



**Lowell Center for  
Sustainable Production**

University of Massachusetts Lowell

# **An Investigation of Alternatives to Mercury Containing Products**

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**Prepared for  
The Maine Department  
of Environmental Protection**

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## Executive Summary

The Maine Department of Environmental Protection (DEP) will issue a report on January 1, 2003 that will include a comprehensive strategy to reduce the mercury content of products. To assist in gathering information for this report, the Maine DEP commissioned the Lowell Center for Sustainable Production of the University of Massachusetts Lowell to conduct a study of alternatives to mercury containing products.

Mercury's chemical and physical properties have been applied to meet the requirements of thousands of products and applications including: dental amalgams, scientific instruments, electrical components, batteries, lamps, and medical devices. These mercury containing products are widely used in residential, commercial, industrial, military, marine, and medical environments.

Mercury from these products can be released to the environment during various stages of the product life cycle including production, transportation, manufacturing, use, and disposal. Once released, the mercury can transform to organic forms, and can readily disperse in the environment through the air, soil, and water. Mercury is persistent in the environment, and also accumulates in concentration as it biomagnifies within the food chain. Mercury is highly toxic to humans; exposure can damage kidneys and the central nervous system. The fetus is particularly sensitive to mercury's toxic effects. Mercury also has adverse effects on wildlife including early death, weight loss, and reproductive issues.

In February 2002, the Interstate Mercury Education and Reduction Clearinghouse (IMERC) was formed under the auspices of the Northeast Waste Management Officials' Association (NEWMOA). IMERC is an umbrella organization designed to assist the eight northeast states in their implementation of mercury reduction laws and programs aimed at getting mercury out of consumer products, the waste stream, and the environment.

The LCSP study included a review of the mercury product notification data submitted by manufacturers to IMERC. The notification data included a description of mercury added components, number of components, amount of mercury per unit, amount of mercury in total domestic sales, and purpose of mercury in the product. At the time of the review, this included seventy-six manufacturers reporting 390 mercury containing products. The LCSP study also included discussions with mercury product experts, discussions with manufacturers of mercury products, review of responses to a May 1, 2002 State of Maine letter to mercury product manufacturers (see Appendix 4), review of published mercury product studies, and review of pertinent data available on the internet.

Since there are thousands of products that contain mercury, a prioritization effort was needed to focus on a core set of products that could then undergo further detailed study. The criteria for this prioritization included: amount of mercury released to the environment, amount of mercury contained within the product, total amount of mercury reported for all product sales, product coverage by current regulation, and the availability of non-mercury alternatives. Products and components were reviewed as part of the prioritization process. Components are typically sold to original equipment manufacturers to be incorporated within a product. For example, the mercury tilt switch is a component that is incorporated in automobiles, vending machines, cranes, wheelchairs, and numerous other products.

The priority products selected for further detailed study included sphygmomanometers, gastrointestinal tubes, manometers, non-fever thermometers, barometers, hygrometers, psychrometers, hydrometers, flow meters, pyrometers, and thermostats (industrial and manufacturing only). The priority components selected for further detailed study included float switches, tilt switches, pressure switches, temperature switches, displacement relays, wetted reed relays, mercury contact relays, and flame sensors.

After the priority products and components were selected, detailed research and analysis was

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then conducted. The findings from this research include:

- Description of how the mercury product/component operates
- Typical applications of the mercury product/component
- Non-mercury alternatives available
- Cost range for the mercury product/component and non-mercury alternatives
- Advantages and disadvantages of the mercury products/components and their non-mercury alternatives
- Manufacturer information for non-mercury alternatives
- Summary of findings for each mercury product/component

In general, cost competitive non-mercury alternatives were identified that meet the functionality requirements for most priority mercury products. Therefore, these products could be targets for mercury reduction efforts. The two products where alternative replacements cannot be recommended are the gastrointestinal tubes and the industrial thermostats.

For the following components there are cost competitive non-mercury alternatives available for new products and applications: flame sensors, float switches, tilt switches, temperature switches, and pressure switches. However, non-mercury relays can cover most, but not all, combinations of design parameters for new relay products or applications.

Certain retrofit situations for mercury switches and relays exist where the non-mercury alternative is not cost competitive. Efforts to reduce the sale of mercury switches and relays for retrofitting existing products or applications should take this into consideration.

There are many opportunities for substituting non-mercury alternatives for mercury containing products and components. Many alternatives are not simple drop-in substitutions. Although a non-mercury alternative may ultimately achieve the

same desired functionality, such as providing an accurate measure of blood pressure or sensing a flame, there are often design considerations or different techniques or practices that must be first learned and communicated.

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## 1.0 Introduction

The Maine Department of Environmental Protection (DEP) will issue a report on January 1, 2003 that is required under *An Act to Phase Out the Availability of Mercury Added Products*, PL 2001, c. 620. The report will include a summary of mercury product data and a comprehensive strategy to reduce the mercury content of the products.

To assist in gathering information for this report, the Maine DEP commissioned the Lowell Center for Sustainable Production (LCSP) to conduct a study of alternatives to mercury containing products. This report summarizes the findings of the LCSP investigation.

The LCSP develops, studies and promotes environmentally sound systems of production, healthy work environments, and economically viable work organizations. The LCSP is based at the University of Massachusetts Lowell, where it works closely with the Massachusetts Toxics Use Reduction Institute (TURI) and the Department of Work Environment.

Because of its persistent, bioaccumulative and toxic nature, the management of mercury presents a hazard to the environment that should be addressed and minimized wherever feasible. Reducing mercury exposure can be accomplished by source reduction, by minimizing uses that disperse the material into the environment, and by diverting and reclaiming any mercury containing products prior to disposal. While regulations on use and waste diversion strategies are necessary, an effective and economically efficient strategy would be, wherever possible, to substitute mercury containing products with products containing less hazardous materials.

The objective of this study is to accomplish the following:

- Investigate mercury product information in the public domain.
- Identify priority products for investigating non-mercury alternatives.

- Identify non-mercury alternatives to the products identified.
- Conduct a qualitative evaluation of viable alternatives, including their cost and performance.

The research methodology undertaken to complete this study included:

- Telephone communication and meetings with Northeast Waste Management Officials' Association (NEWMOA) and Maine DEP personnel were conducted to understand the information received on mercury-containing products.
- An internet search was conducted to obtain data and understand the flow of mercury associated with products. This data provided a reference against which the NEWMOA and DEP mercury product submissions could be compared.
- Telephone interviews of mercury reduction experts were held to gain insight on their perspectives and to reinforce or challenge conclusions drawn by the researchers.
- An internet search and phone interviews were conducted to identify the function of mercury in products and to identify alternatives for mercury containing components and products.
- Telephone interviews were conducted with manufacturers to develop information on the alternatives, their applications, and their advantages and disadvantages.
- Interviews were held with users of medical products to understand what made a product preferable from the user's perspective.
- A search and review of literature in the public domain was conducted to provide data on mercury products and components and their performance.

## 2.0 Mercury Notification Data Review

The Maine statutes (see 38 MRSA § 1661-A) prohibit the sale of mercury-added products unless the manufacturer has provided written notification disclosing the amount and purpose of the mercury. New Hampshire, Rhode Island, and Connecticut have passed similar mercury notification laws.

In February 2002, the Interstate Mercury Education and Reduction Clearinghouse (IMERC) was formed. IMERC is an umbrella organization designed to assist the eight Northeast states in their implementation of mercury reduction laws and programs aimed at getting mercury out of consumer products, the waste stream, and the environment.

Launched under the auspices of the Northeast Waste Management Officials' Association (NEWMOA), IMERC has coordinated regional mercury reduction efforts and assisted state environmental agencies in developing and implementing specific legislation and programs for manufacturer notification, labeling, collection, and eventual phase-out of products that contain mercury.

IMERC has consolidated the mercury notification information obtained by the individual states prior to February 2002, and has served as the clearinghouse for all mercury notification information received since that time for Maine, New Hampshire, Rhode Island, and Connecticut. IMERC has used two notification

*Total Mercury in all Mercury Added Products Form:* This form requests manufacturer contact information, as well as total amount of mercury in all units sold in the United States for a particular product.

Approximately 700 letters in December 2001 and 1,100 letters in June 2002 were sent to manufacturers to request such information for mercury containing products. IMERC has reviewed the received mercury notification forms for adherence to the requested information. The majority of notification forms received require follow-up communications with the manufacturer to address missing or erroneous data. Once the review of the notification forms has been finished and has been considered complete, the information is entered into an IMERC electronic database.

For this study, the mercury notification information in the IMERC electronic database was reviewed in June and July of 2002. At that time, the database contained notification information for seventy-six manufacturers reporting 390 mercury containing products. The total amount of mercury for all units sold in the United States was available for ninety-eight of these products. Substantially more mercury data has been provided to IMERC since the LCSP completed its review.

The following table illustrates the distribution of IMERC data for the various product types:

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