IMERC Fact Sheet
Mercury Use in Batteries

Last Update: August 2008

"Mercury Use in Batteries" summarizes the use of mercury in batteries. This Fact Sheet covers all the types of batteries that contain mercury, including button-cell batteries; the total amount of mercury in all of the batteries that were sold as new in the U.S. in 2001 and 2004; and companies that have phased-out the products' manufacture and sale.

The information in this Fact Sheet is based on data submitted to the state members of the Interstate Mercury Education and Reduction Clearinghouse (IMERC)[1] including Connecticut, Louisiana, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont. The data is available online through the IMERC Mercury-Added Products Database.[2]

A number of important caveats must be considered when reviewing the data summarized in this Fact Sheet:

- The information may not represent the entire universe of mercury-containing batteries sold in the U.S. The IMERC-member states continuously receive new information from mercury-added product manufacturers, and the data presented in this Fact Sheet may underestimate the total amount of mercury sold in this product category.

- The information summarizes mercury use in batteries sold nationwide since 2001. It does not include mercury-added batteries sold prior to January 1, 2001 or exported outside of the U.S.

- Reported data includes only mercury that is used in the product, and does not include mercury emitted during mining, manufacturing, or other points in the products' life cycle.

Types of Mercury Batteries

There are a variety of button-cell batteries that contain mercury, including zinc air, silver oxide, and alkaline manganese oxide batteries. Button-cell batteries are small, thin, energy cells that are not rechargeable. They are most commonly used in watches, toys, hearing aids, and other small and portable electronic devices. The manufacturing of small electronic devices is often possible due to the small size of the button-cell batteries.

[1] IMERC: http://www.newmoa.org/prevention/mercury/imerc/about.cfm
[2] Mercury-Added Products Database: http://www.newmoa.org/prevention/mercury/imerc/notification/index.cfm

Zinc Air miniature batteries are mostly used in hearing aids because of their high energy concentration and their ability to continuously discharge energy. This type of battery uses oxygen from the air to produce electrochemical energy. A hole in the cell allows the surrounding air to enter the battery and react with the cathode. They are also used for small devices, such as wristwatch pagers and ear speech processors.

Examples of Zinc Air Miniature Batteries
Photo Sources: Duracell and Sunhigh

Silver Oxide button-cell batteries are used in various devices, such as hearing aids, watches, cameras, and clocks. In these batteries, the silver oxide makes up the cathode, and powdered zinc provides the anode. Usually sodium hydroxide or potassium hydroxide is added as an alkaline electrolyte. Silver oxide batteries can come in a large size as well as the button-cell size; however the manufacture of the larger batteries is limited due to the high price of silver.

Examples of Silver Oxide Button-Cell Batteries
Photo Sources: Energizer and Duracell

Alkaline Manganese Oxide button-cell batteries are used in toys, calculators, remote controls, and cameras. In these batteries, the cathode consists of manganese dioxide, which is produced through an electrolytic process, and the anode is made up of powdered zinc metal. The electrolyte typically used in this type of button-cell battery is potassium hydroxide.

Examples of Alkaline Manganese Button-Cell Batteries
Photo Sources: GP Batteries

Gas can form in all of these types of batteries due to the corrosion of zinc. Zinc in the battery gets corroded into the electrolyte as the battery is used. This corrosion can cause electrolysis and can cause the generation of hydrogen gas in the canister. Build-up of hydrogen gas can cause the battery to leak, limiting the ability of the battery to function. Mercury suppresses this zinc corrosion, which is why it is added to button-cell batteries. These batteries may contain mercury in the insulating paper surrounding the battery, or mercury may be mixed in the anode itself. All of these different button-cell batteries can contain up to 0.005 grams of mercury.

Mercuric Oxide batteries contain mercury as the electrode and are useful in applications that require a high energy density and a flat voltage curve. In the past, mercuric oxide button-cell batteries were used in hearing aids, watches, calculators, electronic cameras, and other personal electronic items requiring a small battery. However, mercuric oxide button-cell batteries were banned in 1996 in accordance with the "Mercury Containing and Rechargeable Battery Management Act" and are no longer sold in the U.S.[3] Larger mercuric oxide batteries may still be used in such applications as military, medical, and industrial equipment. The IMERC-member states have not received any Notification Forms for mercuric oxide batteries.

Other batteries, such as AAA, AA, C, and D alkaline; atomic; and lithium-ion batteries, do not contain mercury.

Mercury Use in Batteries

Table 1 presents the total amount of mercury contained in mercury batteries sold in the U.S. in years 2001 and 2004. More detailed information can be found in the report, *Trends in Mercury Use in Products: Summary of the IMERC Mercury-added Products Database*, June 2008.[4]

Table 1: Total Mercury Sold in Batteries in the US (pounds)

Product	2001 Total Mercury	2004 Total Mercury
Button-cell Batteries	5,914 (3 tons)	5,122 (2.6 tons)

Note: 1 gram = 0.002205 pounds.

In 2001, the companies reporting to IMERC-member states sold 3 tons (5,914 pounds) of mercury in batteries, which decreased by 0.4 tons to 2.6 tons (5,122 pounds) in 2004. This represents a decline of approximately 14 percent from 2001 to 2004.

Since 2001, many states have passed legislation restricting the sale of mercury button-cell batteries and/or products that contain these batteries, such as toys and other novelty items. As more state laws go into effect, mercury use in this product category will likely continue to decline.

Phase-Outs & Product Bans on the Sale of Mercury Batteries

As stated above, mercuric oxide button-cell batteries are no longer sold in the U.S. for personal use in accordance with the Mercury Containing and Rechargeable Battery

[3] Mercury-Containing and Rechargeable Battery Management Act: http://www.epa.gov/compliance/civil/ba
[4] Trends in Mercury Use in Products: Summary of the IMERC Mercury-Added Products Database: http://www.newmoa.org/prevention/mercury/imerc/pubs/reports.cfm

Management Act of 1996. Research indicates that larger mercuric oxide batteries may still be used in limited applications (i.e., military, medical, and industrial). Federal law (and some state laws, including Maine) allows these mercuric oxide batteries to continue to be sold but only if the manufacturer has established a system to collect waste batteries and ensure that the mercury is properly managed. To date, the IMERC-member states have not received any Notifications for mercuric oxide batteries.

The U.S. battery manufacturers have voluntarily committed to eliminating mercury in button-cell batteries by 2011. A few states, including Connecticut and Maine, have enacted legislation mandating a ban on the sale of mercury-added button batteries after July 1, 2011.

In January 2009, the Maine Department of Environmental Protection (Maine DEP) will submit a report on the status of the development of mercury-free button cell batteries to the joint standing committee of the Maine Legislature. As part of the research for the report, Maine DEP will communicate with representatives of the battery, watch, precision instrument, hearing aid, and medical device industries regarding the industries' experience with testing, reliability of use, cost, and availability of mercury-free button cell batteries.[5]

In response to the upcoming mercury product bans and phase-outs, many companies have ceased manufacturing mercury button-cell batteries and/or stopped selling products in which mercury button-cell batteries are a component.

Non-Mercury Alternatives

Some of the large battery manufacturers, including Sony Corporation, New Leader, and Energizer, manufacture non-mercury zinc air, silver oxide, and/or alkaline manganese button-cell batteries. However, many of these models are more expensive than the mercury counterparts and may not be commercially available in the U.S.

Lithium button-cell batteries and non-miniature cylindrical alkaline batteries do not contain mercury. These may be a suitable alternative to mercury-containing button-cell batteries, depending on the end product and its power needs.

For more information on non-mercury alternatives for button-cell batteries, see: http://sustainableproduction.org/downloads/MaineDEPButtonBatteryReportFinal12-17-04.pdf

[5] Maine Public Law Chapter 509: http://janus.state.me.us/legis/ros/lom/LOM122nd/14Pub501-550/Pub501-550-08.htm#P255_58354