

# Battery Recycling Processes

The following is a brief discussion about how batteries of different chemistries are physically recycled at the end-site recycling plant.



## Alkaline/Zinc Carbon/Zinc Air Batteries

These batteries are recycled in a specialized “room temperature,” mechanical separation process where the battery components are separated into 3 end products. These items are a) Zinc & Manganese Concentrate, b) Steel, c) Paper & Plastic. All of these products are put back into the market place for reuse in new products. These batteries are 100% recycled.

## Lithium Ion Batteries

These batteries are recycled in a specialized “room temperature, oxygen-free,” mechanical process during which the battery components are separated into 3 end products. These items are a) Cobalt & Lithium Salt Concentrate, b) Stainless Steel, c) Copper, Aluminum and plastic. All of these products are then put back on the market to be reused in new products. These batteries are 100% recycled.

## Nickel-Cadmium, Nickel Metal Hydride Batteries

Prior to the smelting process, plastics are separated from the metal components. The metals are then recycled via a High-Temperature Metal Reclamation (HTMR) process during which all of the high temperature metals contained within the battery feedstock (i.e. nickel, iron, manganese, and chromium) report to the molten-metal bath within the furnace, amalgamate, then solidify during the casting operation. The low-melt metals (i.e. zinc and cadmium) separate during the melting. The metals and plastic are then returned to be reused in new products. These batteries are 100% recycled.

## Lithium Batteries

The contents of the batteries are exposed using a shredder or a high-speed hammer depending on battery size. The contents are then submerged in caustic (basic not acidic) water. This caustic solution neutralizes the electrolytes, and ferrous and non-ferrous metals are recovered. The clean scrap metal is then sold to metal recyclers. The solution is then filtered. The carbon is recovered and pressed into moist sheets of carbon cake. Some of the carbon is recycled with cobalt. The lithium in the solution (lithium hydroxide) is converted to lithium carbonate, a fine white powder. What results is technical grade lithium carbonate, which is used to make lithium ingot metal and foil for batteries. It also provides lithium metal for resale and for the manufacture of sulfur dioxide batteries.

## Mercury Batteries

The batteries and heavy metals are recovered through a controlled-temperature process. It's important to note: the percentage of mercuric oxide batteries is decreasing since the passage of the Mercury-Containing Rechargeable Battery Management Act (The Battery Act) of 1996. This act prohibits, or otherwise conditions, the sale of certain types of mercury-containing batteries (i.e., alkaline-manganese, zinc-carbon, button-cell mercuric-oxide and other mercuric-oxide batteries) in the United States.