td>
<td>1900 East Club Blvd, Durham</td>
<td>(919) 549-0551</td>
</tr>
<tr>
<td>Guilford</td>
<td>Ecoflo</td>
<td>2750 Patterson Street, Greensboro</td>
<td>(910) 855-7925</td>
</tr>
<tr>
<td>Mecklenburg</td>
<td>Heritage Environmental, Inc.</td>
<td>4132 Pompano Road, Charlotte</td>
<td>(704) 392-6276</td>
</tr>
<tr>
<td>Orange</td>
<td>Orange Regional Landfill</td>
<td>Eubanks Road, Chapel Hill</td>
<td>(919) 549-0551</td>
</tr>
<tr>
<td>Rockingham</td>
<td>Rockingham County Landfill</td>
<td>Mebane Bridge Road</td>
<td>(910) 627-7783</td>
</tr>
<tr>
<td>Wake</td>
<td>North Wake Landfill</td>
<td>Durant Road, Raleigh</td>
<td>(919) 549-0551</td>
</tr>
</tbody>
</table>

Note: Temporary household hazardous waste collection events are held in many counties. Call the local public works department for information.

Spent Dry Cell Batteries - Household - 4 - June 1996
References

Cited Sources


Uncited Sources


The Office of Waste Reduction provides free, non-regulatory technical assistance to eliminate, reduce, or recycle wastes before they become pollutants or require disposal. For additional information about issues in this Fact Sheet or to discuss any of your waste reduction concerns, contact OWR at (919) 715-6500 or 800-763-0136 or E-Mail nowaste@owr.ehnr.state.nc.us

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