

Eliminating Mercury in Health Care

A workbook to identify safer alternatives



Guidance for designing, implementing, and
evaluating mercury reduction in your hospital



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This document and templates for selected tools are available at: <http://www.sustainableproduction.org>

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Introduction & Overview

Introduction

Mercury is a persistent, bioaccumulative and toxic material (PBT). Exposure to elemental mercury in hospitals from spills or broken equipment, such as mercury-containing fever thermometers and blood pressure cuffs, is a serious problem for employees, patients and visitors. Waste mercury is also a concern for the global environment, as it can easily escape through the air, water and solid waste streams. Exposure to mercury is preventable through the careful choice of non-mercury medical products and through the methodical control of equipment or devices where mercury cannot be easily eliminated.

Another important aspect is that in many countries and regions, mercury is regulated by occupational and environmental policies including national laws, standards, rules and norms. Even if your location does not have mercury regulations at present, it is likely to in the future as international mercury reduction efforts expand further.

This workbook will guide you through a systematic, hospital-wide approach for education, assessment, and improvement of mercury-containing products and the practices related to mercury in your institution. It is based on a model of continuous improvement so that the workbook is appropriate for healthcare institutions at all different levels of experience in their mercury reduction efforts.

Methodology

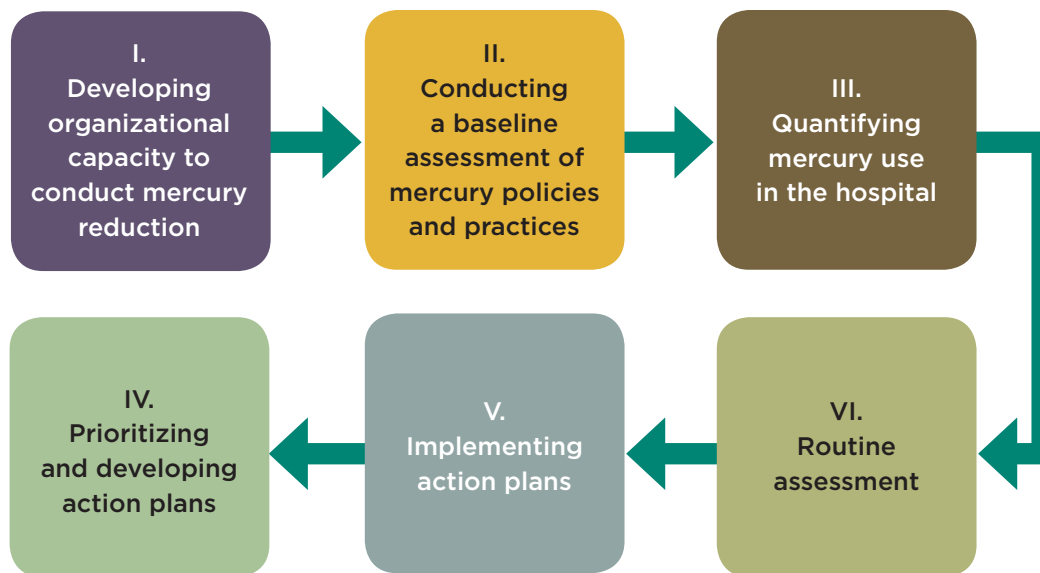
The workbook uses a participatory strategy for mercury reduction and alternatives assessment that integrates environmental and human safety and health. This strategy is called Pollution Prevention and Occupational Safety and Health (P²OSH). The term “participatory” means is that it actively engages all groups that are affected by a change.

The strategy recognizes that a rigid focus on one aspect of a problem, such as addressing only the environmental characteristic of a mercury product or practice, will not generate solutions that are sustainable over the long term. Instead, a successful mercury reduction program will consider how all the pieces come together: the hospital’s policies and practices, environmental characteristics of products, and how products are selected, used, maintained and disposed of in the hospital. The procurers and users of mercury devices are key players, to ensure that the necessary functions and pertinent characteristics are satisfied with any replacement products.

The methodology described in this workbook will help all hospitals, both those who are beginning to reduce the use of mercury and those who are close to virtual elimination in their facilities. This methodology will be useful no matter how far along a hospital is in their mercury reduction efforts; therefore the words “reduction” and “elimination” are interchangeable.

Based on a successfully pilot of this workbook in hospitals in Ecuador and Mexico, the workbook focuses on organizational steps that lead to replacing mercury in healthcare with safer alternatives. Each organizational step contains a tool kit that provides guidance and information as well as examples to facilitate the implementation of a mercury reduction program in the hospital.

The workbook will take you through the following series of logical organizational steps:



I. Developing organizational capacity to conduct mercury reduction

Establishing a working group to reduce mercury use in hospital and tools for training sessions

This first step provides guidance to organize and conduct training for staff members who will be in charge of a mercury reduction project. It includes examples of training matrices, specific tools, sample PowerPoint presentations, and online (internet) video materials that can be used and adapted for the needs of a particular facility or department.

II. Conducting a baseline assessment of mercury policies and practices

Evaluating mercury-related policies and practices in the hospital

In the second step, the workbook provides guidance for a baseline assessment of the institution's mercury policies and practices. The tools and forms in this step are useful for recording current practices as well as guiding next steps.

III. Quantifying mercury use in the hospital

Quantifying the amounts and locations of mercury in the hospital

The third step in the workbook facilitates the process of quantifying the mercury in the hospital. It includes a series of forms and guidance to locate and inventory the existing amounts of mercury throughout the hospital.

IV. Prioritizing and developing action plans

Prioritizing potential efforts to reduce the use of mercury in the hospital

The fourth step focuses on how to prioritize potential projects for reducing the use of mercury. The guidance and tools in this step will help the mercury reduction team think systematically about the different options and clarify which projects are of interest and likely to succeed.

V. Implementing action plans

Planning and carrying out projects that will reduce mercury in the hospital

The fifth step of the workbook provides a systematic approach and tools for evaluating and implementing alternative products and practices that will reduce the use of mercury. Utilizing this process insures that solutions will be acceptable to those affected by the change and will perform the desired function. The process also provides the framework for continuous improvement when newer, better products and options become available.

VI. Routine assessment

Periodic review of mercury-free alternatives selected and in use

The sixth part of this manual is focused on periodically monitoring the mercury reduction program. It will help determine the effectiveness of the program, develop next steps, and insure that mercury products or processes do not slip back into use.

Special topics

Various tools and information that may be useful for mercury management in the hospital

The last section of the workbook introduces a tools and resources for reducing mercury use in hospitals and dental clinics. This includes spill cleanup resources, mercury hygiene guidance, and recommendations for the management of mercury waste.

How to Use the Workbook

The workbook contains a step-by-step plan to help you develop safe practices related to mercury, systematically remove mercury-containing products from your facility, carefully manage mercury devices that cannot be immediately replaced, and monitor the progress of the effort. The information in the workbook sections can be used to

- Plan, launch and maintain a new mercury reduction program
- Enhance or build upon current activities in an ongoing program

The principles may also be applied to other pollution prevention or safety & health activities in your facility.

For those responsible for a hospital-wide mercury reduction effort, the workbook lays out a comprehensive strategy for the program. For teams working on a specific element of the hospital's program, each workbook section is designed so that it can be used as a stand-alone unit. The tools and factsheets included in the appendices complement the workbook sections and provide guidance.

Target Audience

The audience for this information includes hospital administrators, department managers, clinicians, hospital staff, members of hospital committees and work teams, and individuals who are involved in mercury handling. Different sections of the workbook will be useful to different members of the hospital team, and sample forms and worksheets may be adapted to your specific needs.

Mercury Reduction Program in Hospitals: The Experience in Ecuador and in Mexico

Mercury Reduction Program in Hospitals: The Experience in Ecuador

From the outset, the mercury reduction project received significant support from the Ministry of Public Health and the Ministry of Environment of Ecuador. The project started with two hospitals in the city of Quito, each of which agreed to develop a pilot program to reduce mercury in their institution. Later, a third hospital in the city of Quito and a fourth hospital in the city of Guayaquil joined in the mercury reduction effort. These mercury reduction programs could not have been accomplished without the committed participation of hospital managers and staff. All four hospitals shared their experiences and helped identify useful tools for managers and health personnel, included in this workbook.

In the original two hospitals in Quito, programs were developed for a mercury reduction pilot using the methodology contained in the workbook. Their experiences and discussions during the execution of the project served to refine the methodology, to raise new perspectives and awareness about the risks of mercury, identify common sources of mercury, find alternatives and solutions, and especially to highlight the power of staff to implement change and protect the health of employees, patients and the environment in general.

Each pilot project was launched, using the organizational steps in this workbook, under the guidance of representatives of IFA and the University of Massachusetts Lowell. In each hospital, the project began with a training session and the formation of a mercury reduction team. These hospital teams were instrumental for overseeing the identification of mercury in the hospital, prioritizing reduction efforts and evaluating alternative products and processes.

A walk-through assessment of the hospitals and their departments was important for understanding the work processes, staff involvement and interactions, and opportunities for finding solutions. It should be noted that during the visits and interviews with health personnel, it became apparent that mercury thermometers are used in most of the hospitals' services and departments. Thermometer breakage is an ongoing problem that poses a threat to the health of hospital staff and patients. Although mercury spills frequently occurred, there were no policies or established protocols for spill clean up or to prevent exposure to mercury vapors. Findings of the walk-through assessment were discussed in subsequent training sessions.

During visits to the hospital areas, we found digital thermometers on site. Although several hundred digital thermometers were stored in a hospital warehouse, they were not in use and the clinical staff was unaware of their availability. This is important in several ways: First, the existence of thermometers shows that it is possible to have alternatives to mercury thermometers, regardless of cost (which is still very high). In addition, it shows that the purchase of mercury-free devices alone does not insure they will be used. For successful adoption of

new products and practices, health personnel (supervisors, medical assistants and nurses) must participate in the careful evaluation of alternatives. These clinicians understand the conditions under which the devices are used and must be confident that the devices are reliable and can uphold the hospital's delivery of high quality health services. Use of the participatory methodology with its ongoing evaluation of alternatives, presented in this workbook, was instrumental for mercury reduction in hospitals of Ecuador.

In the case of blood pressure cuffs, mercury sphygmomanometers (typically called "tensiometers" in Ecuador) were still mounted on the walls in some areas, but newer non-mercury tensiometers were also in use. This reflected in part that non-mercury tensiometers are cost comparable and easy to maintain. Mercury tensiometer maintenance poses risks to health and the environment, as it includes refilling the glass column with liquid mercury. This activity is unacceptable; it not only exposes maintenance workers to mercury, but it also requires the purchase of liquid mercury despite knowing that there is no mechanism for safe handling or disposal of mercury waste. Since the mercury project began, the hospital has stopped re-filling mercury tensiometers.

Walk-through assessments revealed that mercury amalgams are still used in the dental clinics, either through the mixture of bulk liquid mercury and metal powders or single-use mercury-containing amalgam capsules. The use of resins as a restorative material, an alternative to mercury, was also observed in the clinics.

In storage areas, it was surprising to find large quantities of liquid mercury which were reported to be donations from private foundations for use in the dental clinic. No one knew the source foundation. A review of the product labels revealed that the origin was unclear. The company and address identified on the labels did not appear to exist and could not be verified, which also prevented return of the products. The assessment revealed that large quantities of mercury stored in warehouses are a significant problem for hospitals. Likewise, the transfer of toxic substances to the hospital under the guise of humanitarian donations raises concerns.

Quantifying the baseline inventory of mercury in the hospital allowed prioritizing targets for mercury reduction. Thermometers and liquid mercury (purchased and donated) were identified as two major sources of mercury warranting attention. Alternatives for mercury thermometers were identified, evaluated, and implemented in clinical areas. Health personnel strongly supported the effort to introduce mercury-free products because they saw it as a means to protect their own health and provide better care to patients. Many of the products evaluated are now routinely used in the hospitals.

The methods proposed in the workbook, incorporating the Pollution Prevention and Occupational Safety and Health model (P²OSH), have provided a framework for systematically reducing mercury in hospitals in Ecuador. This protects the health of hospital personnel and patients and the environment as a whole. The methodology was demonstrated to be successful in the two initial pilot projects in Quito hospitals. Two additional hospitals, in Quito and Guayaquil, also successfully launched mercury reduction projects with the assistance of IFA and the University of Massachusetts Lowell, using the workbook and leveraging the success of the first two hospitals. This is an important demonstration of this workbook as a valid instrument for hospitals to advance their own mercury reduction programs.

Much effort is needed to achieve mercury-free hospitals in Ecuador. No doubt this workbook is a powerful starting point for hospitals to take action and for encouraging others in society to identify safer alternatives to toxic mercury.

Mercury Reduction Program in Hospitals: The Experience in Mexico

This mercury reduction program began in late 2009 with two hospitals in Hermosillo, Sonora Mexico, followed by a third hospital in the same city that joined the program in September 2010. The three institutions are public tertiary health hospitals, with 206 beds, 215 beds and 145 beds respectively, and they serve as teaching hospitals for medical and nursing students. The activities took place under the auspices of cooperative agreements between the participating medical institutions and the University of Sonora (UNISON). From the outset, this project received strong support from the Ministry of Health of the State of Sonora (SS) and the Ministry of Environment and Natural Resources (SEMARNAT). The success of the program strongly reflects the interest, support and hard work of managers and staff in the pilot hospitals.

An important factor in the hospitals' successful reduction of mercury was collaboration and international support, through technical assistance and sharing of experience from hospitals in the United States and Ecuador, as well as the involvement of institutions of higher education. The participation of undergraduate and graduate students from local universities in Mexico offered the dual benefit of training the next generation of occupational health professionals while simultaneously providing resources to the hospitals for their mercury reduction programs.

The methodology proposed in this manual was applied in the three hospitals. It is noteworthy that the hospitals had previously begun to reduce mercury in their facilities and had made some progress. Our project offered the opportunity to help identify what mercury products were still being purchased and used, such as thermometers, sphygmomanometers, and other mercury-containing devices, and to assist with the evaluation and implementation of alternatives. Therefore this project provided the hospitals an opportunity to strengthen and combine efforts for mercury reduction, using a systematic methodology. The following is a brief overview of this methodology including findings, challenges, and major accomplishments.

Developing Capacity in the Organization

An early step for each hospital was the formation of working groups, as a means of developing capacity for mercury reduction and dividing up the work. The working groups included the head of each work area that used or was integral to the use or handling of mercury in the hospitals, as well as a person appointed by the hospital director to serve as liaison between the working group and our research team. Liaisons for different working groups included the director of education, the medical director, and a hospital assistant.

The project was launched with an official ceremony. The presence of executives from the SEMARNAT, the State of Sonora, the Ministry of Labor and Social Welfare, the University of Sonora, the participating hospitals, as well as leading environmentalists gave evidence of the relevance and support for this project. This formal and well-attended ceremony was instrumental to the hospitals' commitment and the esteem of the project.

Annual training sessions were an important means of communicating progress and reinforcing commitment to mercury reduction. In these meetings, staff members reported on SEMARNAT policy, regulatory trends, and progress in mercury reduction for the protection of health and the environment. The inclusion of environmental authorities in these sessions provided a further demonstration of support for the project and its objectives.

In the future, we will invite the Federal Commission for Protection against Health Risks (COFEPRIS) of the State of Sonora to participate in training sessions. In 2011, COFEPRIS initiated a health promotion project for reducing occupational exposure to mercury in dental practices, through awareness talks aimed at professionals in the industry. The presence and potential exposure to mercury in dental service was an important finding on our inspection tours in hospitals.

A significant challenge during the course of this work was the constant turnover of staff and administration in the hospitals. Because personnel changes occur frequently, it is essential that all training sessions include basic information for new employees on the toxic effects of mercury, the importance of recognizing sources of mercury, and the importance of managing waste in an environmentally appropriate manner. Our training sessions at the end of the first and second years of the project included a progress report on mercury-reduction policies and practices, the inventory of mercury, and an update on the evaluation of mercury-free alternative products and processes. This showed the progress being made by the working groups and reinforced the support of senior management. An important strategy in presenting the findings of the inspections was to present them as opportunities for improving mercury management within the facility.

One limitation during the capacity-building stage was finding the time for hospital staff to attend training sessions. There is a heavy workload in the hospitals and some staff members work more than one job, limiting their availability. For the future, we must consider holding several training sessions at different times to reach all the staff.

Baseline Assessment of Mercury Inventory, Policies and Practices

Walk-through assessments and taking inventory of mercury-containing products were key to knowing and communicating the presence of mercury throughout the hospital. The systematic manner in which this was done revealed sources of mercury; hospital purchasing practices; use, storage, and disposal of mercury; staff training; and spill control measures. This also established a baseline for measuring progress of mercury reduction and elimination in the workplace, from that point forward. The participation of staff in the work groups gave them first-hand knowledge and real insight into the problem of mercury in their departments. Two areas became newly evident as critical priorities: reducing exposure to mercury in dental clinics and implementation of a state plan for the environmentally-sound management of mercury waste.

A visible gap in the mercury inventory is the potential for mercury to be hidden in laboratory products. This reflects the wide variety of substances and chemicals used and the lack of information about their composition and ingredients. Laboratory chemicals warrant further examination and consultation with suppliers and manufacturers.

One of the hospital working groups was assigned to search for existing mercury reduction/elimination policies in the hospital and to develop new policies where none existed. To insure they knew what to look for, the team was given examples of policies implemented in other hospitals. The examples were an important source of support for their activities and served as models for drafting new policies.

Prioritization of Efforts to Reduce Mercury and to Develop and Implement Action Plans

Sources of mercury were ranked in terms of mercury content, potential impact on health and the environment, ease of replacement, and cost. This led to prioritizing replacement of mercury thermometers, followed by sphygmomanometers.

Digital fever thermometers and aneroid sphygmomanometers were commercially available in the region as alternatives to the mercury-containing devices. The replacement process has taken place gradually. Most of the mercury fever thermometers have been eliminated and aneroid sphygmomanometers are systematically being phased in to replace the mercury sphygmomanometers.

Both digital thermometers and aneroid sphygmomanometers were well received by the hospital staff. For the initial evaluation of the new devices, the alternatives assessment tools in this manual were used to obtain user feedback. Results of the initial evaluation were favorable. However, late in the second year, there were reports of aneroid sphygmomanometer pedestals breaking. (The pedestal is the wheeled-base on which the device is

mounted.) This was particularly evident in the emergency area where activities require the use of more robust products. As a result, the recommendation was made to switch to another brand of aneroid sphygmomanometer with a more durable base.

Routine Evaluation

A mercury inventory conducted one year after the project began revealed significant progress in the reduction of mercury associated with thermometers and sphygmomanometers. Purchasing records also showed clear evidence of progress; the only fever thermometers entering the hospital via purchasing were digital thermometers.

At this time, mercury elimination in hospitals is constrained by economic resources and the lack of an official federal government policy pertaining to mercury. The federal government's leadership is critical for mercury reduction. Government support for eliminating the use of mercury in the health sector should address purchasing criteria to prevent the acquisition of mercury, allocation of resources for procurement of mercury-free alternatives, and assistance with the handling of waste mercury. With this support, hospitals will move forward more quickly and may even become mercury free.

An important consideration is the environmentally sound management of waste mercury. The implementation of a state management plan for mercury, in accordance with the provisions of the General Law on the Prevention and Waste Management, is in process and will be essential to mercury reduction efforts.

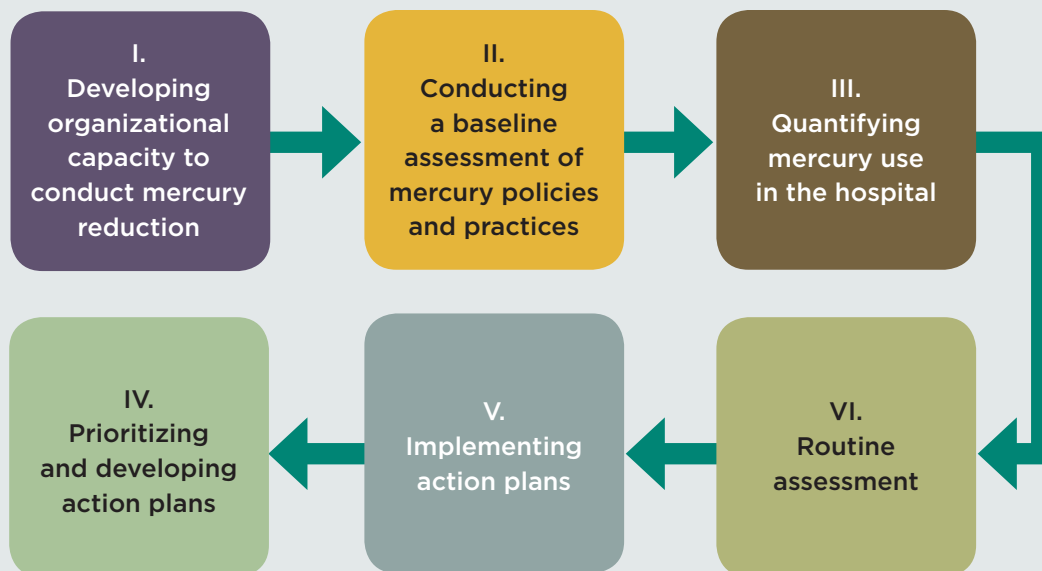
General Comments

This manual includes successful strategies to prevent pollution and protect health. The methodology outlined in the manual was piloted and refined in the hospitals and is enriched by the contributions of the hospital staff. The hands-on development process has resulted in this tool for hospitals which will facilitate elimination of mercury in the health sector.

It is worth noting that the methodology outlined in this manual has the potential for being more widely applied. The process can be adapted and used in other workplaces where mercury is present, or it can be used to address substances other than mercury that are potentially harmful to health and the environment.

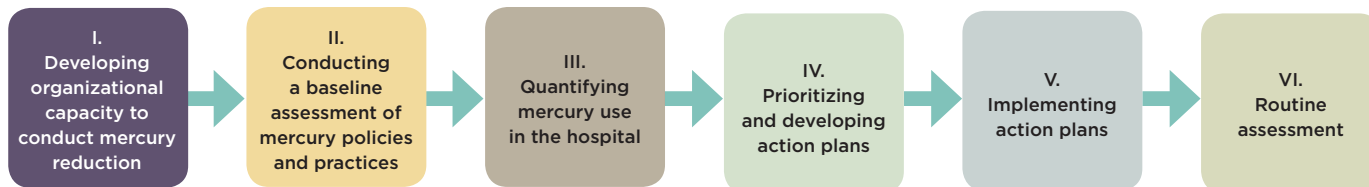
Organizational Steps

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ORGANIZATIONAL STEP I.

Developing organizational capacity: guidance to training and implementation



Key points

- Establish a multidisciplinary leadership team for mercury reduction
- Launch the project within the hospital
- Create an institution-wide program
- Involve senior-level management

Toolkit for this Activity

- Matrix of training and review meetings for mercury reduction (Tool I-1)
- Guidance notes for mercury reduction training – government and non-government stakeholders (Tool I-2)
- Guidance notes for mercury reduction training – hospital staff (Tool I-3)
- Sample PowerPoint presentation #1 (Tool I-4)
- Link to video: Bowling Green State University Mercury Vapor Experiment (Tool I-5)

What is organizational capacity?

It is the infrastructure or the basic, underlying framework needed to carry out the mercury reduction program in your institution. This section provides the guidance for commencing the program.

The proposed model is an institution-wide program in which the responsibility is held jointly by members of a leadership team focused on mercury reduction. Representation of staff from across disciplines ensures that needed resources, expertise and perspectives are involved. The responsibility and authority for program coordination should be assigned to an individual with appropriate organizational and leadership skills. Representation from senior-level management is important to provide visible leadership and demonstrate the administration's commitment to the program. The team should also include persons from clinical and laboratory department who use mercury devices, as well as staff members with expertise in infection control, employee training, environmental services, procurement/materials management, and waste handling.

Launch the Project

One of the first steps in a mercury reduction effort is to launch the project within the hospital. This is typically one or several meetings with hospital employees to communicate the hospital's commitment to mercury reduction. In some cases, it will be combined with a broader commitment to mercury reduction and will include speakers from outside the hospital, such as a regional or international program.

The launch meeting will convey the following points:

- Welcome
- Overview of the meeting's purpose and agenda
- The problem with mercury
- The hospital's commitment to mercury reduction
- Endorsement of the project by speakers within and/or external to the hospital
- Next steps

After the launch meeting has taken place, the management-endorsed Mercury Reduction Leadership Team will be formed and will take responsibility for the mercury reduction project.

Setting up a Mercury Reduction Working Group

A mercury reduction working group is comprised of individuals from different areas of the hospital working together to eliminate mercury and to foster a culture of continuous improvement. The team leader should be someone with management responsibility who can ensure that the project is fully implemented. The team should include representation from all relevant departments and people who have a passion for and understanding of the focus on mercury reduction. This team is responsible for managing the mercury reduction project within the hospital by overseeing the execution of Steps II-VI in this manual.

Why is a diverse team beneficial?

- A facility-wide team that is looking at the whole picture can spot opportunities and can anticipate and provide effective solutions to obstacles.
- Diverse perspectives of members from different departments can challenge current practices and promote innovative solutions. A team can work together to create pilot projects.
- If each department is part of the process, there will be greater buy-in to changes in practices and products
- A dedicated team can motivate the purchasing and other departments to implement new products and practices.

Examples of Potential Participants in a Mercury Reduction Working Group

Potential Representatives	Contributions/Strengths
Administration/Senior Management (<i>Mandatory</i>)	<ul style="list-style-type: none"> Communicate the organization's commitment to elimination of mercury Ensure personnel and fiscal resources are available to meet program goals
Clinical staff and Laboratory services staff	<ul style="list-style-type: none"> Provide insight into current practices and use of mercury Participate in pilot evaluations of proposed products and offer feedback on implications of new products or practices Identify key product criteria Serve as conduit between the team and clinicians/lab staff to facilitate communication, ensure buy-in and assist with training staff on new products/practices
Financial services	<ul style="list-style-type: none"> Assist with financial justification for alternative products and practices
Purchasing/procurement, Materials management	<ul style="list-style-type: none"> Help identify alternative products and manufacturers Provide cost data for making informed decisions.
Housekeeping, Waste management	<ul style="list-style-type: none"> Provide insight into and ensure safe control of waste mercury Assist with evaluation and implications of alternative products/practices
Environmental Services	<ul style="list-style-type: none"> Provide insight into and ensure safe control of waste mercury Assess the environmental implications of proposed products
Operations (Physical plant, security, maintenance, operations)	<ul style="list-style-type: none"> Provide insight into non-medical mercury use in the physical plant Assist with proper management of mercury in the plant
Infection control	<ul style="list-style-type: none"> Ensure that alternative products/practices meet infection control needs
Food services, Laundry	<ul style="list-style-type: none"> Participate in controlling mercury in equipment (e.g. freezer thermometers, candy thermometers, flame or temperature sensors in ovens, tilt/position switches in freezers or laundry washers & dryers)
Communications/ Public relations	<ul style="list-style-type: none"> Communicate to employees, patients, visitors, and local community about the hospital's commitment to a healthy environment through the reduction of mercury Promote successes Assist with educational outreach

Although the leadership team will include a core group, staff from additional areas might be invited to participate in a particular discussion or as part of a subgroup working on a specific task.

Tool Kit

The following tools are resources for achieving the objectives of this step. These tools have been used in hospitals in the United States, Ecuador and Mexico and may be used for your hospital's mercury reduction program.

- **Tool I-1:** Matrix of training and review meetings for the mercury reduction project
This tool provides guidance for planning and carrying out effective education sessions.
- **Tool I-2:** Guidance notes for mercury reduction training workshop—Audience: Hospital staff
When planning training workshops sessions for hospital staff and mercury reduction team members, it is important to have a training outline to guide the session. This tool is an example of training notes used during the project.
- **Tool I-3:** Guidance notes for mercury reduction training workshop—
Audience: government and non-government stakeholders.
While training sessions are essential for health personnel, it is also important to engage and train allies to support mercury reduction efforts in the hospital. Government agencies and NGOs are important partners in this regard. This tool is an example of training notes used during the project.
- **Tool I-4:** Power Point Presentation Powerpoint to be added
This tool contains presentations used during the project's training sessions. The material can be used as a model for creating new presentations tailored to other hospitals.
- **Tool I-5:** Bowling Green State University—Mercury Vapor Experiment
Link to online video: During the training sesión, it is very important to have examples and visuals that send a message about mercury and its properties. This tool provides a link to a video that can be shown during the training to show how rapidly mercury evaporates at room temperature.

Tool Kit

Tool I-1: Matrix of Training & Review Meetings for the Mercury Reduction Project

Example of organization objectives and training sessions

Guidelines for planning and implementing effective education sessions in the hospital

		Topics to cover →								
Type of Meeting	Purpose of Meeting	Welcome & introductions	Participant assessment*	Mercury overview	Project or topic overview	Highlights of Accomplishments & obstacles	In-depth presentation on topic of interest	Evaluation of past year	Next steps	Participant assessment
Project launch	Formal launch of a mercury reduction project in your hospital. May include guests and dignitaries from government, partner NGOs, and other collaborators (e.g. university). Typically ceremonial as well as educational.	✓	✓	✓	✓				✓	✓
Initial employee education session	Employee education session featuring basic introduction to mercury & its drawbacks, introduction to the hospital's plans for mercury reduction, and action plans/timing for addressing mercury in the hospital.	✓	✓		✓				✓	✓
Continuing education session	In-depth focus on a particular topic that is part of the hospital's mercury reduction effort. Examples: conducting a mercury inventory, mercury spill clean up, mercury waste disposal, alternatives to mercury devices, introduction to <i>The ABCs of Mercury Reduction</i> (workbook), developing mercury policies for the hospital.	✓	✓		✓	✓	✓		✓	✓
Year end review	Year end review of progress, barriers, and next steps (may be held at intervals other than yearly)	✓	✓	✓	✓	✓		✓	✓	✓

* "Participant assessment" is a short evaluation of participant knowledge on the meeting topic, measured once at the start of the meeting and a second time at the end of the presentation

Year End Review Meeting

Example of organization objectives and training sessions

Option 1: Single meeting (longer in duration)

Time	Session (single session)	
8:30–9:00	Registration, opening, short participant assessment	Led by Facilitator and hospital administrator
9:00–10:00	Technical training session: discuss specific mercury reduction topic(s) that hospital considers a priority	
10:00–11:00	Review of the draft Mercury Reduction Workbook	
11:00–11:15	Break	
11:15–12:00	Discussion on the hospital's written mercury reduction policy	
12:00–13:00	Evaluation of the project's first year. Identification of the project topics for Yr 2.	
13:00–13:15	Closing remarks and post-training assessment	Led by facilitator and hospital representative

Option 2: Two shorter meetings

Time	Session 1	
8:30–9:00	Registration, opening, short participant assessment	Led by Facilitator and hospital administrator
9:00–10:00	Technical training session: discuss specific mercury reduction topic(s) that hospital considers a priority	
10:00–11:00	Review of the draft Mercury Reduction Workbook	
11:00–11:15	Closing remarks and post-training assessment	Led by facilitator and hospital representative
Time	Session 2	
8:45–9:00	Registration, opening, and short participant assessment	Led by Facilitator and hospital administrator
9:00–10:00	Discussion on the hospital's written mercury reduction policy	
10:00–11:00	Devaluation of the project's first year	
11:00–11:15	Closing remarks and final participant assessment	Led by facilitator and hospital representative

Tool I-2: Guidance notes for training on mercury reduction

Audience: Hospital staff

Objectives

The purpose of the mercury reduction training in the participating hospitals includes:

- Formally launch the project work with the hospital(s);
- Insure that the hospital staff members who will be part of the project understand:
 - the basic concepts of mercury reduction in healthcare,
 - the activities and expected outcomes of the project,
- Discuss appropriate approaches and any challenges anticipated in the Project's activities,
- Agree on tasks to be carried out in the hospital and the due dates.

Organizers

The training in each hospital will be organized jointly by:

- UMASS Lowell's Sustainable Hospitals Program
- The facilitating institute of Ecuador: the Institute for the Development of Production and the Work Environment (IFA), Quito, Ecuador
- The facilitating institute of Mexico: the Department of Chemical and Biological Sciences, the University of Hermosillo, Hermosillo, Sonora, Mexico
- Each participating hospital of Ecuador and Mexico.
- The facilitating institutes will select the venue that is most convenient to the hospital staff, for example, within the participating hospital's training room.

Participants

The participants will include the frontline staff and department managers of the participating hospitals. In consultation with the hospital administrators/directors, the facilitators will identify and invite the most appropriate individuals.

Model program

A model program outline follows. Facilitators can adapt this proposal for their own training agenda.

The first session. Each training event starts with a welcome by the UML representative, the facilitators and a director/administrator of the participating hospital.

Participant assessment. A brief baseline assessment of each participant's knowledge about mercury and its use in the hospital will be carried out.

Refreshment break. The project will provide a small budget for refreshments and snacks.

The second session. The UML representative and facilitators will give a background presentation on the importance of mercury reduction in healthcare, existing international efforts, and specific aims of the UML-EPA Project.

The third session. A hospital representative will give an overview of existing healthcare-related mercury reduction efforts (past and present) in Ecuador/ Mexico. This presentation will highlight the following: what healthcare-related efforts have been or are being carried out and by whom, achievements, and lessons learned from these efforts (i.e. strengths and weaknesses).

The fourth session. This will be an interactive session with the audience—moderated by the UML representative and the facilitators—to describe the project's activities and specific areas that will be covered. The purpose of

this session is to: (i) insure that the key staff understand what outcomes are expected, (ii) allow staff to suggest the best approaches and note the challenges, and (iii) clarify the responsibilities of the participants in the project.

The fifth session. Based on the notes of the 4th session, next steps and future action items will be listed on a flip chart.

Final participant assessment. The same assessment participants completed at the beginning of the training session will be repeated, to measure the increase in their knowledge about mercury over the course of this training session.

Closing remarks. A representative of the participating hospital, the UML representative, and the facilitators will thank the participants and remind them about the next important steps.

Sample Training Agenda

Time	Session
8:30–9:00	Registration, opening welcomes, and introduction: <ul style="list-style-type: none"> • Representative of University of Massachusetts Lowell (UML) • Facilitators • Director or Hospital Administrator
9:00–9:15	Short participant assessment
9:15–9:30	Break
9:30–10:15	Background to international mercury reduction work and the importance of mercury reduction in the healthcare sector (45 min) <ul style="list-style-type: none"> • Representative of University of Massachusetts Lowell • Facilitator
10:15–11:00	Hospital presentation on mercury sources by a selected hospital representative
11:00–12:30	Interactive session on the upcoming project tasks (2 hrs) <ul style="list-style-type: none"> • Rudimentary assessment and review of plans • Inventory • Implementing one alternative • Posts-implementation assessment
12:30–12:45	Summary of the next steps, action items.
12:45–1:00	Final participant assessment.
1:00	Closing remarks <ul style="list-style-type: none"> • UML representative • Facilitator • Hospital representative

Tool I-3: Guidance notes for training on mercury reduction

Audience: Government and non-government stakeholders

Objectives

The purpose of the mercury reduction training workshop is to:

- Formally launch the University of Massachusetts Lowell Mercury Project in Mexico and Ecuador,
- Ensure the support of government agencies and non-government organization stakeholders interested in the project.
- Promote national and regional policies on mercury reduction in healthcare.
- Produce a workshop report to be used as a mechanism to generate regional and national mercury reduction policies, programs, and other initiatives.
- Promote the project approach for other opportunities in healthcare facilities.

Organizers

The University of Massachusetts Lowell's Sustainable Hospitals Program (SHP) will organize the two training workshops (one in Mexico and one in Ecuador) jointly with the facilitating institutes of each country:

- The Institute for the Development of Production and the Work Environment (IFA), Quito, Ecuador.
- The Department of Chemical and Biological Sciences, the University of Sonora, Hermosillo, Sonora, Mexico.

These facilitators will select the most suitable training workshop venue within their own premises.

Participants

In the training workshop, the participating organizations may include representatives, for example, from the following organizations:

- Key government agencies administering public health, environmental protection, and occupational safety and health policies (e.g. Ministries of Health, Environment, Labor).
- Non-government agencies—with a focus on public health, environmental protection, and OSH research and/or advocacy (e.g. trade unions and other non-profit organizations).
- Universities with significant programs on nursing, public health, occupational safety and health, and environmental protection.
- Healthcare industry representatives (participating hospitals, large healthcare organizations).
- Representatives of appropriate international organizations, if possible (e.g. EPA, World Health Organization, and others).

The facilitators will identify and invite the most appropriate participating organizations to the training workshop.

Model program

A model program outline follows. Facilitators can adapt this proposal for their own training agenda.

The first session. The training workshop starts with welcoming addresses by the UML representative, facilitators, and a prominent Government representative who places importance on the mercury reduction.

Refreshment break. The project will provide a small budget for refreshments and snacks.

Participant assessment. A brief baseline assessment of each participant's knowledge about mercury and its use in healthcare will be carried out.

The second session. The UML representative and facilitators will give a background presentation on the importance of mercury reduction in healthcare, existing international efforts, and specific aims of the mercury reduction project.

The third session. An appropriate government representative will give an overview of existing mercury reduction policies or programs (past and present) in Ecuador/Mexico and actions/ initiatives for the future.

The fourth session. An appropriate representative gives a presentation on past and present existing mercury reduction efforts in healthcare in Ecuador/ Mexico. This presentation will highlight the following: what national and international healthcare-related mercury reduction efforts have been or are being carried out, achievements thus far, and lessons learned from these efforts (strengths and weaknesses).

The fifth session. A guided group work to promote important mercury reduction initiatives will be conducted. The participants will receive a document (no more than 3–5 pages) with thought-provoking illustrations (e.g. texts of existing mercury reduction policies, photos of mercury containing products with non-mercury alternatives, diagrams how mercury enters the environment, statistics/ statements that highlight the magnitude of the global mercury problem (e.g. countries advising to limit the consumption of fish). The selected illustrations will be accompanied with 2–4 closed- and open-ended questions to prompt the participants to think concretely about mercury reduction initiatives: what can they do themselves and in which areas more systemic efforts are needed.

The 6th session. Key points of the workshop discussion and next steps will be compiled, based on a discussion of the participants' answers to questions in the guided group works.


Final participant assessment. The same assessment participants completed at the beginning of the training session will be repeated, to measure the increase in their knowledge about mercury over the course of this training session.

Closing remarks. A government representative, the UML representative, and the facilitators will thank the participants and remind them about the next important steps

Sample Agenda


Time	Session
8:30–9:15	Registration, opening welcomes, and introduction: <ul style="list-style-type: none"> • Representatives of the key Government agencies • Representative of University of Massachusetts Lowell (UML) • Facilitator
9:15–9:30	Break
9:30–9:45	Short participant assessment
9:30–10:15	Background to mercury reduction in healthcare <ul style="list-style-type: none"> • Representative of University of Massachusetts Lowell • Facilitator
10:15–11:00	Presentation on existing national and regional mercury reduction policies by selected government representative
11:00–11:45	Presentation on mercury reduction efforts in healthcare by selected healthcare sector representative
11.45–12.30	Guided group work on mercury reduction policies, programs, and other initiatives
12.30–12.45	Develop statement summarizing key points of the workshop and next steps
12:45–1:00	Final participant assessment.
1:00	Closing remarks <ul style="list-style-type: none"> • Government representative • UML representative • Facilitator

Tool I-4: Power Point Presentation




Sustainable Hospitals Program
University of Massachusetts Lowell

*Catherine Galligan,
Project Manager*



Sustainable Hospitals Program (SHP)

*Reduce occupational and
environmental hazards*




Mercury in Healthcare

- Why is mercury a problem?
- Environmentally Preferable Purchasing
- Alternative products




Sustainable Hospitals Program

- In-hospital and field research
- Speak at meetings and conferences
- Technical literature
- Website (www.sustainableproduction.org/proj.shos.abou.php)



Mercury

- Elemental - medical instruments (liquid & vapor)
- Organic - methyl mercury (liquid)
- Inorganic - mercury salts (solid)



Why Mercury?

- Cohesive fluid
- Sensitive to temperature
- Favorable properties for pressure indication
- Good electrical conductor

So What's the Problem?

Persistent
Bioaccumulative
Toxic

Persistent

- long-lasting
- don't break down easily
- difficult to clean up

Bioaccumulative

- Bioaccumulate in food chains and build up in the body

Toxic

- poisonous

So What's the Problem? Pollution

Mercury contamination from:

- Spills from broken hospital devices
- Air pollution from coal
- Industrial waste

Because of this...

- More regulations and controls

Tool I-4: Power Point Presentation (CONTINUED)

SH Sustainable HOSPITALS

Elemental Mercury

- Easily vaporizes
- Readily taken up from the lungs and delivered to brain and fetus
- Hg^0 oxidized in red blood cells, brain and fetus to Hg^{2+}
- Trapped by virtue of being ionized
- Neurological damage

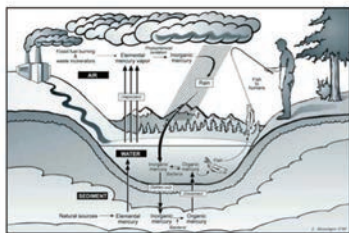
SH Sustainable HOSPITALS

Mercury in Fish

- Mercury enters the environment and collects in lakes and rivers
- Microorganisms convert mercury to methylmercury
- Methylmercury bioaccumulates in fish
- Biomagnification up the food chain

SH Sustainable HOSPITALS

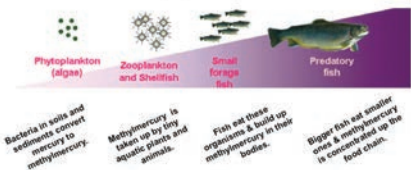
Atmospheric Transport of Mercury



http://www.mercury.utah.gov/atmospheric_transport.htm

SH Sustainable HOSPITALS

Moving up the food chain



This process is called "bioaccumulation"

<http://www.epa.gov/mercury/exposure.html#comp>

SH Sustainable HOSPITALS

Methyl Mercury (Organic)

- Lipid-soluble
- Distributed to central nervous system
- Crosses placenta and concentrates in fat tissue and brain of fetus
- Oxidized to Hg^{2+}
- Neurological damage

SH Sustainable HOSPITALS

Environmentally Preferable Purchasing:

Reducing Waste, Hazards, and Cost At the Source

CREDIT

The following EPP slides are products of the EPP workgroup of the Hospitals for Healthy Environment (HHE) cooperative project between the US EPA and the American Hospitals Association. The Sustainable Hospitals Program was a member of this workgroup.

What is Environmentally Preferable Purchasing?

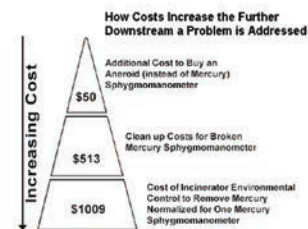
- Selecting products and services whose environmental impacts have been considered and found to be **preferable** to those of comparable alternatives.

What are the Benefits of EPP?

- Reduced impact on the environment from hospital operations
- Healthier environment for patients and employees
- Potential cost savings
- Positive publicity

Why Purchasing?

- Central point for procuring nearly every hospital product or service
- Money changes hands here
- Proactive pollution prevention



Reference: C. Galligan, SHP, using data from Mercury Elimination and Reduction Challenge (MERC), "Mercury in the Health Care Sector: The Cost of Alternative Products", November, 1996, pp 14-24

Keys to EPP Success

- A hospital policy to implement and support environmentally preferable purchasing
- Measurable goals
- Education of staff, patients, GPOs, manufacturers

Example of a Hospital Purchasing Policy


Kaiser Permanente

Tool I-4: Power Point Presentation (CONTINUED)




Kaiser Permanente's RFPs state that Kaiser is:

- Favoring products that cause the least environmental harm
- Partnering with suppliers who demonstrate a commitment to environmental quality
- Collaborating with distributors, manufacturers, and suppliers in designing/refining products to minimize environmental impact




Kaiser asks vendors to submit information on:

- Vendor's Sustainable Practices
- Pollution prevention attributes of products
- How products reduce solid waste
- Mercury content of products




Kaiser EPP Results

- Kaiser no longer procures:
 - Hg thermometers or sphygmomanometers
 - Certain Hg-containing lab products
- Kaiser recycles fluorescent lights
- Kaiser recycles xylene and alcohol
- Kaiser switched from latex to nitrile gloves




Examples of measurable goals

- Reduce purchase of mercury-containing products by 80% by next year.
- Increase purchase of recyclables or reusables by 30% by next fiscal year.
- Reduce packaging waste or total solid waste by 20% in 12 months.



Reducing Mercury With EPP

- Thermometers
- Sphygmomanometers
- Calibrators
- Gastrointestinal tubes
- Lab Chemicals
- Batteries, Lighting, Switches



**Summary:
Mercury in Healthcare**

- Mercury is a problem
- Environmentally Preferable Purchasing is a solution
- Alternative products have a good track record in many U.S. hospitals

Tool I-5: Link to video: Bowling Green State University—Mercury Vapor Experiment

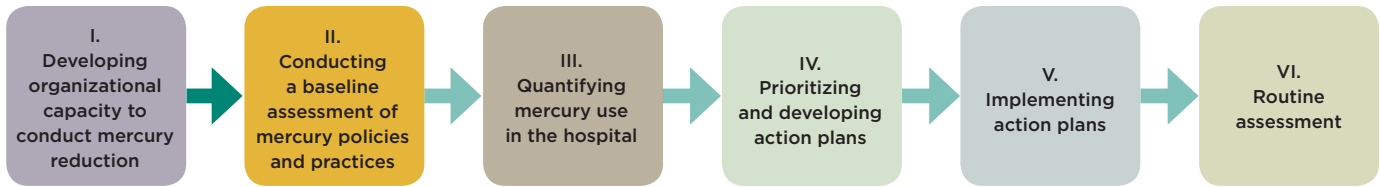
Bowling Green State University (BGSU), Bowling Green, Ohio, USA has produced a very effective video showing the vaporization of mercury. This can be found online at:

<http://wbgustream.bgsu.edu/bgsu/epa/index-fl.html> (accessed February 10, 2013)

In the event that this link does not work in the future, you may find it using an internet search on the phrase “Mercury Vapor Experiment Bowling Green State University”

According to their website, *“This video documents an experiment conducted by BGSU, Ohio EPA, and Rader Environmental Services. Toxic mercury vapors can not be seen with the naked eye. However, mercury vapors can create a shadow when placed between a short-wave ultraviolet light source and a fluorescent background.”*

ORGANIZATIONAL STEP II. Baseline assessment of policies and practices



Key points

- Conduct a baseline assessment of policies and practices related to mercury
- Assess the hospital resources related to mercury or other areas where there might be synergies (e.g. glutaraldehyde elimination, integrated pest management, etc.)
- Consider policies, practices, spill response procedures, green teams, safety committees, EPP efforts, et cetera
- Identify roles in handling & managing mercury

Toolkit resources for this Activity

- Identifying existing mercury policies (Tool II-1)
- Sample mercury policies for hospitals (Tool II-2)
- Worksheet: Walk-through interviews and assessment (Tool II-3)
- Mercury policies and regulations in Ecuador (Tool II-4)
- Mercury policies and regulations in Mexico (Tool II-5)

The “baseline assessment” examines and records the policies or practices in your facility related to mercury at this point in time. It can include, for example, purchasing policies, spill clean-up procedures, what mercury products are used in each department and how they are used, whether mercury devices are sent home with patients, and whether alternative mercury-free products have been tried or are in use.

The baseline assessment serves multiple purposes:

- identifies existing policies/practices that can be built upon
- establishes a ground level from which subsequent progress (or non-progress) can be tracked
- facilitates periodic assessment of the effectiveness of the improvement activities
- provides for positive feedback when new levels are achieved
- shows whether the issues identified in the original baseline still exist
- allows one to see if new issues have emerged that need to be addressed
- allows self-assessment of progress

How to conduct the assessment

The assessment is done by interviewing people in the hospital who are knowledgeable about policies and practices related to mercury. Policies and practices may be written down or they may be informal, such as verbal training on how to clean up a broken thermometer. Tool II-2 includes sample written policies from other hospitals; these examples can help an interviewer know what to look for as they are starting the assessment.

It may be more difficult to tease out the unwritten practices, which become so natural that a worker may not think of them as a policy or practice when asked about it. General questions are likely to reveal the practices, such as:

- Do you use any products that contain mercury? How do these products get selected and procured?
- Do the mercury products ever break? How are the pieces cleaned up?
- Do you have spill kits?
- What is done with the waste mercury from the broken device? Is it wrapped up or put in a container? Can you show me? Who is it given to for disposal?
- Does the same procedure get followed if something breaks at night or during the weekend (off-shift)?
- Who else cleans up or handles mercury? Do they do it the same way?
- Is there anyone else I should talk to about mercury handling in this department?

A key element of the interviews is that the interviewee and his/her department is not blamed or punished for what they say about how mercury is handled. The answers may reveal an urgent need for improving the practices and that is part of the process. It is important to remember that the assessment provides the baseline for improvement and a trusting relationship is essential for an effective and sustainable mercury reduction effort.

In addition to interviewing administrators, this evaluation will include interviews of procurement staff, front line workers, custodians, and others who have a direct link to the use of mercury. Members of the Mercury Reduction Leadership Team can help identify key interviewees and if appropriate, help with scheduling interviews. The tool *“Walk-Through Interviews and Assessment”* (Tool II-3) is designed to capture the information from an interview that asks about written or informal procedures/practices, mercury-containing equipment, and mercury in labs and non-clinical areas.

There are several points worth noting:

- Typically, one worksheet is used for a single department or interviewee.
- The most important step is getting into the working areas of the hospital (clinical areas, labs, procurement office, environmental services, maintenance areas, waste storage) and working with the person in charge or their designee.
- The worksheet is designed to be used with a clipboard, allowing for information to be gathered during a hospital walk-through. Being out in the work area will provide a better understanding of the circumstances in which mercury products are used.
- Interviews can be conducted in a single, focused sweep or in shorter visits over the course of several days.
- There is nothing sacred about the form—notes can be written in the margins, on the backside, or on additional sheets of paper. If your interviews suggest additional questions that should be asked, ask them!
- You may find that no policies or documented practices, such as mercury clean up procedures, exist. Don't feel that this is a failure in any way. The assessment is not a judgment, it is merely a written description of what the hospital does at this point in time.

Follow up to the walk-through assessment

After completing the interview(s), the findings should be summarized promptly to ensure that the key points are recorded and clearly stated. The summary report becomes the baseline for prioritizing improvement activities and for measuring future progress.

The worksheets (notes) from individual departments should also be maintained on file by the leadership team. These notes can serve as a useful resource in future months.

The toolkit contains the following tools that will help in achieving the objectives of this step. The tools may be tailored to the specific needs of your hospital.

- **Tool II-1.** Identifying policies on the use of mercury in the hospital
This tool describes how to identify mercury policies and practices in the hospital
- **Tool II-2.** Sample mercury policies for hospitals
Tool 2 provides examples of policies and commitments for reducing the hospital's mercury use.
- **Tool II-3.** Walk-through interviews and assessment worksheet
A sample assessment form is provided for walk-through assessments and interviews. This can be used as it is or tailored to your hospital, for systematically recording information from visits to the different areas of the hospital.
- **Tool II-4.** Mercury policies and regulations in Ecuador
It is important to understand the mercury policies and regulations that apply to your hospital, including international, country, state, region, and local policies and regulations. This section shows policies and regulations found in Ecuador at the time the workbook was developed.
- **Tool II-5.** Mercury policies and regulations in Mexico
It is important to understand the mercury policies and regulations that apply to your hospital, including international, country, state, region, and local policies and regulations. This section shows policies and regulations found in Mexico at the time the workbook was developed.

Tool II-1. Identifying existing mercury policies in the hospital

The first step in identifying mercury policies or standard practices is to determine whether the hospital has a corporate or institutional policy pertaining to mercury. This policy may have been issued directly by the hospital administration, or there may be an internal procedure for each of the hospital departments.

If there is no formal policy, or if a policy is not well defined, you can use the following steps to determine where the responsibility lies and whether informal practices are in place to control mercury use.

First, identify who is responsible for managing hazardous materials in the hospital. In many hospitals this may have a title like Department of Occupational Health, Safety and Environment or Waste Management. In other hospitals, it may fall under committees or other departments, such as the Biosafety Committee. Regardless of the responsible department’s name, it is important to determine their role and whether there are established policies for the management of mercury in the hospital.

During the investigation, it is important to maintain a positive attitude for the process and encourage staff to express their knowledge freely. There are no wrong answers. Those interviewed should understand that the questions and answers are part of the process of building a baseline for the hospital, regardless of whether or not a mercury policy exists.

For hospitals or departments without an institution-wide mercury policy, it is important to identify and visit areas where mercury-containing products or materials may be used. It is possible that a department has developed its own internal policy or protective practices for mercury. A list of mercury-containing products commonly used in healthcare settings is shown in the following table; this can be used to help identify the departments and locations in the hospital that you should visit.

Table 1. Materials, instruments and hospital equipment containing mercury

- Mercury thermometers
- Mercury sphygmomanometers
- Mercury lamps (fluorescent lamps)
- Esophageal dilators weighted with mercury
- Cantor tubes with mercury
- Miller Abbott tubes with mercury
- Feeding tubes with mercury
- Mercury amalgam dental fillings
- Thermostats with mercury switches
- Meters (needle) with liquid mercury
- Equipment with mercury switches
- Mercury Barometers
- Certain laboratory reagents
- Other equipment, instruments or materials containing mercury components

Using this table as a guide, you can make a list of the hospital departments that routinely use mercury devices. In departments with large numbers of mercury devices in use, you may find guidelines, training, or standard practices for mercury use and control. These should be recorded in your baseline assessment of the hospital’s mercury policies.

Tool II-2. Sample Mercury Policies for Hospitals

What is a mercury policy?

A mercury policy states the hospital's aims & principles related to mercury and is a declaration of the institution's commitment to continual reduction of mercury.

Why have a policy?

To ensure that the hospital is:

- Obeying the law
- Assuring employees, patients and the community that the hospital is committed to safe and protective practices
- Maintaining good relations with the public, local communities, and government
- Providing employees with a clear statement of the hospital's standards and what is expected of them
- Providing a mechanism for employees to improve their own working environment
- Reducing incidents that expose workers, patients, visitors or the environment to mercury
- Reducing incidents that result in liability to the hospital
- Improving cost control

Does a hospital have just one specific mercury policy?

Probably not. The hospital should have a general hospital-wide policy that states the institution's broad aims and principles related to mercury. This overall policy is meant to be long-lasting. While a hospital's specific procedures or practices and associated goals may change each year, this overarching policy statement should remain largely unchanged because it is the company's guiding principle.

In addition to this broad policy, hospitals will have secondary policies that are specific to certain areas of the hospital. These include procedures or goals that provide guidance for translating the general hospital policy into practice in different areas of the hospital. Examples, such as Mercury-free Purchasing Policy, are shown at the end of this document.

These supporting policies may be called "policies" or may have other names such as "standard operating procedure", "annual mercury reduction goals" or "mercury pledge". The intent of these secondary documents is to provide specific guidance for accomplishing the hospital-wide policy.

What should a general hospital-wide mercury policy look like?

- One page
- Clear & easy to read and understand, since it is meant for everyone to see
- Realistic, achievable, relevant to hospital's activities and practices
- Have top level support, endorsement from key administrator(s)
- Include the date the policy was issued

What supporting policies are needed?

Secondary policies, or documents that outline how the hospital's mercury will be carried out, may take many different forms depending on which area of the hospital a document pertains to. These should be thought of as a "how to" manual and be developed to serve the employees. Areas that might be a priority for developing mercury policies include purchasing, nursing, odontology, laboratory and maintenance.

In some cases it may be feasible to adopt or modify an existing policy. For example, the World Federation of Dentists (FDI) Policy Statement on Mercury Hygiene Guidance may be adapted to your odontology setting. This policy statement is included below (sample #5) and is available online.

The following samples can serve as models for your hospital.

- Sample hospital-wide mercury policy¹
- Mercury pledge²
- Hospital-wide mercury minimization policy³
- Mercury-free purchasing policy⁴
- FDI Policy Statement: Mercury Hygiene Guidance⁵

1 Based on *How to write an environmental policy*, available online: <http://online.businesslink.gov.uk> (Use the search function to locate “How to write an environmental policy”) (accessed September 23, 2011); and *How to Write An Environmental Policy*, available online: <http://agreenfootprint.wordpress.com/2008/05/21/how-to-write-an-environmental-policy/> (accessed September 23, 2011).

2 Based on: A Guide to Mercury Reduction in Industrial and Commercial Settings. (July 2001) Online at: <http://www.delta-institute.org/sites/default/files/Steel-Hg-Report-0627011.pdf> (accessed September 23, 2011)

3 This was based loosely on Masco Mercury Work Group, Hg Management Guidebook, Appendix A. Online at: http://masco.enotion.net/system/files/downloads/programs/phase_ii_hg_management_guidebook_17402.pdf (accessed September 23, 2011)

4 Based on: “Sutter Health’s Policy for Mercury-Free Purchasing”, online at <http://www.premierinc.com/safety/topics/mercury/downloads/sample-mercury-free-purchasing-policy.pdf> (accessed September 23, 2011)

5 (English) FDI Policy Statement: Mercury Hygiene Guidance. Revised version adopted October 26, 2007, online: http://www.fdiworldental.org/c/document_library/get_file?uuid=618df037-2097-4ed1-8ebf-eea664d46abe&groupId=10157
(Spanish) Declaración de Principios de La FDI: Recomendaciones para la Higiene de Mercurio. Versión revisada adoptada el 26 de octubre de 2007. Online at: http://www.fdiworldental.org/c/document_library/get_file?uuid=eea18502-444b-4f82-a710-027a6f3524b7&groupId=10157

[HOSPITAL NAME] Mercury Policy

Protecting our workers, patients, visitors, local communities and the environment from the toxic effects of mercury is of fundamental importance to [HOSPITAL NAME]. To support this goal, we will:

- Comply with applicable local, state, and federal mercury regulations.
- Continually reduce the use of mercury-containing products and processes.
- Protect the health and safety of our employees, patients, visitors, and surrounding communities and ecosystems.

We will work to achieve these commitments by:

- Requiring general mercury awareness training of all our employees and more specific training where appropriate.
- Conducting a facility-wide assessment of mercury at routine intervals to understand the locations and amounts of mercury at the facility.
- Instituting a mercury control plan for existing mercury in products, processes and waste in our facilities.
- Evaluating products and processes from the point of view of mercury, dedicating ourselves to finding better alternatives based on preventing mercury from coming onsite.
- Working collaboratively with our suppliers and employees to reduce the use of mercury.

We will make every effort to ensure that mercury elimination is an integral part of [HOSPITAL NAME]'s performance and the performance of all of our employees. To this end, we will measure and report annually [OR SPECIFIED PERIOD] on our progress in realizing these commitments.

Administrator 1

signature
Title

Administrator 2

signature
Title

Administrator 3

signature
Title

Reference: Based on: *How to write an environmental policy*, available online: <http://online.businesslink.gov.uk> (Use the search function to locate "How to write an environmental policy") (accessed September 23, 2011); and *How to Write An Environmental Policy*, available online: <http://agreenfootprint.wordpress.com/2008/05/21/how-to-write-an-environmental-policy/> (accessed September 23, 2011).

[HOSPITAL LOGO] Mercury Pledge

We pledge to continue to seek out opportunities to reduce or eliminate mercury in the Hospital's equipment and processes, and we will:

- Identify mercury used and stored in our hospital
- Evaluate non-mercury alternatives and phase in as many as possible, as soon as possible
- Develop and implement a mercury reduction plan and report on our results
- Establish purchasing policies related to mercury
- Inform and educate staff, suppliers, and clients about mercury issues and non-mercury alternatives

HOSPITAL NAME

ADDRESS

Administrator Signature
ADMINISTRATOR NAME
Date

Reference: Based on *A Guide to Mercury Reduction in Industrial and Commercial Settings*. (July 2001) Online at: <http://www.delta-institute.org/sites/default/files/Steel-Hg-Report-0627011.pdf> (accessed September 23, 2011)

[NAME OF HOSPITAL] Mercury Minimization Policy

PURPOSE: The purpose of this hospital-wide mercury policy is to enable the Hospital to provide a safe working environment and to minimize the impact of the Hospital's operations on the environment.

BACKGROUND: Mercury is a hazardous substance. Once mercury is introduced into the environment through wastewater, air, or solid waste, controlling it can be very difficult and expensive. The hospital, therefore, must attempt to prevent mercury from entering the environment to protect the public health and to avoid environmental pollution.

POLICY STATEMENT: Mercury-containing products and processes will not be used in any manner on the Hospital campus, including within the Hospital buildings and medical office buildings, unless no reasonable alternatives, as determined by the Hospital Administration, are available. When use of a mercury containing product is permitted, measure will be taken to avoid introduction of mercury into the air, water, and sewer.

APPLICABILITY: Compliance with this policy and its procedures is a condition of employment and the use of any property on the Hospital campus. The Hospital reserves the right to take any and all actions to prevent violation of this policy by any party.

PROCEDURES

- The Hospital's Departments of Engineering, Environmental Services, Purchasing, Pathology, Radiology, and Safety will work together to identify product(s) or process(es) containing mercury currently in use within the Hospital campus and to identify acceptable alternatives. A list of such products/processes and their alternatives will be presented to the Safety Committee that will arrange for its distribution throughout the Hospital community. The list will be reviewed, updated, and distributed at least once per year.
- When mercury-containing products or processes are identified, the manager(s) for the department(s) using such products/processes will develop a plan to include a) procedures for the prevention of disposal of any mercury into the sewer system, air or other waste streams, b) a schedule for the elimination of the use of these products/processes or, if elimination isn't possible, an explanation to justify continued use of the products/processes. The manager(s) will present the plan to the Safety Committee for review and approval.
- The Safety Committee will review all mercury use plans and may approve the plans as submitted or with modification. Upon approval, the affected departmental manager(s) will implement the plans.
- Managers of the departments using mercury products/processes will maintain a readily retrievable log of the mercury containing products/processes, the approved use(s), the alternatives considered, the reasons such alternatives were deemed unacceptable, and a schedule for reconsideration of available alternatives.
- In case of a mercury spill, employees will follow the Hospital's spill clean-up procedures. Managers must report all such spills to the Safety Committee for review.
- All employees will prevent the disposal of mercury into any unapproved waste stream and will refrain from using mercury-containing products/processes on the Hospital campus unless such use has been approved according to this policy.
- All employees are encouraged to present suggestions for eliminating mercury-containing products or processes from the Hospital to the Hospital Safety Committee.

Reference: This was based loosely on Masco Mercury Work Group, *Hg Management Guidebook, Appendix A*. Online at: http://masco.enotion.net/system/files/downloads/programs/phase_ii_hg_managment_guidebook_17402.pdf (accessed September 23, 2011)

[NAME OF HOSPITAL] Mercury-Free Purchasing Policy

POLICY: As part of the ongoing efforts to ensure a safe environment for patients, staff and visitors, [NAME OF HOSPITAL] will at a minimum limit and to the extent possible, avoid the purchase of equipment or materials that contain mercury.

PURPOSE: The purpose of this policy is to provide guidelines for purchasing activities that minimize mercury sources in the hospital environment. In complying with this policy, hospital purchasing and buyers will request that suppliers identify mercury contained in any products to be purchased, specify the amount of mercury per unit, and recommend, if available, mercury free alternatives.

SCOPE: This policy applies to all employees that purchase, request or plan for equipment or materials.

GUIDELINES

A. Responsibilities

1. Purchasing Department

In an effort to minimize mercury hazards, personnel involved in purchasing decisions shall adhere to the guidelines set forth in this policy when making purchasing decisions. The Purchasing department will participate in establishing goals to reduce mercury containing equipment and materials in the facility.

2. Hazardous Materials Coordinator

The Hazardous Materials Coordinator will provide purchasing agents with the necessary support regarding mercury hazards and product evaluation. New equipment or material containing mercury or mercury compounds shall be reviewed by Hazardous Material Coordinator prior to purchase.

3. Department Managers/End Users

The individuals in the various departments including central services, clinical staff, facilities and other departments must work with purchasing and the Hazardous Materials Coordinator to evaluate the feasibility of mercury alternatives in application.

B. Purchasing Guidelines

1. Establish a mercury free policy with vendors.

Whenever possible the use of equipment and hazardous materials containing mercury should be minimized and/or eliminated. Products that contain mercury should be avoided whenever feasible as long as mercury free alternatives exist and will not compromise patient care. Vendors should be contacted and provide information regarding [NAME OF HOSPITAL's] mercury free position.

2. Select those vendors who are willing to meet mercury free goals

[NAME OF HOSPITAL] will develop a preferred list of vendors based on those who are willing to provide mercury free product alternatives. In the proposal process, purchasing agents shall request information relating to mercury content in equipment. Purchasing should incorporate a mercury disclosure requirement into the standard purchase agreement. The disclosure should require the supplier to specify the amount of mercury contained in products to be purchased and provide alternatives if available.

3. Ensure mercury product hazards are evaluated prior to purchase.

Where alternatives are not feasible, the hazards associated with equipment or materials containing mercury should be evaluated prior to purchase. This should be conducted in conjunction with [NAME OF HOSPITAL's] environmental health and safety personnel and the internal customers who have the application knowledge. Any new chemical or hazardous product brought into the healthcare environment should be evaluated in this context.

4. Identify mercury reduction goals through purchasing efforts.

A Mercury Assessment will be conducted to evaluate equipment and materials that use or contain mercury. Based on the results of the Mercury Assessment, goals will be established to reduce mercury containing equipment and materials in the hospital environment. Periodically Purchasing will evaluate and modify the purchasing process based on the results and efforts made to reduce the presence of mercury at [NAME OF HOSPITAL]

Reference: Based on *Sutter Health's Policy for Mercury-Free Purchasing*, online at <http://www.premierinc.com/safety/topics/mercury/downloads/sample-mercury-free-purchasing-policy.pdf> (accessed September 23, 2011)

FDI Policy Statement: Mercury Hygiene Guidance

To view the document, see Special Topics Tool #5 on page 105.

<http://www.fdiworldental.org/media/11271/Mercury-hygiene-guidance-2007.pdf>
Mercury Hygiene Guidance



FDI POLICY STATEMENT
Mercury Hygiene Guidance
Original version adopted by the General Assembly on October 1998, Barcelona, Spain REvised version adopted by the General Assembly: 26 th October 2007, Dubai, UAE

Tool II-3. Walk-Through Interviews and Assessment

Mercury Reduction in Ecuador and Mexico

A joint effort of the University of Massachusetts Lowell, USA;
the Institute for the Development of Production and the Work Environment (IFA),
Quito, Ecuador and the University of Sonora (UNISON), Hermosillo, Mexico.
Funded by the U.S. Environmental Protection Agency

Walk-Through Interviews and Assessment

Name of Facility:

Location:

Number of beds:

Hospital Representative(s)

Date:

	Written procedure?	
I. Mercury policies and practices		
What departments are responsible for environmental care at your hospital? (e.g. Health & Safety, Maintenance/Facility, Industrial Hygienist, Environmental Department, Nursing, other)		
Written plans & general training Does your facility have a Mercury Management Plan? Train employees on mercury awareness?		
Purchasing guidance Does the facility have a purchasing policy which includes a commitment to purchase mercury-free products whenever possible? Have a policy regarding the purchase of mercury-containing devices? Require the manufacturer/vendor to disclose mercury concentrations? Phase out mercury devices or components when replacing equipment (e.g. thermometers, temperature sensors)? Identification of mercury containing products Does the facility have equipment and supplies that contain mercury been identified? Centrally track or have an inventory form for mercury products? Label the equipment as containing mercury? Inventoried and labeled all mercury-containing facility devices (switches, thermostats, etc.)?		

<p>Spills and handling of liquid mercury</p> <p>Does the facility train employees how to properly respond to and clean up a mercury spill?</p> <p>Have a policy or guidance on how to clean up a mercury spill?</p> <p>Have a spill kit in each department or area? If so, is it stored in a designated or clearly identified area? Who is responsible for replacing the used spill kit or missing items?</p> <p>Have procedures for cleaning and refilling instruments with mercury?</p> <p>Estimate the number of spills of mercury in the facility last year? # _____ or ____ Don't know</p> <p>Estimate the amount of mercury involved in spills last year?</p>		
<p>Waste</p> <p>Does the facility have employees been trained on the correct procedures for segregating mercury waste?</p> <p>Have procedures for controlling mercury at the end of a device's service life?</p> <p>How is the mercury containing waste stored in the facility? Is the area clearly marked? Is access to the waste limited (e.g. to trained staff)</p> <p>Have a protocol for disposal of intact mercury-containing products?</p> <p>Does the facility completely drain and recycle all residual mercury from thermometers, blood pressure reservoirs, and other medical devices prior to discarding the equipment?</p> <p>Recycle mercury containing parts when you replace old equipment (e.g. remove and recycle mercury switches)?</p> <p>Have a policy to ensure that mercury is not flushed down the drain?</p> <p>Clean mercury out of pipes?</p>		
<p>Issue mercury thermometers</p> <p>Send patients or new mothers home with mercury thermometers? What circumstances (e.g. monitoring H1N1 flu, newborns)?</p> <p>If so, how many are issued each year?</p>		

II. Mercury equipment

Does your facility or its satellites use or purchase:

Mercury thermometers

Mercury sphygmomanometers

Mercury lamps (fluorescent lights)

Are spent lights recycled?

Mercury weighted esophageal dilators

Mercury weighted Cantor tubes

Mercury weighted Miller Abbott tubes

Mercury weighted feeding tubes

Mercury containing dental amalgams

Thermostats with mercury switches

Gauges with liquid mercury

Equipment with mercury switches

Mercury Barometers

Other mercury containing equipment

III. Mercury in labs and non-clinical areas

Has your facility examined and inventoried mercury-containing laboratory chemicals?

Are mercury thermometers used in labs or non-clinical areas?

Are other mercury devices in use? (barometers, hydrometers, hygrometers)?

Tool II-4. Policies and regulations on mercury in Ecuador

Ecuador has no specific mercury policy however efforts underway to address the issue may result in a future policy. For example, the Ministry of Environment has conducted a National Emissions Inventory of Mercury and Products Containing Mercury to determine the extent of the problem in Ecuador.

Despite the absence of specific policies on mercury, it is important to note national regulations and local initiatives in Ecuador that relate to the use and management of mercury. Below is a list of some of them.

Constitution of the Republic of Ecuador: Published in Official Gazette No. 449 of Monday, October 20, 2008. (*Translation from the Center for Latin American Studies (CLAS), Georgetown University. Accessed February 15, 2013. <http://pdba.georgetown.edu/Constitutions/Ecuador/english08.html>*)

Title II: Rights—CHAPTER TWO: Rights of the good way of living (buen vivir)

- SECTION TWO: Healthy Environment
 - Article 14. The right of the population to live in a healthy and ecologically balanced environment that guarantees sustainability and the good way of living (sumak kawsay), is recognized. Environmental conservation, the protection of ecosystems, biodiversity and the integrity of the country's genetic assets, the prevention of environmental damage, and the recovery of degraded natural spaces are declared matters of public interest.
 - Article 15. The State shall promote, in the public and private sectors, the use of environmentally clean technologies and nonpolluting and low-impact alternative sources of energy. Energy sovereignty shall not be achieved to the detriment of food sovereignty nor shall it affect the right to water. The development, production, ownership, marketing, import, transport, storage and use of chemical, biological and nuclear weapons, highly toxic persistent organic pollutants, internationally prohibited agrochemicals, and experimental biological technologies and agents and genetically modified organisms that are harmful to human health or that jeopardize food sovereignty or ecosystems, as well as the introduction of nuclear residues and toxic waste into the country's territory, are forbidden.
- Section Seven: Health
 - Article 32. Health is a right guaranteed by the State and whose fulfillment is linked to the exercise of other rights, among which the right to water, food, education, sports, work, social security, healthy environments and others that support the good way of living.

CHAPTER SEVEN: Rights of nature

- **See** Articles 71-74

Title VI: Development Structure

Title VII: The Good Way of Living System

CHAPTER TWO: Biodiversity and natural resources

- SECTION ONE: Nature and the environment
 - Article 395. The Constitution recognizes the following environmental principles:
 1. The State shall guarantee a sustainable model of development, one that is environmentally balanced and respectful of cultural diversity, conserves biodiversity and the natural regeneration capacity of ecosystems, and ensures meeting the needs of present and future generations.

2. Environmental management policies shall be applied cutting across all sectors and dimensions and shall be mandatorily enforced by the State at all of its levels and by all natural persons or legal entities in the country's territory.
3. The State shall guarantee the active and permanent participation of affected persons, communities, peoples and nations in the planning, implementation and monitoring of all activities exerting environmental impacts.
4. In the event of doubt about the scope of legal provisions for environmental issues, it is the most favorable interpretation of their effective force for the protection of nature that shall prevail.

Environmental Laws

Environmental Basic Policies of Ecuador: Official Register No. 456 on Tuesday June 7, 1994.

Environmental Management Act of Ecuador: CODING 2004-019. September, 2004.

Unified Text of Secondary Environmental Legislation: Executive Order 3516, published in the Register Official No. 2, the Monday, March 31, 2003.

Book VI—Environmental Quality

International Agreements

- Rotterdam Convention
- Basel Convention

Safety Regulations and Health at Work

- Andean Instrument on Safety and Health at Work. Andean Labour Institute, Decision 584.
- Regulation of the Andean Instrument on Safety and Health at Work. Andean Labour Institute, Resolution 957
- Regulations on the Health and Safety of Workers and the Improvement of the Working Environment, adopted in Ecuador by Decree No. 2393 of 13 November 1986 and promulgated in the Official Gazette, No. 565 of 17 November 1986
- General Regulation of Labor Risks Insurance. Official Gazette No. 579 of 10 December 1990.

Tool II-5. Policies and regulations on mercury in Mexico

Mexico supports the international guidelines for reducing the toxicological risks and environmental contamination associated with use and disposal of mercury, including those promoted by the World Health Organization (WHO), the United Nations Environment Programme (UNEP), and the North American Regional Action Plan (NARAP) on Mercury.

There is no regulation in Mexico banning use of mercury in the health sector. However other legal instruments are emerging with provisions that protect people's health and the environment from mercury, such as maximum allowable mercury limits in water, food, perfumes and beauty products. Similarly, mercury is included in regulatory policies that limit mercury and regulate its management in the workplace, in transportation of hazardous materials, and in hazardous waste emissions from incineration thereof and wastewater discharges.

There have also been initiatives to prevent damage from the use and disposal of mercury in hospitals and dentistry. These are being promoted by the Secretariat of Environment and Natural Resources (in Spanish: Secretaría del Medio Ambiente y Recursos Naturales, SEMARNAT), the Secretariat of Health (SS), institutions of higher education, the private sector, professional associations, NGOs and international agencies. Initiatives include programs for safe handling of mercury products and waste, and implementation of non-mercury alternative products and practices.

Listed below are examples of Mexico's international collaborations, including treaties and international agreements that specifically include mercury. These commitments provide a regulatory framework for protecting the health of the population, workers, and environment from mercury toxicity; with an emphasis on labor and penal provisions environment.

International Treaties

1. The North American Regional Action Plan (NARAP) on Mercury, Phase I and II. In accordance with the North American Agreement on Environmental Cooperation (NAAEC) and CEC Council Resolution #95-5, cooperative efforts were initiated to build Mexico's capacity with respect to the prevention and reduction of anthropogenic releases of mercury and the sound management of mercury. The emphasis of capacity-building is to enable Mexican governments, industries and institutions to take advantage of, and adapt, as appropriate, Canadian and US regulatory and non-regulatory experiences.
2. Decision 25/5, Chemicals management, including mercury) adopted by the United Nations Environment Programme (UNEP) in February 2009. This initiative proposes a legal instrument to solve global health problems caused by mercury. The committee developing this instrument has a target completion in 2013, and Mexico may consider adoption of the instrument.

National Policies that Include Mercury

Federal Level

The Constitution of the United Mexican States, Title I, Chapter I of individual rights, states in Article 4 that everyone has the right to protection of health and a suitable environment for their development and welfare.

Pollution Prevention and Control

The General Law for the Prevention and Management of Wastes (LGPGIR) published in the Official Journal Federation (DOF) on October 8, 2003. This includes a provision in Article 31 requiring a management plan for certain hazardous wastes include mercury, such as in batteries, mercury containing lamps, and fluorescent and mercury vapor fixtures containing mercury.

Mercury-containing wastes are classified as hazardous waste according to the Standard on Hazardous Waste NOM-052-SEMARNAT-2005 (Norma Oficial Mexicana; DOF June 23, 2006). This standard establishes the characteristics and identification of hazardous waste and classifies specific types of hazardous waste. The rule

establishes maximum permissible limits for toxic ingredients; materials with mercury content greater than the maximum allowable mercury of 0.2 milligrams / liter are considered hazardous (per procedures outlined in NOM-053-SEMARNAT-1993; October 22 DOF 1993). NOM-052-SEMARNAT-2005 also addresses integrated management of mercury waste, including transportation by service providers and carriers authorized by SEMARNAT.

Transportation of mercury falls under the Mexican Standard NOM-002-SCT-2003, List of Hazardous Substances and Materials More Usually Transported. This standard identifies and classifies the hazardous substances and materials typically transported in the country, according to the class, risk division, subsidiary risk, number assigned by the Organization of the United Nations. The standard covers provisions for packing requirements and transportation by land, maritime and air, applicable to shippers, carriers and receivers of hazardous substances and materials.

Occupational Safety and Health

In the occupational setting, mercury and mercury compounds fall under NOM-010-STPS-1999 (DOF March 13, 2000), Safety and Hygiene Conditions for Workplaces Where Chemical Substances Capable of Generating Occupational Pollution Are Handled, Transported, Processed or Stored. The objective of this standard is to prevent harm to workers and to establish maximum allowable limits for occupational exposure. The maximum allowable limit of 0.05 mg/m³ is specified for worker exposure to liquid mercury and all inorganic forms of the metal (salts). This is calculated at standard temperature and pressure and a working day of eight hours per day and 40 hours a week (TWA). The main routes of exposure for mercury are inhalation and dermal contact.

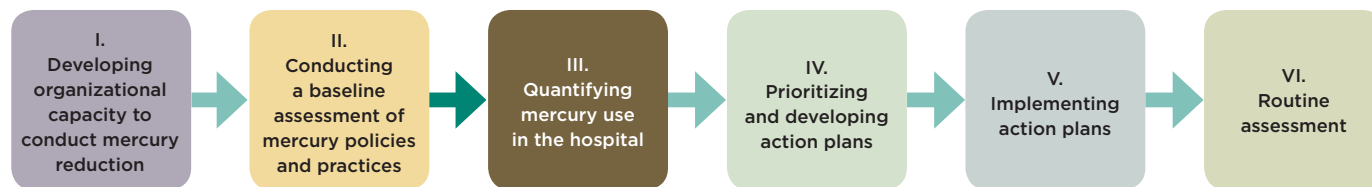
Organic mercury compounds (i.e. mercury combined with carbon or carbon-containing substances) are grouped into two categories with different exposure limits: alkyl (carbon-chain) and aryl (aromatic ring) groups.

For alkyl-organic mercury compounds, the permissible time-weighted average exposure limit is 0.01 mg/m³ (this limit is referred to as *LMPE-PPT* in Mexico). The short term exposure limit is 0.03 mg/m³, over a 15 minute period (maximum), with no more than four periods at this level and intervals of at least 1 hour between exposure periods. These limits reflect that organic mercury compounds readily enter the human body by absorption through the skin and by inhalation.

For aryl-organic mercury compounds, the time-weighted average exposure limit (LMPE-PPT) is 0.05 mg/m³. The main routes of entry into the body are by inhalation and dermal contact.

ORGANIZATIONAL STEP III.

Quantifying mercury use—the whys and hows of doing a mercury inventory



Key points

- Conduct a baseline count (inventory) of mercury-containing products and materials in the facility
- Compile the findings into a database

Toolkit for this Activity

- Mercury inventory worksheet (Tool III-1)
- Sample completed mercury inventory worksheet (Tool III-2)
- Record sheet for inventory process (Tool III-3)
- Summary of mercury inventory in the hospital (Tool III-4)
- Quantities of mercury in hospital equipment (Tool III-5)

The mercury inventory provides a detailed description of mercury in the hospital, including the type of mercury-containing product or material, where they are located and the number or amount of each type of product or material. This information is important for several reasons:

- It facilitates estimating the total amount of mercury in the hospital,
- It allows the mercury team to gain consensus on the magnitude and extent of the hospital's mercury use and to develop a prioritized strategy for eliminating the mercury,
- It helps explain the scope of the team's work to someone outside the team, and
- It demonstrates the benefits of undertaking the mercury reduction work.

How to conduct the inventory

1. Distribute the worksheets to the designated contact in each department. To keep track of inventory activities, the Mercury Team may wish to keep a master list of the departments and contact person for each department.

Tool III-1 Mercury inventory worksheet

Tool III-2 Record Sheet for Inventory Process

2. In each department, the designated staff member goes through department with the Mercury Inventory worksheet and locates all the mercury-containing products. For each product, he/she records a brief description of product and the quantity of that product in the department. If the product is a liquid or material measured by volume or weight, the appropriate measure should be recorded. For example: *10 unopened jars (125 g each) of mercuric oxide. 1 partially used jar approximately 1/2 full (~63 g).*

The staff member chosen to perform the inventory in his/her department should be familiar with the devices or materials used in that department and knowledgeable about how to identify mercury. (In clinical areas, most of the mercury will be in the form of a silvery liquid contained in a glass column or ampoule.)

3. The completed form is returned to the Mercury Leadership Team.
4. The Mercury Team (or designee) will compile the inventory information into a database.
5. The database will be used to estimate total amount of mercury, amount by department, et cetera that will be used to prioritize and develop action plans, as well as to measure progress over time.

Follow up

After completing the inventory, the records should be reviewed to ensure that the data are recorded and clearly stated. The worksheets should also be maintained on file by the leadership team. These worksheets can serve as a useful resource in future months.

The toolkit contains the following tools that will help in achieving the objectives of this step. The tools may be tailored to your hospital.

- **Tool III-1.** Mercury inventory worksheet
This worksheet helps capture information about mercury use around the hospital. It allows you to list the devices and equipment containing mercury. An example is shown on how to complete the form.
- **Tool III-2.** Record sheet for inventory process
This summary tool can be used to help the Mercury Team keep track of inventory activities and identify staff members who provided assistance in each department. It will speed up the inventory process and help resolve questions that arise later.
- **Tool III-3.** Mercury inventory summary, by department
This form helps systematically compile the amounts of mercury contained in specific devices in each area of the hospital.
- **Tool III-4.** Summary of mercury inventory, hospital-wide
This form shows a summary of the amounts of mercury found, by type of device, across the entire hospital. It will help the team estimate the quantity of mercury overall in the hospital.
- **Tool III-5.** Amounts of mercury in hospital equipment
This is a useful resource for estimating the amount of mercury found in the hospital.

Tool Kit

Tool III-1: Mercury Inventory Worksheet⁶

Hospital Name:

Department:

Date of Inventory:

Person Responsible for Inventory:

Mercury-containing device, equipment, or instrument	Quantity	Comments

Look for mercury-containing products, including thermometers (fever, laboratory, freezer), blood pressure devices with a mercury column, switches containing visible mercury, barometers, laboratory chemicals (e.g. thimersol), liquid mercury for dental fillings, other.

See example on next page

⁶ Worksheet format from the initiative “Reduction of Mercury Use in Costa Rican Hospitals” (2008-2009). The Costa Rican project was supported by the Ministry of Environment, Energy and Telecommunications (MINAET), the Caja Costarricense de Seguro Social - CCSS (Costa Rican Social Security Agency), the National Children’s Hospital in San José, and the Carlos Luis Valverde Vega Hospital in San Ramón, with financial support from DR-CAFTA environmental cooperation, and technical assistance from the United States Environmental Protection Agency (USEPA)

Sample completed mercury inventory form

This form allows you to record the inventory of mercury-containing devices in a department or hospital work areas, as shown in this example.

Mercury Inventory Worksheet

Hospital Name: General Hospital

Department: Pediatrics

Date of Inventory: Feb 23, 2013

Person Responsible for Inventory: Catherine M.

Mercury-containing device, equipment, or instrument	Quantity	Comments
Fever thermometers	12	Stored in cabinet (new; unused)
Fever thermometers	5	In examination rooms
Sphygmomanometers (Tensiometer)	2	In examination rooms, mounted on wall
Sphygmomanometers (Tensiometer)	5	Portable devices stored on shelf— 1 of the 5 is broken and not being used

Look for mercury-containing products, including thermometers (fever, laboratory, freezer), blood pressure devices with a mercury column, switches containing visible mercury, barometers, laboratory chemicals (e.g. thimersol), liquid mercury for dental fillings, other.

Tool III-2: Record sheet for inventory process

This summary tool can be used to help the Mercury team keep track of inventory activities and identify staff members who assisted in each department. It will speed up the inventory process and help resolve questions that arise later.

Record Sheet for Inventory Process

Completed (✓)	Inventory request: Date issued	Inventory worksheet: Due date	Department & Contact Person	Comments
			Department Contact person & phone number	
			Department Contact person & phone number	
			Department Contact person & phone number	
			Department Contact person & phone number	
			Department Contact person & phone number	
			Department Contact person & phone number	

Tool III-3: Mercury inventory summary, by department⁷

This form helps systematically compile the amounts of mercury contained in specific devices in each area of the hospital.

Hospital Name: Department:
Date of Inventory: Person Responsible for Inventory:

Mercury-containing equipment, device or item	Mercury content each (g)	Quantity	Total mercury content (g)	Notes/observations
Estimated total amount of mercury in department				

See example on next page

⁷ Modified from the tool developed for the project “Mercury Elimination at Hospital Nacional de Niños and General Hospital Dr. Carlos Luis Valverde Vega, Costa Rica”. EPA Contract EP-W-044-22. (March 2009)

Sample completed mercury inventory summary, by department

This form helps systematically compile the amounts of mercury contained in specific devices in each area of the hospital.

Hospital Name: Specialty Hospital

Department: Pediatrics

Date of Inventory: 2/14/13

Person Responsible for Inventory: Mary Smith, RN

Mercury-containing equipment, device or item	Mercury content each (g)	Quantity	Total mercury content (g)	Notes/observations
Oral thermometers	1 g	3	3 g	In use
Rectal thermometers	1 g	2	2 g	In stockroom
Oral thermometers	1 g	2	2 g	Broken thermometers collected in glass jars, awaiting hazardous waste collection
Sphygmomanometers	95 g	3	285 g	Mobile units on wheeled base, stored at nurses' station
Sphygmomanometers	95 g	3	285 g	Mounted on the wall in rooms 202, 203, and 204
Estimated total amount of mercury in department			577 g	

Tool III-4: Summary of mercury inventory, hospital-wide

This form shows a summary of the amounts of mercury found, by type of device, across the entire hospital. It will help the team estimate the quantity of mercury overall in the hospital.

Hospital Name:
Date of Inventory:

Page number:
Person compiling Inventory:

		Number of units per area						Total # units counted (all areas)	Total amount of mercury = total # units x mercury content per unit
Mercury-containing item	Approx. mercury content per unit (g)	Area:	Area:	Area:	Area:	Area:	Area:		
Total amount of mercury on this page									

Tool III-5. Amounts of Mercury in Hospital Equipment

Reference: Sustainable Hospitals Program. *Amounts of Mercury in Hospitals Equipment*. 2009. (Factsheet.) Lowell Center for Sustainable Production, University of Massachusetts Lowell. USA.

Just how much mercury is there in hospital equipment? Many hospitals ask this question in order to prioritize mercury reduction efforts and to understand the potential for a mercury release if there is a spill. An estimate of mercury content in medical devices and facility equipment is shown in the following tables. Note that these are *estimates* and that variations may exist by manufacturer or even model.

Table 1. **Mercury in Medical Devices**

Medical Device	Approximate Hg content
Oral/rectal/baby thermometers ^{1,3}	0.5 g-3 g
Basal thermometer ²	2.25 g
Hospital laboratory thermometers ^{2,3}	3 g-5 g
Sphygmomanometers ²	50-140 g
Esophageal Dilators (Bougies) ² Older dilators consist of thick latex-coated tubing with approximately 2-3 pounds of mercury	907-1360 g
Gastrointestinal tubes (including Abbott-Miller, Sengstaken-Blakemore, and Cantor tubes) ^{2,4}	907 g

1 Bill Ravanese, Health Care Without Harm (HCWH)

2 NEWMOA; <http://www.newmoa.org/prevention/mercury/>. (Accessed 8/10/09)

3 Environment Canada, Mercury and the Environment; Sources of Mercury: Mercury-containing Products. <http://www.ec.gc.ca/MERCURY/SM/EN/sm-mcp.cfm?SELECT=SM> (Accessed 8/10/09)

4 King County, Washington; Local Hazardous Waste Management Program. <http://www.govlink.org/hazwaste/mercury/MedicalEquipment.html#Esophageal> (Accessed 8/10/09)

Table 2. **Mercury in Building Equipment**

Building Product	Approximate Hg content
Barometers and vacuum gauges ² Note: rare old collectable barometers have been found to contain as much as 6 kilograms.	300-600 g
Boiler gauge controls ¹	Some boilers contain 23-75 pounds of mercury
Fluorescent Lamps ²	
Compact fluorescent bulbs	1-25 mg
Fluorescent U-tubes	3-12 mg
Fluomeric lamps	2 mg per lamp
Linear fluorescent lamps	3-12 mg (Hg-reduced lamps) 10-50 mg (non-Hg reduced lamps)
Mercury vapor high intensity discharge (HID) lamps	25 mg (75 watt lamp)-225 mg (1500 watt lamp)
Metal Halide lamps	25 mg (75 watt lamp)-225 mg (1500 watt lamp)
Sodium vapor lamps	20 mg (35 watt lamp)-145 mg (1000-watt lamp)

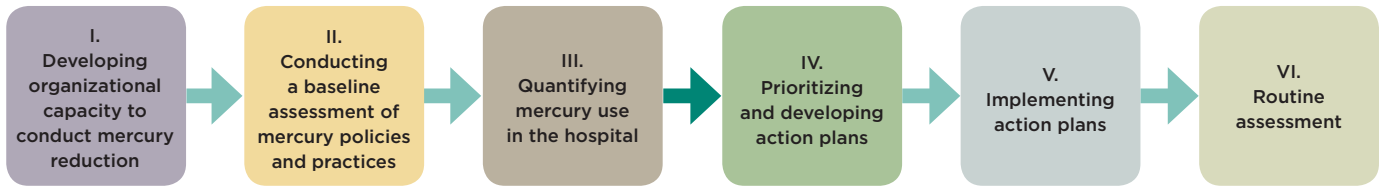
Table 2. **Mercury in Building Equipment** (continued)

Building Product	Approximate Hg content
Flowmeters ^{1, 2}	Often 5000 g (11 pounds) or more
Flame sensors ¹	3 g
Gas regulators and meters ¹	Older gas meters contain approximately 2 g–4 g of mercury
Manometers ²	100–500 g
Switches <div> <div>Float switches</div> <div>Pressure switches</div> <div>Temperature switches</div> <div>Tilt switches</div> <div>Wetted reed relay</div> </div>	<div> <div>1–15 g per switch</div> <div>1–20 g per switch</div> <div>1–10 g per switch</div> <div>0.4–71 g</div> <div>1 g</div> </div>
Thermostats ^{1, 2} Note: there may be one to six ampoules depending on the model and application of the thermostat.	3 g per switch/ampoule
Thermostat probes ²	1 g

1 Collated by Todd Dresser and the Burlington, Massachusetts Board of Health

2 Environment Canada, Mercury and the Environment; Sources of Mercury: Mercury-containing Products. <http://www.ec.gc.ca/MERCURY/SM/EN/sm-mcp.cfm?SELECT=SM> (Accessed 8/10/09)

ORGANIZATIONAL STEP IV. Prioritizing mercury reduction efforts



Key points

- Decide which source of mercury will be addressed first (or next)

Toolkit resource for this Activity

- IV-1. Worksheet (selection grid) for prioritizing mercury reduction projects (Tool IV-1)

Prioritizing mercury reduction efforts

The hospital's mercury inventory shows the locations and approximate amounts of mercury throughout the hospital. The next step is to prioritize the order in which each source of mercury will be addressed and then to come up with action plans for eliminating or reducing the mercury. This section focuses on prioritization. A tool for doing this is called a "selection grid".

Consider criteria for prioritizing mercury reduction projects. Look at the different products/processes that contain mercury or departments where you might work on mercury reduction. Make a list of projects you might work on, such as elimination of mercury fever thermometers or replacement of bulk mercury in odontology. Start with two basic questions:

1. Is it worthwhile—is reduction of this source of mercury worth working on? Try to think of all the relevant considerations:
 - Volume of mercury
 - Impact on health of staff and patients
 - Potential for or history of spills
 - Ease
 - Cost
2. Is it doable—can we make progress on reducing this source of mercury? Do we have:
 - Support from management and others
 - Time to see the work through to completion
 - Knowledge about and availability of alternatives
 - Interest in working hard on this

To prioritize your mercury reduction efforts, organize your information to help you select one option from several possible projects. A tool for this is the selection grid, shown in the following examples. Make a grid with your criteria (above) across the top of the grid and the possible projects on the left side. Fill in the grid to evaluate how well each option satisfies each criterion. As shown below, you can fill in the grid in different ways

to help you rate different projects. The summary score is an indicator of each project’s ranking within the group. It also allows for flexibility—for example, you may choose to do a low-ranking project that is quick, easy and low cost before doing a higher ranking more complex project.

While the grid will not answer precisely what project to tackle, it will help clarify which projects are of interest and likely to succeed. This process will help your team think systematically about the different options and make the final judgment. The mercury reduction team may also use the grid to discuss its work with management or other stakeholders and gain their agreement and support.

Example 1: Within the group of people deciding on the projects below, each person answered high/low or yes/no for each criterion. The summary score gives an indication of how the group as a whole viewed the projects. This scoring represents the opinions of the ten people in the group. It doesn’t mean that lower scoring projects shouldn’t be worked on, but it helps identify the merits and challenges of the different projects.

(List your own criteria)→ Project	Worthwhile?				Doable?				Summary score
	Volume of mercury	Potential for breakage or spill	Health impact on employees & patients	Ease	Support of management & others	Time	Alternatives available	Interest	
Replace mercury fever thermometers	High: 10 Low:	High: 10 Low:	High: 9 Low: 1	High: 9 Low: 1	Yes: 8 No: 2	Yes: 10 No:	Yes: 10 No:	High: 8 Low: 2	High/Yes = 74 Low/No = 6
Replace mercury tensiometers	High: 4 Low: 6	High: 2 Low: 8	High: 2 Low: 8	High: 10 Low:	Yes: 7 No: 3	Yes: 8 No: 2	Yes: 10 No:	High: 8 Low: 2	High/Yes = 51 Low/No = 29
Eliminate dental mercury	High: 8 Low: 2	High: 2 Low: 8	High: 8 Low: 2	High: 5 Low: 5	Yes: 2 No: 8	Yes: 6 No: 4	Yes: 7 No: 3	High: 3 Low: 7	High/Yes = 41 Low/No = 39
Replace bulk mercury in odontology with amalgam capsules	High: 8 Low: 2	High: 2 Low: 8	High: 8 Low: 2	High: 10 Low: 0	Yes: 9 No: 1	Yes: 10 No:	Yes: 10 No:	High: 9 Low: 1	High/Yes = 66 Low/No = 14
Replace lab thermometers	High: 1 Low: 9	High: 5 Low: 5	High: 1 Low: 9	High: 6 Low: 4	Yes: 5 No: 5	Yes: 5 No: 5	Yes: 9 No: 1	High: 2 Low: 8	High/Yes = 34 Low/No = 46
Replace mercury electrical switches in HVAC equipment (e.g. furnaces, thermostats)	High: 2 Low: 8	High: Low: 10	High: Low: 10	High: Low: 10	Yes: No: 10	Yes: No: 10	Yes: 2 No: 8	High: Low: 10	High/Yes = 4 Low/No = 76

Example 2: This is the same group of projects, but with a simpler rating system. The same group of people considered the projects and gave a score for each criterion. The summary score gives an indication of how the group as a whole viewed the projects. This scoring represents the opinions of the ten people in the group. It doesn’t mean that lower scoring projects shouldn’t be worked on, but it helps identify the merits and challenges of the different projects.

Rating for each criterion: + = low ++ = moderate +++ = high

Project	Worthwhile?				Doable?				Summary score = # of “+”
	Volume of mercury	Potential for breakage, spill or exposure	Health impact on employees & patients	Ease	Support of management & others	Time	Alternatives available	Interest	
Replace mercury fever thermometers	+++	+++	+++	+++	+++	+++	+++	+++	24
Replace mercury tensiometers	++	+	+	+++	++	+++	+++	++	17
Eliminate dental mercury	+++	+++	+++	+	+	++	++	+	16
Replace bulk mercury in odontology with amalgam capsules	++	+++	+++	+++	+++	+++	+++	+++	23
Replace lab thermometers	+	+	+	++	++	+++	+++	++	15
Replace mercury electrical switches in HVAC equipment (e.g. furnaces, thermostats)	+	+	+	+	+	+	+	++	9

Tool IV-1: Worksheet for Prioritizing Projects

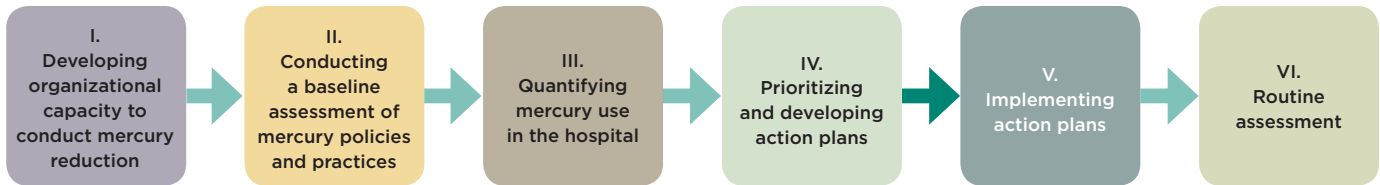
This tool helps prioritize potential mercury reduction projects.

Team Members names:

Date:

Criteria						Summary score
Potential Projects						

ORGANIZATIONAL STEP V. Developing and implementing action plans



Key points

- Establish a multi-disciplinary team
- Characterize the existing process and the function of the mercury-containing device or process
- Research and screen alternatives
- Select the best alternative
- Implement the alternative
- Monitor and evaluate results

Toolkit resource for this Activity

- Flow chart (Tool V-1)
- Problem statement (Tool V-2)
- Selection grid (Tool V-3)
- Technical criteria for mercury free equipment - thermometers and sphygmomanometers (Tool V-4)
- Replacing mercury thermometers with digital thermometers (Tool V-5)
- Sample dental amalgam capsule evaluation form (Tool V-6)
- Sample dental resin evaluation form (Tool V-7)
- Sample non-mercury sphygmomanometer evaluation form (Tool V-8)
- Sample digital thermometer evaluation form (Tool V-9)

The foundation for a successful mercury reduction project is a strategy that integrates pollution prevention (environmental impacts) and occupational safety and health (worker considerations). This pollution prevention-occupational safety and health (P2OSH) model relies on three guiding principles:⁸

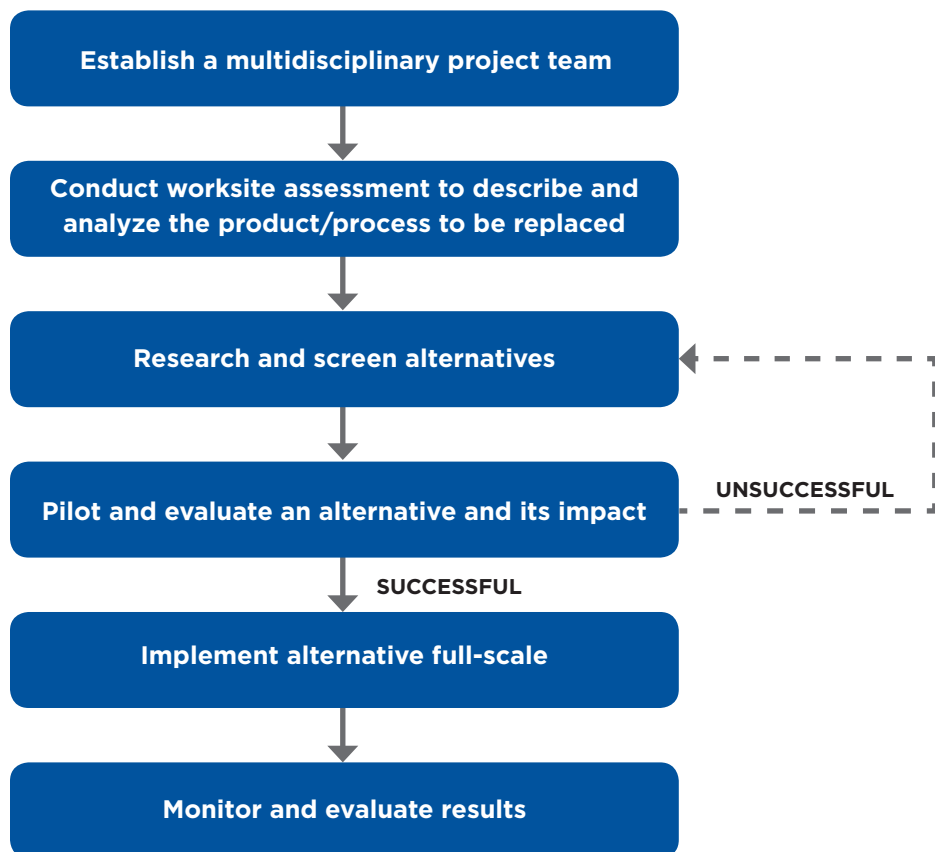
1. A material or process cannot be changed successfully without understanding its function in the production process, the associated job requirements and work practices, and the final product or service to which it contributes.
2. A material or process intervention cannot be implemented successfully in the long term without the participation of the people affected by the change because they understand the functions and work practices best, and ultimately, maintain the change.
3. Very few alternative products or processes can be categorized as entirely “good” or “bad” with respect to occupational safety and health or the environment. Therefore this model assesses the relative differences

⁸ This model was developed at the University of Massachusetts Lowell and is described in the article “Pollution Prevention—Occupational Safety and Health in Hospitals: Alternatives and Interventions”, *Journal of Occupational and Environmental Hygiene*, April 2006; pp.182-193.

between a conventional material and one or more alternatives and selects the alternative that offers the greatest benefits overall. The focus is on the *process* of evaluating and implementing alternatives so that when new choices become available, the process can be repeated.

Once a mercury reduction project has been identified, the series of steps shown in figure 1 begins.

Figure 1. **Process for evaluating & implementing alternatives**



Establish a multidisciplinary project team

The first step is the formation of a team of stakeholders who will develop and implement the mercury reduction project. This will include members from all the departments involved in or affected by the project. Why is a team desirable?

- Members from different departments will have diverse perspectives and can challenge current practices and promote innovative solutions. Employees from each department know best how to get the work done and can provide effective solutions to obstacles.
- If each department is part of the process, there will be greater buy-in to changes in practices and products. A department's employees are also the ones who suffer from products or practices that are not optimal, so they have a special interest in improving the existing conditions and coming up with good alternatives.
- Sometimes alternatives will require doing the job slightly differently, or an alternative may initially appear more inconvenient or expensive, so it's important to involve the users in the process.
- The team can see the whole picture, rather than just one piece of it. It has the resources to pilot and implement new alternatives across the full range of departments affected, from when the mercury enters the hospital to the disposal of mercury at the end of its useful life.

The team members should include representatives from all relevant departments, including someone with management responsibility. In constructing the team, it is helpful to identify the key suppliers and customers of the product or practice being improved. From acquisition of mercury to its disposal, there are a series of suppliers and customers along its life span in the hospital. Each department supplies services or resources to internal customers (other departments) or external customers (patients), for example:

Department	Examples of services provided
Director General	Financial and human resources for hospital operations
Material Resources Department	Procurement of products
Central Equipment and Sterilization	Storage & distribution of materials used in the hospital
Medical departments & clinical staff: Outpatient services Hospital services Emergency Department Blood Transfusion Center Clinical laboratories	Health services to patients
Communications/Public Relations	Outreach within and external to the hospital
Environmental Services	Hazardous waste management
Facilities Operations	Physical plant, operations, logistics, security
Food services	Food preparation and distribution within hospital
Financial Services	Accounting support
Custodial, housekeeping and maintenance	Maintenance of hospital buildings and grounds

When establishing the mercury reduction team, consider each supplier and customer as potential team members. For example, if the mercury project is elimination of mercury-containing flame sensors in the gas ovens in the hospital kitchen, it would be important to include team members from facilities operations, food services, and environmental operations.

Conduct a worksite assessment to describe and analyze the product/process to be replaced

Information gathering: After the team is formed, the next step is to characterize the conventional product/process and the function of the material (mercury-containing product or process) to be replaced. This provides direction for seeking alternatives and a baseline against which to compare the options found.

Ask and compile information about the current product/process. One tool for information-gathering is the “Five Ws and One H”: **Who**, **What**, **When**, **Where**, **How** and **Why**. Conduct interviews with clinicians and others who rely on the product/process or support it. For example, ask:

- **Who** uses this product/process?
- **What** function(s) or purpose(s) does this product/process serve?
- **What** characteristics are important?
- **What** is the product/process life cycle in the hospital, from when it enters the door to when it is taken out of service and disposed of?
- **When** is it used?
- **Where** in the hospital is it used? Does the product stay in one place or is it moved around?
- **How** is the product/process used?
- **Why** is this product/process needed?
- **Why** is it used the way it is?

Compile the information into a form that describes the product/process succinctly and can be used as a reference point for evaluating alternatives. Several tools might be useful for this:

- A flowchart of the existing process, showing the sequence of steps that make up the life cycle of the mercury product or process in the hospital
- A problem statement that describes the current state, the impact and the desired state for the product or process being addressed

Research and screen alternatives

Once the current process has been analyzed, identify the key criteria and factors by which to judge alternatives. These might include:

- Accuracy
- What is the accuracy of the current device/process?
- Are there industry standards for this type of product?
- Compliance with professional and regulatory standards and guidelines (such as American National Standards Institute [ANSI], European Standard [EN], or College of American Pathologists [CAP]; a group that oversees accreditation program for medical laboratories]
- Environmental and health impacts including toxicity, biopersistence, irritant and sensitization properties, dermal uptake, odor
- Physical properties relative to safety (e.g. vapor pressure and flammability) and storage, handling and disposal requirements.
- Durability
- Source of power (e.g. solar, rechargeable, or battery powered products)
- Battery life
- Maintenance requirements
- Ease of use (e.g. size, readability)
- The degree of workplace reorganization required to make the change to a new product/process
- Product cost relative to the organization's financial resources

Next, look for non-mercury products that will serve the desired function. To find alternatives, start with sources close to you and move to other sources:

- Ask your suppliers for alternatives
- Conduct personal or telephone interviews with hospital personnel already using an alternative
- Review scientific, engineering, and medical products websites
- Review advertisements in professional journals
- Post inquiries on list serves or read existing posts

For each alternative product or material, ask manufacturers or suppliers for the user manual, technical specifications, or other documents that describe the use and performance characteristics of the product/material. Use a search engine to look for online information about a product. For example, an searching on the phrase "problems with Brand X Model 321 tensiometer" might reveal useful information.

Organize the alternatives you find into a summary form, such as a selection grid, to help you understand the relative benefits of each one and to narrow down your options. If an alternative appears more favorable with respect to environment and health characteristics, consider it for pilot evaluation. Ask team members and potential users for their input and assess how effectively each alternative would work in your hospital. Prioritize the alternatives for evaluation.

Pilot and evaluate an alternative and its impact

Develop pilot methods to trial the alternative in a controlled manner under typical working conditions. This might comprise recruiting and training a hospital staff member on the use of an alternative, observing the alternative product in use, and collecting feedback from the user.

Tools for collecting feedback:

Design a brief survey or evaluation form that will capture key information about the product/process being evaluated. After the pilot has been completed, interview the user and ask for verbal or written feedback using the evaluation form.

Using input from the staff member piloting the product/process and the team member's observations, assess how well the product/process performed compared with the criteria established earlier. For example:

- Use a simple grading scale of positive (+), negative (-), mixed (+/-) or neutral for how the alternative performed against each of the criteria developed earlier. Determine whether the alternative was preferable from an overall perspective of pollution prevention and occupational safety and health.
- If a problem statement was written for the mercury containing product/process, does the alternative meet the description of the desired state?

If the pilot results are unfavorable, select another approach. Either seek to resolve the shortcoming, for example through more training, or try a different product. Expect the full-scale implementation of an alternative to require multiple iterations of piloting and assessing alternatives, as different departments may have different experiences—favorable or unfavorable—with the alternatives.

Implement alternative

Once a product has been successfully piloted and selected as a viable alternative, begin introducing the product to the hospital. Start slowly and monitor performance, addressing any problems before moving into new areas. Continue to evaluate, modify and expand the program. Document and communicate results.

Monitor and evaluate results

Continue to monitor how the new product/process performs over the coming months. Provide feedback to the supplier and if possible, to the manufacturer. Communicating the benefits and shortcomings of a product/process provides the information and incentive for development of better products.

Tools

The following tools were used during the development of this workbook for mercury reduction in hospitals of Ecuador and Mexico. They may be useful for your hospital or may be refined to meet your specific needs.

Tool V-1. Flow Chart¹⁰

A flow chart is a drawing that shows the steps of a product/process in the sequence in which they occur.

Purpose:

Documentation of a process

Useful for understanding and improving a work process

Creates a common understanding of how work is done

Application:

The main elements of a simple flowchart are:

□ Box — activities

◇ Diamond — decision point

→ Arrow — direction of flow from one activity to the next

- Gather a group of people who represent the various parts of the process
- Decide where the process begins and ends.
- Brainstorm the main activities and decision points in the process.
- Arrange these activities and decision points in their proper order, using arrows to show the directions of flow.
- As needed, break down the activities to show their complexity.

¹⁰ Reference: This tool is taken from the Total Quality TOOLBOX, unpublished

¹¹ Reference: Based on the paper by Moreno Grano M, Alvarez Chavez CR, Arce Corrales ME, et al. *Eliminacion de Mercurio (Hg) en el Sector Salud: el Caso de un Hospital en la Ciudad de Hermosillo, Sonora, Mexico.*

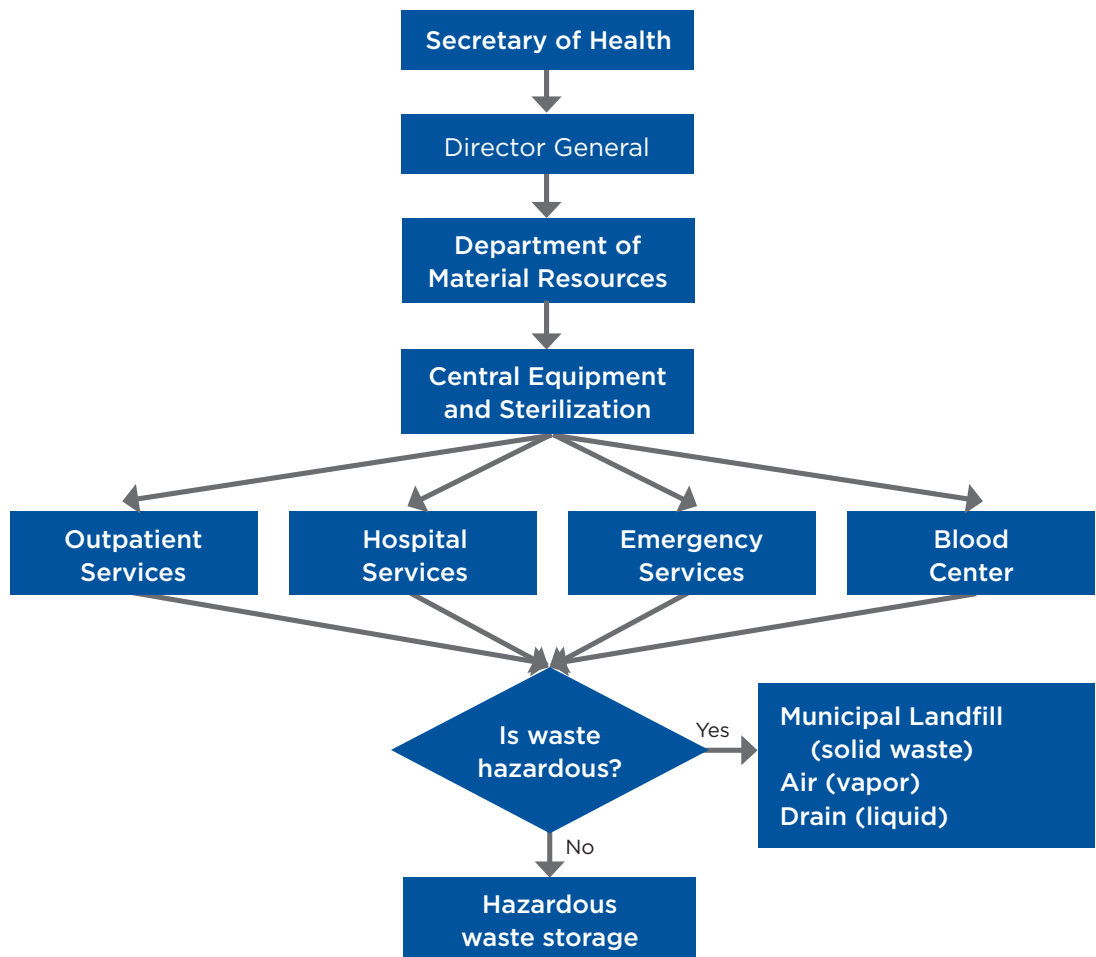
Example: Life cycle of mercury fever thermometers¹¹

PROCUREMENT

**STORAGE &
DISTRIBUTION**

USE

FINAL DISPOSITION



Keep in mind:

- When the process is complex, draw a simple sequence of events first, then make up additional flow charts to show the detail within complex portions of the work.
- Flow charts can be done top to bottom (vertically) or from side to side (horizontally)
- There is usually only one arrow out of a box. Otherwise it may require a decision diamond.

Tool V-2. Problem Statement¹²

A problem statement is a technique for describing a problem, its impact, and the desired state.

Purpose

- Gaining consensus among team members on what the problem is
- Explaining to someone outside the team what the problem is
- Demonstrating the effects of the problem and the benefits of solving it

Application

1. Divide a flip chart page into three horizontal sections. Label the first *Current State*, the second *Impact*, and the third *Desired State*.
2. In the first section, write a concise description of current state.
3. In the second section, describe the impact of the particular problem you have chosen.
4. In the third section, describe in a few sentences what it would be like if the problem were solved (the desired state).
5. If useful, include a short description of the impact of correcting or eliminating the problem.
6. Review the current state, impact of the problem, and the desired state to be sure all team members are in agreement.

Example

Current State

The hospital currently has 213 mercury fever thermometers in use and another 450 devices in the storeroom, which were an unsolicited donation to the hospital. Broken thermometers are common.

Impact of the Problem

- Hospital staff must be trained and prepared for mercury spill cleanup.
- Spills disrupt the delivery of health care services in busy hospital areas.
- The mercury waste must be handled as hazardous waste and environmentally sound disposal options are few and costly.
- Donations result in mercury entering the hospital in an uncontrolled manner.

Desired state

Mercury use in the hospital would be eliminated or substantially reduced and new sources of mercury would not enter the hospital.

Keep in mind

- Be careful not to include causes of the problem or possible solutions to it in your problem statement.
- Express the desired state in realistic and attainable terms

¹² Reference: This tool is taken from the Total Quality TOOLBOX, unpublished

Problem Statement Worksheet

Current State—write a concise description of current state

Impact—describe the impact of the particular problem you have chosen

Desired State—describe in a few sentences what it would be like if the problem were solved

Tool V-3. Selection Grid¹³

A selection grid is a tool for organizing information, comparing options and selecting one option from several possibilities.

Purpose

- Organize information in a clear and useful manner
- Choose an alternative from a list of possibilities

Application

1. Choose the criteria that are important for making a choice
2. Make a grid with the criteria across the top and the options (alternatives) on the left side. Fill the grid to evaluate how well each option satisfies each criterion.
3. Use the information on the grid to help you select the best option.

Here are suggested criteria:

1. Worthwhile. Is the problem worth looking at?
2. Doable. Can we make progress on the situation?

	Worthwhile?				Doable?			
	Criterion #1	Criterion #2	Criterion #3	Criterion #4	Criterion #5	Criterion #6	Criterion #7	Criterion #8
Option #1								
Option #2								
Option #3								

Keep in mind

- List your criteria without regard to the options.
- The selection grid may not give you a clear-cut decision, but it does provide useful information. You must still make the final judgment.

See examples on following pages.

¹³ Reference: This is based on the *Total Quality TOOLBOX*, unpublished.

Example 1: Selecting a mercury reduction project

The Mercury Reduction team came up with 8 criteria they deemed important for weighing the merits of potential mercury projects. Next, they listed six projects. The team members then evaluated how well each project satisfied each criterion, giving a rating of high/low or yes/no. The summary score gives an indication of how the group as a whole viewed the projects. This scoring represents the opinions of the ten people in the group. It doesn't mean that lower scoring projects shouldn't be worked on, but it helps identify the merits and challenges of the different projects.

(List your own criteria)→	Worthwhile?				Doable?				Summary score
	Volume of mercury	Potential for breakage or spill	Health impact on employees & patients	Ease	Support of management & others	Time	Alternatives available	Interest	
Project									
Replace mercury fever thermometers	High: 10 Low: 2	High: 10 Low: 2	High: 9 Low: 1	High: 9 Low: 1	Yes: 8 No: 2	Yes: 10 No: 2	Yes: 10 No: 2	High: 8 Low: 2	High/Yes = 74 Low/No = 6
Replace mercury tensiometers	High: 4 Low: 6	High: 2 Low: 8	High: 2 Low: 8	High: 10 Low: 0	Yes: 7 No: 3	Yes: 8 No: 2	Yes: 10 No: 2	High: 8 Low: 2	High/Yes = 51 Low/No = 29
Eliminate dental mercury	High: 8 Low: 2	High: 2 Low: 8	High: 8 Low: 2	High: 5 Low: 5	Yes: 2 No: 8	Yes: 6 No: 4	Yes: 7 No: 3	High: 3 Low: 7	High/Yes = 41 Low/No = 39
Replace bulk mercury in odontology with amalgam capsules	High: 8 Low: 2	High: 2 Low: 8	High: 8 Low: 2	High: 10 Low: 0	Yes: 9 No: 1	Yes: 10 No: 2	Yes: 10 No: 2	High: 9 Low: 1	High/Yes = 66 Low/No = 14
Replace lab thermometers	High: 1 Low: 9	High: 5 Low: 5	High: 1 Low: 9	High: 6 Low: 4	Yes: 5 No: 5	Yes: 5 No: 5	Yes: 9 No: 1	High: 2 Low: 8	High/Yes = 34 Low/No = 46
Replace mercury electrical switches in HVAC equipment (e.g. furnaces, thermostats)	High: 2 Low: 8	High: 10 Low: 10	High: 10 Low: 10	High: 10 Low: 10	Yes: 10 No: 10	Yes: 10 No: 10	Yes: 2 No: 8	High: 10 Low: 10	High/Yes = 4 Low/No = 76

Example 2: Selecting a mercury reduction project

This is the same as Example 1, but with a simpler rating system. In this case, the summary score is the number of plus marks (+), which gives an indication of how the group as a whole viewed the projects. The score helps identify the merits and challenges of the different projects.

Rating for each criterion: + = low ++ = moderate +++ = high

(List your own criteria)→	Worthwhile?				Doable?				Summary score
	Volume of mercury	Potential for breakage or spill	Health impact on employees & patients	Ease	Support of management & others	Time	Alternatives available	Interest	
Project									
Replace mercury fever thermometers	+++	+++	+++	+++	+++	+++	+++	+++	24
Replace mercury tensiometers	++	+	+	+++	++	+++	+++	++	17
Eliminate dental mercury	+++	+++	+++	+	+	++	++	+	16
Replace bulk mercury in odontology with amalgam capsules	++	+++	+++	+++	+++	+++	+++	+++	23
Replace lab thermometers	+	+	+	++	++	+++	+++	++	15
Replace mercury electrical switches in HVAC equipment (e.g. furnaces, thermostats)	+	+	+	+	+	+	+	++	9

Example 3: Choosing a replacement for a mercury fever thermometer

In this case, the team is deciding which alternatives to pilot in the hospital. They decided that accuracy is critical, so the alcohol thermometer was ruled out because the manufacturer did not provide assurance of its accuracy. The solar thermometer was appealing, but not readily available, so it too was not pursued. As they gathered information, their selection grid included notes to help guide their decision on which alternatives to pilot.

Rating for each criterion: + = less favorable or unknown ++ = moderate/neutral +++ = more favorable

Alternative	Criteria								Summary score = # of "+"
	Accuracy	Durability	Power Source	Ease of use	Degree of workplace reorganization needed	Cost	Is alternative readily available?	User experiences	
Alcohol in glass tube, Model AGT-5	+ Unacceptable	+	+++ (none)	+	+++	+++	++	+ (Note 1)	15
Battery powered small digital thermometer, Model BPD-1	+++ (Note 2)	++	++ (battery)	++	++	++	+++	+++	17
Solar powered small digital thermometer, Model BPD-2	+++ (Note 2)	++	+++ (solar)	++	++	++	+ (Note 3)	+++ (Note 4)	18
Disposable phase-change thermometer, Model X123	+++ (Note 2)	+ (Note 5)	+++ (none)	+	+++	+	+++	++ (Note 6,7)	17
Reusable phase-change thermometer, Model X246	+++ (Note 2)	+	+++ (none)	+	++	+	+++	++ (Note 6,7)	16
Vital signs monitor with temperature probe, Model VSM-200	+++ (Note 2)	+++	++ (plug in)	+++	++	+ (Note 8)	+++	+++ (Note 9)	20

Notes:

1. Breakage is a problem and column of alcohol is hard to read, according to interview with Nurse Manager (at hospital across town)
2. Meets ASTM standard for this type of thermometer:
 - a. ASTM E825-98(2009) Standard Specification for Phase Change-Type Disposable Fever Thermometer for Intermittent Determination of Human Temperature
 - b. ASTM E1299-96(2010) Standard Specification for Reusable Phase-Change-Type Fever Thermometer for Intermittent Determination of Human Temperature
 - c. ASTM E1112-00(2006) Standard Specification for Electronic Thermometer for intermittent Determination of Patient Temperature.
3. Would have to buy from U.S. or Germany; no distributor in our country
4. Nurse B. (at hospital in next county) tried a sample solar thermometer and rated it very favorably
5. This is a single-use disposable thermometer
6. Dr. S. liked the disposable version for infection control purposes, to avoid cross contamination. There was a learning curve for reading the temperature display, but after using it for a day or two, he found it easy to read. He used it when working at another hospital.
7. Nurse C. used this type thermometer for several weeks (at another hospital) and felt that the temperature display was too difficult to read in low-light areas.
8. The Vital signs monitor is much more costly, but needs little maintenance and is very durable so over time it might be more cost effective.
9. Nurse Z. in our hospital has used a vital signs monitor for almost a year and recommends it highly. Probes for other vital signs (e.g. pulse, oxygen level) can be plugged into the same device and used simultaneously. She also tried a battery powered small digital thermometer but didn't like it due to the uneven distribution of weight, which resulted in patients having the thermometer fall out of their mouth and break.

Selection Grid Worksheet

	Criteria								Summary Score
Alternatives	Score								

Tool V-4. Technical criteria for mercury-free medical devices— thermometers and sphygmomanometers

In many hospitals, department managers or supervisors are responsible for ordering materials and supplies for their departments. They, in turn, receive input and requests for the materials and supplies needed from department staff, including physicians, nurses, or nursing assistants. In other hospitals, a procurement department or even a support group outside the hospital may be doing the ordering. When a mercury reduction program is undertaken, it is essential to purchase equipment and materials that do not contain mercury. From our experience working in hospitals, it is clear that hospital staff want to use non-mercury products. However it is important to consider the products' technical and performance characteristics to ensure quality patient care and ease of use. This must be communicated to whichever individuals or groups are selecting the products.

The World Health Organization (WHO) report *Replacement of mercury thermometers and sphygmomanometer in health care: technical guidance* is an excellent resource when selecting mercury-free thermometers and sphygmomanometers.¹⁴ The report's *Annex 1* and *Annex 2* contain comprehensive lists of recognized certifications and performance characteristics for non-mercury thermometers and sphygmomanometers. These will be useful when talking to suppliers and evaluating new devices.

The WHO report may be accessed online at either of the following sites (accessed on April 18, 2013):

http://www.who.int/water_sanitation_health/publications/2011/mercury_thermometers/en/

http://whqlibdoc.who.int/publications/2011/9789241548182_eng.pdf

If these links are not active, the report may also be found by using a search engine and the search phrase: *WHO replacement of mercury thermometers and sphygmomanometers in health care*

In general, the following should be considered when selecting non-mercury sphygmomanometers and thermometers (whether digital, battery or solar):

- The device should meet recognized standards for accuracy and performance. (See the tables in Annex 1 and Annex 2 of the WHO report.)
- Pilot evaluations can be performed in your clinical areas to compare mercury-free devices with existing mercury devices, for performance and ease of use. These comparisons can be done by the nursing staff. Feedback from evaluations—both favorable and unfavorable—should be given to the product supplier and manufacturer's representative. Communicate both what you like and dislike in the products so that suppliers can find better alternatives and manufacturers can improve their products.
- Once you have selected a device for widespread implementation in the hospital, ask the supplier or manufacturer's representative to provide staff training on the use of the thermometer or sphygmomanometer. Make sure that the training and any instructions are available in the language spoken in your hospital.
- Make sure you have a maintenance program for the devices. Log in and assign a unique identification number for each device, then keep track of its maintenance, repairs, and useful service life. (Bar coding works very well for device identification.) Also set up a system for replacing worn out batteries and collecting used batteries for proper disposal. Ask the supplier to offer all services: provide new batteries, collect used batteries, and provide maintenance of the equipment as needed. This practice is becoming common in some hospitals in Latin America, for example among suppliers of glucose measuring equipment.

¹⁴ Shimek JAM, Emmanuel J, Orris P, Chartier Y. *Replacement of mercury thermometers and sphygmomanometers in health care: Technical Guidance*. 2011. World Health Organization.

Tool V-5. Replacing Mercury Thermometers with Digital Thermometers

The purpose of this factsheet is to encourage healthcare administrators to replace mercury fever thermometers with digital thermometers. Mercury is a persistent, bio-accumulative, toxic material that can harm the brain, heart, kidneys, lungs, and immune system of people of all ages. (Reference: U.S. EPA, <http://www.epa.gov/mercury/about.htm>) When a mercury thermometer breaks, spilled mercury can evaporate and become an invisible, odorless toxic vapor. For this reason, efforts are underway globally to eliminate the use of mercury-containing medical devices.

The transition may not be an easy one because the cost increases seem to be enormous: in some locations, the purchase price of a digital thermometer can be ten times or greater than the price of a mercury thermometer. The following section lays out a number of facts explaining why digital thermometers are indeed preferable and cost effective in the long run.

Advantages and cost-saving elements of digital thermometers

Digital thermometers avoid the shortcomings of glass/mercury thermometers and are appealing for several reasons:

- Digital thermometers are **easier and faster to use**: “Shaking down” the thermometer is eliminated. The digital thermometer senses and then beeps to indicate that the temperature reading is ready to be recorded. The digital readout can be read easily, compared with having to assess the mercury level and read the temperature scale divisions on the glass tube.
- The **risks of broken glass and exposure to mercury spills are eliminated**, as well as the time needed to clean up and safely dispose of mercury from a broken thermometer. Avoiding exposure to mercury is healthier for hospital workers, patients and visitors.
- It is likely that **fewer thermometers will be purchased each year**. Eliminating the need to shake down the thermometer decreases the likelihood of dropping and breaking the device, whether it is glass or digital. Patient-related breakage, including young patients biting on the thermometer and patients accidentally dropping the thermometer, are also eliminated.

The higher up-front cost of digital thermometers is the price a hospital pays for ease of use, reduced breakage, reduced need for replacement thermometers, a healthier environment and prevention of long term health effects caused by mercury exposure. Numerous interviews with digital thermometer users provide convincing evidence that the digital devices are viable and well-received in health care facilities.

Important considerations for selecting digital thermometers

Accuracy—With the variety of digital thermometers available, it is essential to ensure the quality of the tool you select. One way to do this is to seek thermometers that have been tested and shown to meet voluntary standards set by the American Society of Testing and Materials¹ (ASTM). The following table shows the maximum error allowed under the ASTM standards. (Glass/mercury and digital thermometers have the same requirements over the range of 96.4–106 °F.)

	Maximum Error over Temperature Range Shown ^{2,3}				
↓ Thermometer Type					
Celsius Scale	<35.8 °C	35.8 °C to < 37 °C	37.0 °C to 39.0 °C	>39.0 °C to 41.0 °C	>41.0 °C
Mercury in Glass ²	± 0.3 °C	± 0.2 °C	± 0.1 °C	± 0.2 °C	± 0.3 °C
Digital Thermometers ³	± 0.3 °C	± 0.2 °C	± 0.1 °C	± 0.2 °C	± 0.3 °C
Fahrenheit Scale	<96.4 °F	96.4 to < 98.0 °F	98.0 to 102.0 °F	>102 to 106 °F	>106 °F
Mercury in Glass ²	± 0.4 °F	± 0.3 °F	± 0.2 °F	± 0.3 °F	± 0.4 °F
Digital Thermometers ³	± 0.5 °F	± 0.3 °F	± 0.2 °F	± 0.3 °F	± 0.5 °F

1 American Society of Testing and Materials (ASTM), www.astm.org, West Conshohocken, PA, USA.

2 ASTM Procedure E667, Standard Specification for Mercury-in-Glass, Maximum Self-Registering Clinical Thermometers

3 ASTM Procedure E1112, Standard Specification for Electronic Thermometer for Intermittent Determination of Patient Temperature

Batteries—A drawback to digital thermometers is that most use miniature batteries, which have their own environmental impact. When you are evaluating different devices, ask the manufacturer or supplier how the thermometer is powered. There are solar powered digital thermometers on the market that completely eliminate the need for batteries. While preferable, they cost considerably more; on the order of 65% higher in cost than battery powered thermometers. If you choose a thermometer that uses a miniature battery, make sure that the battery can be replaced. Otherwise, you will have to discard the entire device when the battery wears out. Because the batteries contain metals, salts, acids and plastics, the spent (dead) batteries should be collected and recycled, rather than put in the trash.

Flexible Tips—When possible, it is best to avoid thermometers with flexible tips. Some digital thermometers have flexible tips made out of polyvinyl chloride (also called “PVC” or “vinyl”). The purpose of the flexible tip is to make the thermometer more comfortable for the patient. However PVC has both known and suspected health and environmental shortcomings at all stages: during manufacture, in use as a medical device, and after disposal. During use, a concern is that plasticizers—additives used to make the PVC flexible (and hence more comfortable for the patient)—can slowly leach from the PVC. There are sufficient questions about safety to avoid PVC when possible.

Evaluate alternative products—Ask for samples. A hands-on look at the digital thermometers is essential. If the samples look promising, do a small scale clinical trial in the hospital. Look closely at employee feedback. This will help rule out inferior devices or, from criticism and questions raised, will identify key points to communicate during widespread introduction and training for the new thermometers. When you buy a new device, consider using the manufacturer’s representative for training staff and to introduce the new product to all the different departments in the hospital. Encourage staff members to question and offer constructive criticism to the manufacturer’s representative. The representative is a direct link back to the design engineers and this is one way products get refined and improved.

Keep purchasing agreements flexible—The first thermometer you select may prove over time to have drawbacks that you don’t want to live with. Make sure you have the freedom to procure different thermometers if this happens.

Be prepared for uncertainty when selecting a product—There are no perfect products. For example, which is preferable: a solar-powered thermometer with a PVC flexible tip or a battery-powered thermometer without PVC? In situations like this, see if the supplier has a product with the best of both alternatives: a solar powered thermometer without PVC. Look at the bigger picture for guidance. Finally, remember that either type of digital thermometer is safer than a mercury thermometer.

Tool V-6. Sample Dental Amalgam Capsule Evaluation Form

Date: _____ Department: _____ Occupation: _____

Product: _____ How long used: _____

Please **circle** the most appropriate answer for each question. Not applicable (N/A) may be used if the question does not apply to this particular product.

TRAINING	Disagree.....Agree
1. The user does not need extensive training for correct use	1 2 3 4 5 N/A
2. The design of the amalgam capsule suggests proper use	1 2 3 4 5 N/A
DURING USE	
3. The amalgam capsule no longer requires handling of raw materials	1 2 3 4 5 N/A
4. The amalgam capsule can be used with existing equipment	1 2 3 4 5 N/A
5. The amalgam capsule provides good results	1 2 3 4 5 N/A
6. This capsule is easily used by a worker who may be pressed for time	1 2 3 4 5 N/A
7. This capsule is compact and convenient to use	1 2 3 4 5 N/A
8. This pre-measured single dose capsule is a better alternative to traditional methods (measuring and mixing individual raw materials)	1 2 3 4 5 N/A
AFTER USE	
9. Clean up after using the capsule is as easy as cleaning up after measuring and mixing individual raw materials.	1 2 3 4 5 N/A
10. Clean up after using a capsule is easier than after measuring and mixing individual raw materials.	1 2 3 4 5 N/A
11. There is less waste with the use of single-use capsules compared with measuring and mixing individual raw materials.	1 2 3 4 5 N/A
12. The amalgam capsule is safer than preparing amalgam by measuring and mixing individual raw materials.	1 2 3 4 5 N/A

Of the above questions, which two or three do you think are most important to successfully using this product?

Are there other questions which you feel should be asked regarding the safe or appropriate use of this product?
(Reverse side of form may be used for comments)

Acknowledgement: Questions and format for this evaluation form were modeled on the Training for Development of Innovative Technologies evaluation tools for safety medical devices (www.tdict.org), developed by Dr. June Fisher. This form was developed jointly by the Lowell Center for Sustainable Production, the Institute for Development of Production and the Work Environment, and the University of Sonora. (April 13, 2010)

Tool V-7. Sample Dental Resin Evaluation Form

Date: _____ Department: _____ Occupation: _____

Product: _____ How long used: _____

Please **circle** the most appropriate answer for each question. Not applicable (N/A) may be used if the question does not apply to this particular product.

TRAINING	Disagree.....Agree
1. The user does not need extensive training for correct use	1 2 3 4 5 N/A
2. The design of the resin suggests proper use	1 2 3 4 5 N/A
DURING USE	
3. The resin can be used with existing equipment.	1 2 3 4 5 N/A
4. The resin does not require more time to use than using amalgam capsules or preparing amalgam from raw materials.	1 2 3 4 5 N/A
5. The resin gives good results.	1 2 3 4 5 N/A
6. This resin is easily used by a worker who may be pressed for time.	1 2 3 4 5 N/A
7. The resin is compact and convenient to use.	1 2 3 4 5 N/A
8. The resin provides a better alternative to traditional methods (using amalgam capsules or preparing amalgam from raw materials).	1 2 3 4 5 N/A
AFTER USE	
9. Clean up after using the resin is as easy as cleaning up after mixing raw materials or capsules.	1 2 3 4 5 N/A
10. Clean up after using the resin is easier than cleaning up after mixing raw materials or capsules.	
11. There is less waste with the use of resin compared with measuring and mixing individual raw materials or using capsules.	
12. The resin is safer than mixing and preparation of materials or capsules.	1 2 3 4 5 N/A

Of the above questions, which two or three do you think are most important to successfully using this product?

Are there other questions which you feel should be asked regarding the safe or appropriate use of this product?
(Reverse side of form may be used for comments)

Acknowledgement: Questions and format for this evaluation form were modeled on the Training for Development of Innovative Technologies evaluation tools for safety medical devices (www.tdict.org), developed by Dr. June Fisher. This form was developed jointly by the Lowell Center for Sustainable Production, the Institute for Development of Production and the Work Environment, and the University of Sonora. (April 13, 2010)

Tool V-8. Sample Non-mercury Sphygmomanometer Evaluation Form

Date: _____ Department: _____ Occupation: _____

Product: _____ How long used: _____

Please **circle** the most appropriate answer for each question. Not applicable (N/A) may be used if the question does not apply to this particular product.

TRAINING	Disagree.....Agree
1. The user does not need extensive training for correct operation	1 2 3 4 5 N/A
2. The design of the sphygmomanometer suggests proper use	1 2 3 4 5 N/A
DURING USE	
3. The non-mercury sphygmomanometer does not require more time to use than a mercury thermometer	1 2 3 4 5 N/A
4. This sphygmomanometer is accurate	1 2 3 4 5 N/A
5. This sphygmomanometer is easy to read	1 2 3 4 5 N/A
6. This sphygmomanometer is easily used by a worker who may be pressed for time	1 2 3 4 5 N/A
7. This sphygmomanometer is comfortable to use and compact	1 2 3 4 5 N/A
8. This sphygmomanometer provides a better alternative to traditional mercury sphygmomanometer	1 2 3 4 5 N/A
AFTER USE	
9. Transporting and storing this sphygmomanometer is as easy as a mercury sphygmomanometer	1 2 3 4 5 N/A
10. The non-mercury sphygmomanometer is safer than the mercury sphygmomanometer	1 2 3 4 5 N/A
	1 2 3 4 5 N/A
	1 2 3 4 5 N/A
	1 2 3 4 5 N/A

Of the above questions, which two or three do you think are most important to successfully using this product?

Are there other questions which you feel should be asked regarding the safe or appropriate use of this product?
(Reverse side of form may be used for comments)

Acknowledgement: Questions and format for this evaluation form were modeled on the Training for Development of Innovative Technologies evaluation tools for safety medical devices (www.tdict.org), developed by Dr. June Fisher. This form was developed jointly by the Lowell Center for Sustainable Production, the Institute for Development of Production and the Work Environment, and the University of Sonora. (April 13, 2010)

Tool V-9. Sample Digital Thermometer Evaluation Form

Date: _____ Department: _____ Occupation: _____

Product: _____ How long used: _____

Please **circle** the most appropriate answer for each question. Not applicable (N/A) may be used if the question does not apply to this particular product.

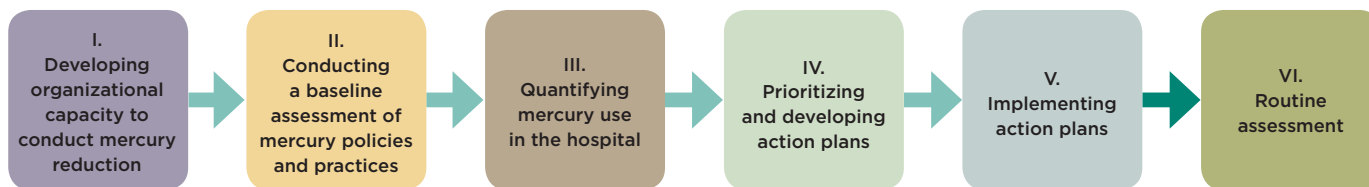
TRAINING	Disagree.....Agree
1. The user does not need extensive training for correct operation	1 2 3 4 5 N/A
2. The design of the digital thermometer suggests proper use	1 2 3 4 5 N/A
DURING USE	
3. This digital thermometer does not require more time to use than a mercury thermometer	1 2 3 4 5 N/A
4. There is a clear and unmistakable change (audible or visible) that occurs when the temperature is reached	1 2 3 4 5 N/A
5. This thermometer is accurate	1 2 3 4 5 N/A
6. This thermometer is easy to read	1 2 3 4 5 N/A
7. This thermometer is easy to handle while wearing gloves	1 2 3 4 5 N/A
8. This thermometer is easy to handle with damp hands	1 2 3 4 5 N/A
9. This thermometer is easily used by a worker who may be pressed for time	1 2 3 4 5 N/A
10. This thermometer is comfortable to use and compact	1 2 3 4 5 N/A
11. This thermometer provides a better alternative to traditional mercury thermometers	1 2 3 4 5 N/A
AFTER USE	
12. Cleaning of this digital thermometer is as easy as a standard mercury thermometer	1 2 3 4 5 N/A
13. Replacement batteries for this digital thermometer are available in this hospital	1 2 3 4 5 N/A
14. Recycling is available for old batteries in this hospital	1 2 3 4 5 N/A

Of the above questions, which three do you think are most important to successfully using this product?

Are there other questions which you feel should be asked regarding the safe or appropriate use of this product?
(Reverse side of form may be used for comments)

Acknowledgement: Questions and format for this evaluation form were modeled on the Training for Development of Innovative Technologies evaluation tools for safety medical devices (www.tdict.org), developed by Dr. June Fisher. This form was developed jointly by the Lowell Center for Sustainable Production, the Institute for Development of Production and the Work Environment, and the University of Sonora. (April 13, 2010)

ORGANIZATIONAL STEP VI. Routine Assessment



Key points

- Perform an annual assessment of the mercury reduction program
- Examine the amount of mercury 1) coming into the hospital, 2) in storage and use, and 3) leaving the hospital
- Record quantitative and qualitative indicators of mercury reduction in the hospital.
- Compare current mercury use to the baseline assessment and to prior years' records
- Plan the next year's activities

The section is organized into three topics:

- Steps for conducting a routine assessment
- Tips for performing the assessment
- A general discussion of qualitative and quantitative measures

Figure 1. **Assessment of mercury from multiple perspectives**



A. Steps for Conducting a Routine Assessment

Routine assessment is the process of periodically monitoring the mercury reduction program in your hospital. This process will help you determine effectiveness of your program, develop next steps, and insure that mercury products or processes don't slip back into use unnoticed. It is carried out in four main steps:

1. Plan the routine assessment

Done by: Mercury coordinator and mercury reduction team

- Look at your hospital's baseline assessment and any prior years' assessments as guidance for where to conduct inventories and walk-through assessments¹⁵
- Brainstorm other areas where mercury might be present and how it might be measured
- Consider where mercury was eliminated in the past and plan a walk-through assessment to confirm that the alternative products/processes are still working effectively
- Establish the format for collecting information, such as inventory worksheets and walk-through assessment forms
- Schedule and assign responsibility for inventories and walk-through assessments throughout the hospital

2. Perform the mercury assessment activities

Done by: Individuals or small groups responsible for conducting the assessments

- Conduct the inventories and walk-through assessments
- Record the findings in the agreed-upon format and return the findings to the coordinator

3. Compile and analyze the findings

Done by: Mercury coordinator and mercury reduction team

- Compile the findings from the inventories and walk-through assessments
- Compare the findings with the baseline information and information from prior routine assessments
- Identify trends and key indicators that tell the effectiveness of the mercury reduction effort, such as:
 - decreases or increases in mercury procurement and use
 - improvements relative to mercury
 - how well the existing mercury is controlled (spills, containment of waste)
 - barriers to reducing mercury (mercury products that have slipped back into use, no recognized alternatives, etc.)

4. Develop action plans for the next year

Done by: Mercury coordinator and mercury reduction team

- Based on the findings of the inventories and assessments, identify and prioritize the next steps for the coming year
- Communicate your successes and next steps to celebrate accomplishments, reinforce the effort, and recognize the efforts of the hospital staff

¹⁵ A walk-through assessment is an information-gathering visit in which the assessor observes and interviews knowledgeable individuals about the use of mercury or mercury alternatives.

B. Tips for performing the assessment

An annual assessment should examine mercury from multiple perspectives:

Mercury entering the hospital (inflows)

Why look at this: This measure is an indicator of how well your hospital is doing at preventing mercury from entering the hospital. Once mercury enters the hospital, it requires vigilant control in storage, in use and as hazardous waste. Avoiding the procurement of mercury in the first place is the most effective mechanism for mercury reduction.

Mercury in storage or use (mercury on hand)

Why look at this: This measure clearly shows the location and amount of mercury the hospital is responsible for. It also shows how successful the hospital is at reducing the use of mercury in its operations. Over time, there should be a trend of a lower amounts of mercury in use and greater amounts of mercury in the hazardous waste containment areas.

Mercury leaving the hospital (outputs)

Why look at this: This measure allows the hospital to insure that waste products are being carefully managed and not released in a way that will cause human or environmental harm.

Assessment measures can be both **quantitative** and **qualitative**.

Quantitative measures are things that can be easily counted or measured numerically, such as:

- inventories of mercury-containing devices
- volumes of bulk mercury or mercury-containing reagents
- quantities of compact fluorescent lamps
- weight or volume of waste amalgam

Qualitative measures show characteristics or activities that are not easily counted, but which reflect the hospital's reduction or control of mercury such as:

- new or refined mercury policies
- more extensive training of staff
- improved storage and inventorying of mercury devices and waste
- tagging of mercury-containing electrical components
- transition from one type of non-mercury device to a new and improved device

Here are tips for performing the assessment of mercury in the hospital:

Recording mercury entering the hospital (inflows of mercury)



Mercury entering the hospital

Mercury products/processes entering the hospital through material management department or other means such as donations, samples, or with patients or staff

1. Record types and quantities of mercury-containing products and processes purchased in the past year
Use purchasing records to count the number of mercury-containing products purchased in the past year. If this type of assessment was done the previous year, use last year's records to help identify what products to look for.
2. Record types and quantities of mercury-containing products and processes that came into the hospital by other means, including charitable donations, samples or with staff or patients
Assess whether mercury entered the hospital through a means other than traditional procurement, including donations and samples. (This might be done through interviews in the purchasing department, warehouses, in the clinical areas, in labs and in other hospital areas.)
3. Assess and record other qualitative indicators of mercury reduction and control through interviews and observations, such as:
 - A hospital-wide or purchasing department policy that limits mercury coming into the hospital (e.g. purchasing, donations)
 - Purchase of mercury-free products from manufacturers that offer a "take back" of the mercury devices being replaced
 - Second generation non-mercury alternative products¹⁶
 - Staff training on mercury and alternative products
 - Record efforts to identify and evaluate alternative products, including successful evaluations and purchases of new products and unsuccessful attempts to find viable alternatives
4. Compile the records (of steps 1–3, above) into a summary table that shows a year-by-year summary of mercury coming into the hospital and the qualitative indicators.
Examine the records from year to year and look for a trend of reduced mercury entering the hospital. If this trend is not apparent, consider focusing future mercury reduction efforts on the procurement stage.

Once you have recorded this information, what does it tell you?

- The number of mercury devices and amount of mercury entering the hospital on an annual basis
- Progress (or lack of) in preventing mercury from entering the hospital
- The types of products still using mercury, and hence where to apply resources for finding alternatives
- Uncontrolled sources of mercury entering the hospital (such as donations)
- Whether there is a culture of mercury reduction among the groups that control materials coming into the hospital

By comparing the input records from year to year, it becomes clear whether the hospital is reducing mercury at the source; that is, preventing mercury from coming into the hospital in the first place.

¹⁶ "Second generation" refers to a non-mercury device or process that has replaced an earlier alternative, such as an improved version or more advanced technology.

Recording mercury on hand in the hospital



Mercury on hand

Mercury devices or supplies in the warehouse, in use, set aside, or mercury collected & stored as hazardous waste.

1. Complete an inventory of mercury-containing medical devices or pharmaceuticals in use in the clinical areas, in warehouses or storage areas, in the pharmacy, or in maintenance/repair areas
In each area, do a walk-through assessment and complete an inventory of any mercury devices or processes in the department. Typical medical devices include fever thermometers and blood pressure devices (tensiometers, sphygmomanometers). In the pharmacy, mercury may be used as a preservative (e.g., thimerosal) in medical preparations such as vaccines, ointments (ear medicines, hemorrhoid medication), contact-lens solutions and nasal sprays. In the Dental/Odontology clinic, record the inventory of bulk mercury, mercury in amalgam capsules and mercury in amalgam waste.
2. Compile inventories of mercury-containing products in clinical laboratories
Work with the laboratory staff to identify and record the mercury-containing products and processes, including lab thermometers (column, oven or freezer thermometers), barometers, and reagents (e.g. stabilized with thimerosal).
3. Take inventory of mercury used in the operation of the facility
Work with the facilities staff to identify and record the inventory of mercury-containing items such as compact fluorescent lamps (CFLs), electrical switches (such as in food service ovens, laundry machine tilt switches, float switches), HVAC equipment, barometers, thermometers, or sling psychrometers.
4. Compile an inventory & description of mercury collected and stored as hazardous waste
Examine records in the hazardous waste storage area to assess and compile an inventory of the amount of mercury held in this area.
5. Use interviews and observations to assess and record other qualitative indicators of mercury reduction throughout the hospital, such as:
 - A hospital-wide or department policies related to the use of mercury
 - Efforts to identify and evaluate alternative products, including successful evaluations and purchases of new products and unsuccessful attempts to find viable alternatives
 - Use of second-generation non-mercury containing products; that is, a department that already used non-mercury devices has evaluated other alternatives and moved on to better non-mercury products.
 - Information from mercury spill logs about the number and cleanup of mercury spills that provide insight into the nature and number of spills
 - Staff training on mercury and alternative products
 - Staff comments that indicate a greater understanding of the problems with mercury
 - Innovative practices in place to avoid mercury use or exposure
 - Hospital employees seeking input from colleagues in other hospitals or institutions

6. Compile the records (of steps 1–5, above) into a summary table that shows a year-by-year summary of mercury amounts and practices in the hospital.

Examine the records and compare this year with prior years. Is there a clear trend of mercury reduction and control? Has mercury slipped back into use? Are there new solutions or obstacles that appeared in the past year?

Once you have recorded this information, what does it tell you?

- The number of mercury devices and amount of mercury in the hospital
- Progress (or lack of) in reducing mercury use in different departments
- Whether there are opportunities for one department/individuals to educate other departments/individuals on alternative products
- The types of products still using mercury, and hence where to apply resources for finding alternatives
- Whether there is a culture of mercury reduction within the hospital and whether some areas are better than others

Comparing the year-to-year results provides a clear picture of the hospital's mercury reduction efforts.

Mercury Leaving the Hospital (mercury output)



Mercury output

Mercury leaving the hospital as hazardous waste, or in municipal waste, air, or through the drain

Each year a certain amount of mercury leaves the hospital either as hazardous waste (e.g. compact fluorescent lamps; CFLs) or into the environment through municipal waste, air or down the drain. Ideally, these quantities would be part of the annual assessment. With the exception of CFLs, which can be easily counted, it may be difficult to quantify these amounts. Do the best you can to find and record the information available. As better alternatives become available for safe removal of mercury, it will be easier to quantify mercury leaving the hospital.

1. Compile records of mercury waste taken offsite by a hazardous waste vendor.
For example, record the number of CFLs sent offsite for recycling.
2. Look for and record movement of mercury out of the hospital, such as through mercury exchange programs or other collection programs. This should also include any mercury devices given to other hospitals or facilities.¹⁷
3. Use interviews and observations to assess and record other qualitative indicators of mercury control, such as:
 - *Policies related to the disposition of mercury waste*
 - *Improved equipment or practices for storage or movement of waste mercury*
 - *Staff training programs*
 - *Better control of potential mercury exposures or releases of mercury to the environment, such as preventing drain disposal of reagents in the clinical laboratory, training on improved spill management, or prohibiting washing dental garments at home.*

¹⁷ A mercury exchange program is one in which a vendor offers to take back one mercury device for each non-mercury product purchased. For example, manufacturers of tensiometers (sphygmomanometers) take back one intact mercury tensiometer for each non-mercury tensiometer purchased.

C. A General Discussion of Quantitative and Qualitative Measures

Quantitative measures are things that can be easily counted or measured numerically, such as:

- inventories of mercury-containing devices
- volumes of bulk mercury or mercury-containing reagents
- quantities of compact fluorescent lamps
- weight or volume of waste amalgam

Qualitative measures show characteristics or activities that are not easily counted, but which reflect the hospital's reduction or control of mercury such as:

- new or refined mercury policies
- more extensive training of staff
- improved storage and inventorying of mercury devices and waste
- tagging of mercury-containing electrical components
- transition from one type of non-mercury device to a new and improved device

Quantitative Measures

What do inventories tell?

- The hospital's burden of mercury
 - How much is present
 - Where it is located
- Identification of products for which alternatives are needed

The count tells the amount of mercury and where it is located (products, processes and departments), which is beneficial for prioritizing the hospital's mercury efforts. Compare the current inventory with the inventories from prior years. *Look for a trend of mercury changing from year-to-year, as judged by the amount of mercury in operations (ideally lowering from year to year) and in hazardous waste collection and disposal (possibly increasing, reflecting the movement of mercury out of operations). An overall lower mercury level in use and warehouses suggests that the hospital is making progress.*

Inventories don't show the whole picture; what they fail to show includes 1) when the mercury devices were purchased and put into use (the longevity of the devices or processes), 2) how much mercury was taken out of service due to replacement or breakage, and 3) mercury that wasn't properly captured and that escaped in the air, down the drain, or in municipal waste.

Qualitative Measures

In addition to quantifying the amount of mercury, there are a number of qualitative indicators that can be used to assess the progress of mercury reduction efforts. These indicators provide a fuller picture of mercury use than the numbers alone can provide. Key indicators might include:

- Procurement records
 - What types of mercury products are still being purchased?
 - Are alternatives available?
 - Are there alternatives for these products being used elsewhere in the hospital?
- Policies or standard operating procedures (SOPs)
 - The number of mercury policies in the hospital
 - More comprehensive policies that indicate thoughtful refinements to the original version (are your policies dated and updates systematically recorded?)
 - Are there SOPs or training materials for alternatives?
 - Improved documentation of practices
 - Have changes in practices taken place in the past year?

- Hazardous waste response
 - Mercury spills and cleanups: how many occurred and how serious were they?
- Site wide training
 - Mercury awareness
 - Health and safety regulatory reporting and compliance
 - Spill clean-up
- Education sessions pertaining to mercury reduction and control (consider topics, number of sessions, number of people attending)
- Products or processes that have moved from first-generation to second-generation alternatives
- Products or process alternatives that are more sophisticated than basic ones in use elsewhere in the hospital. (e.g. a vital signs monitor for measuring temperature versus a digital pocket thermometer)
- Mercury Team records
 - For example, a readily retrievable log of mercury-containing products and processes in use, the rationale for continued use, and a time frame for the reconsideration of available alternatives.
- Has the mercury reduction effort prompted other improvements?

Special Topics

Key point
This section includes a variety of tools and resources for reducing mercury use in the hospital and in the dental office or clinic.

Resource Materials

#	Title	Comments
1	How to Prepare a Spill Kit for Small Mercury Spills	For all departments that use mercury or mercury-containing devices
2	Mercury Quick Facts: Cleaning Up Mercury Spills in Your House Fact sheet provided by the Agency for Toxic Substances and Disease Registry (ATSDR) and the Environmental Protection Agency (EPA)	Although this guide was prepared for mercury spills in homes, is a good general reference.
3	How to clean up a small mercury spill (brochure)	This compact brochure can be distributed in the hospital. A copy can also be placed in the spill cleanup kit.
4	Sample labels for mercury waste containers	These labels can be printed and attached to containers of mercury waste for clear identification of the hazardous contents.
5	FDI Policy Statement: Mercury Hygiene Guidance (2007)	The FDI mercury hygiene statement provides recommendations on handling both encapsulated and bulk mercury.
6	Workplace controls in dental offices and clinics: preventing Mercury Exposures	This provides helpful advice for controlling mercury in dental offices and clinics.

Resource 1. How to Prepare a Spill Kit for Small Mercury Spills

Silvery elemental mercury liquid is used in thermometers, blood pressure devices with a mercury column (sphygmomanometers, tensiometers), barometers, dental amalgam, and other control devices in hospitals. If a device breaks or leaks and the mercury spills, it can evaporate into an invisible, odorless toxic vapor. Therefore spills should be promptly cleaned up. Spill kits can be prepared in advance and kept on hand for a quick response.

Every area that uses mercury should have access to a spill kit. Most things in the kit are common items already in the workplace, but the spill kit consolidates them for emergency use. Spill kits should be located around work areas in fixed locations so they will be easily accessible. The kit contents should be checked periodically and restocked after each use.

Recommended items:

A container for the spill clean-up supplies, such as a plastic container with a snap-on lid or heavy-duty plastic freezer bag, marked "Mercury Spill Kit"	A tupperware* container or ziploc* bag can be used
4-5 zipper-top plastic bags	For example, a ziploc* bag
Protective nitrile or rubber gloves	Powder free gloves. Dispose after use.
Paper towels	
Cardboard or squeegee	To pick up large residues of mercury
Eye dropper	To pick up large residues of mercury
Duct tape	Useful for picking up small residues of mercury
Flashlight	Preferably bright white light
Powdered sulfur (optional)	
Glass jar with metal screw lid and gum seal (preferred), or high density polyethylene (#2 plastic) containers with screw caps or pressure fit seals	A canning-style jar, large peanut butter jar or similar container may be useful. It will be used to deposit the residues of mercury collected and all waste materials (gloves, paper towels, et cetera).
Labels	To identify the hazardous contents of the waste container

*This is an example, not an endorsement

Store the items in the container clearly marked "Mercury Spill Kit". The container can be as basic as a plastic box or zipper-top plastic bag. The key point is that the kit is kept fully stocked and is in a designated location and accessible.

Resource 2. Mercury Quick Facts: Cleaning Up Mercury Spills in Your House

Available online at: http://www.atsdr.cdc.gov/mercury/docs/Residential_Hg_Spill_Cleanup.pdf

February, 2009

Mercury Quick Facts Cleaning up Mercury Spills in Your House

If a thermometer or other small mercury-containing item such as a thermostat or compact fluorescent light bulb breaks, you may be able to clean it up yourself. Follow the steps in this flier to clean up the spill. If the mercury spill is larger than two tablespoons, follow the instructions in this flier and get professional help to clean up the spill.



What NEVER to Do When Cleaning Up a Mercury Spill

- **Never use a vacuum cleaner or broom to clean up the spill.**
A vacuum cleaner or broom will break the mercury into smaller drops and spread it around more. Tiny mercury droplets will settle throughout the area, increasing the spread of the mercury in the room. The droplets will evaporate faster and increase your chance of breathing high levels of mercury vapor. They will be harder to clean up.
- **Never pour mercury down a drain.**
The mercury can become lodged in the "p" traps and may continue to vaporize into the room. Mercury can also pollute septic tanks or wastewater-treatment plants.
- **Never allow people who are wearing mercury-contaminated shoes or clothing to walk around the house.**
This will help limit the spread of spilled mercury.
- **Never use a washing machine to launder clothing or other items that may have come in contact with mercury.**
Mercury can contaminate the washer and/or pollute sewage. Throw all clothing that came in contact with liquid mercury in the trash. If mercury is visible on the clothing take it to your local household hazardous waste collection site for disposal. Wash clothing or other items that were exposed to mercury vapor during the cleanup, but did not get mercury directly on them.

"In no case should a vacuum cleaner or broom be used to remove mercury. This will spread the mercury over a larger area and will put mercury vapors into the air and increase your chance of breathing high levels of mercury vapors."



ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

How to Clean up a Small Mercury Spill

(a broken thermometer, thermostat or compact fluorescent bulb)

Step 1. Isolate the spill and ventilate the area right away.



- The person who will clean up the spill should have everyone else, **especially children**, leave the spill area, including pets. Don't let anyone walk through the mercury on their way out.
- Open all windows and doors that open to the outside of the house.
- Close all doors between the room where the mercury was spilled and the rest of the house.
- Close all cold air returns so that mercury vapor is not carried throughout the house.
- Turn down heaters and turn up single-room air conditioners, but **don't** use central air conditioning.
- Use fans to blow mercury-contaminated air outside. Turn off fans that do not blow air to the outside.

Step 2: Get the items needed to clean up a small mercury spill.



You will need the following items:

1. 4 or 5 zipper-top plastic bags
2. trash bags (2 to 6 mm thick)
3. rubber, nitrile or latex gloves
4. paper towels
5. cardboard or squeegee
6. eye dropper
7. duct tape, or shaving cream and small paint brush
8. flashlight
9. powdered sulfur (optional)

Step 3: Cleanup Instructions



- Put on rubber, nitrile or latex gloves.
- Pick up any broken pieces of glass and place them on a paper towel. Fold the paper towel, place it in a zipper-top bag, and seal the bag.
- **Clean up the beads of mercury.** Use a squeegee or cardboard to slowly roll the beads onto a sheet of paper. An eye dropper can also be used to collect the beads. Slowly squeeze mercury from the eye dropper onto a damp paper towel. Put the paper towel, paper, eye dropper, or anything else that has mercury on it, into a zipper-top bag, and seal the bag.
- After you remove larger beads, put shaving cream on top of a small paint brush and gently blot the affected area to pick up smaller hard-to-see beads. You can also use duct tape or masking tape to collect smaller hard-to-see beads. Place the paint brush or tape into a zipper-top bag.

How to Clean up a Small Mercury Spill (a broken thermometer, thermostat or compact fluorescent bulb)

Step 3 continued...



- It is **OPTIONAL** to use commercially available powdered sulfur to absorb beads that are too small to see. The sulfur does two things: (1) it makes the mercury easier to see since there may be a color change from yellow to brown, and (2) it binds the mercury so that it can be easily removed, and it helps to keep mercury that may have been missed during the cleanup from vaporizing into the room. Mercury spill kits that contain sulfur can be purchased from laboratory, chemical and hazardous materials response supply manufacturers. Read and understand how to use the cleanup kit before using. **Note:** Powdered sulfur may stain fabrics. Also, when using powdered sulfur, avoid breathing in the powder as it can be moderately toxic.

Step 4: Look for mercury that may have been missed during the cleanup.



- Take a flashlight, hold it at a low angle close to the floor in a darkened room, and look for additional glistening beads of mercury that may be sticking to the surface or in small cracks. **Note:** Mercury can move surprising distances on hard and flat surfaces, so be sure to carefully inspect the entire room when you are searching.

Step 5: Remove contaminated carpet and throw away.



- Place outside the house in a safe place until household trash is picked up.

Step 6: Remove mercury from shoes, clothing, and skin.



- If mercury had touched your skin, shoes or clothing, remain still and have someone bring you a plastic trash bag and wet paper towels. Wipe off any visible beads of mercury with the wet paper towels and then put them into the trash bag. Remove contaminated shoes and clothing and place them in a trash bag. Seal that bag and place it in another bag.

Step 7: Properly dispose of contaminated cleanup materials.



- Place all materials used in the cleanup, including gloves, in a trash bag. Place the zipper-top bags that contain mercury and other objects into the trash bag. Close and seal the trash bag and place it in a safe place outside your house. Label the bag as directed by your local health or fire department.

How to Clean up a Small Mercury Spill (a broken thermometer, thermostat or compact fluorescent bulb)

Step 7 continued...



- Contact your local health department, municipal waste authority, or your local fire department for proper disposal in accordance with local, state and federal laws.

Step 8: Following the spill



- Keep the area well ventilated to the outside (i.e., windows open and fans in exterior windows running) for at least 24 hours after cleaning up the spill. Continue to keep pets and children out of the cleanup area. If anyone gets sick, call your doctor or the Poison Control Center at (888) 222-1222 immediately.
- You may want to hire a contractor who has monitoring equipment to screen for mercury vapors. Consult your local environmental or health agency to inquire about contractors in your area.
- If young children or pregnant women are in the house, seek additional advice from your local or state health or environmental agency.

What to Do for Mercury Spills Greater Than the Amount in a Thermometer, Thermostat or Compact Fluorescent Light Bulb

Mercury is heavy. Just two tablespoons weigh nearly one pound. If more than the amount of mercury in a thermometer or thermostat or a compact fluorescent light bulb is spilled in your house, be sure to follow these steps:

- Have everyone else leave the area; don't let anyone walk through the mercury on their way out.
- Open all windows and doors to the outside.
- Turn down the heater in winter and turn up the air conditioner in summer.
- Shut all doors to other parts of the house, and leave the area.
- Call your local or state health or environmental agency for help.

If more than two tablespoons of mercury are spilled in your house, you are strongly urged to call the National Response Center (NRC), available 24 hours a day, 1-800-424-8802.

Resource 3. How to Clean Up a Small Mercury Spill

CAUTION! What NEVER to Do When Cleaning Up a Mercury Spill

Never use a vacuum cleaner or broom to clean up the spill

This will spread the mercury over a larger area and will put mercury vapors into the air and increase your chance of breathing high levels of mercury vapor.

Never pour mercury down the drain

The mercury can become lodged in the "p" traps and may continue to vaporize into the room. Mercury can also pollute septic tanks or wastewater-treatment plants.

Never allow people who are wearing mercury contaminated shoes or clothing to walk around

This will help limit the spread of spilled mercury.

Never use a washing machine to launder clothing or other items that may have come in contact with mercury

Mercury can contaminate the washer and/or pollute sewage. Throw all clothing that came in contact with liquid mercury in the trash.



Reference:
<http://www.atsdr.cdc.gov/mercury/docs/ResidentialSpillCleanup.pdf>

This brochure is based on:

EPA/ATSDR fact sheet
Mercury Quick Facts: Cleaning up Mercury Spills in Your House, online at:
<http://www.atsdr.cdc.gov/mercury/docs/ResidentialSpillCleanup.pdf>

with waste storage recommendations from:

Maine Department of Environmental Protection
Maine Compact Fluorescent Lamp (CFL) Study
(February 2008), online at:
<http://www.maine.gov/depl/rwm/homeowner/cflreport.htm>

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**For more information about mercury
reduction, please visit our website**

<http://www.sustainableproduction.org/MercuryProject.php>

*Funding was provided by the U.S.
Environmental Protection Agency (EPA)*

Spring 2010



How to Clean Up a Small Mercury Spill



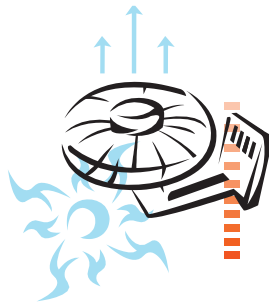
This guidance is taken from the U.S. EPA and
ATSDR fact sheet "Mercury Quick Facts: Cleaning
up Mercury Spills in Your House".

Please refer to the online fact sheet for the full text.
<http://www.atsdr.cdc.gov/mercury/>

How to Clean up a Small Mercury Spill

References: <http://www.atsdr.cdc.gov/mercury/docs/ResidentialSpillCleanup.pdf> & <http://www.maine.gov/dep/nwm/homeowner/cflreport.htm>

- Step 1. Isolate the spill and ventilate the area right away.**
- The person who will clean up the spill should have everyone else leave the spill area. Don't let anyone walk through the mercury on their way out.
 - Open all windows and doors that open to the outside.
 - Close all doors between the room where the mercury was spilled and the rest of the house/hospital.
 - Use fans to blow mercury-contaminated air outside. Turn off fans that do not blow air to the outside.



Step 2. Get the items needed to clean up a small mercury spill

You will need the following items:

1. zipper-top plastic bags
2. trash bags
3. rubber, nitrile or latex gloves
4. paper towels
5. cardboard or squeegee
6. eye dropper
7. duct tape
8. flashlight
9. powdered sulfur (optional)
10. glass jar with metal screw lid and gum seal (preferred), or high density polyethylene (#2 plastic) containers with screw caps or pressure fit seals (Per recommendation of Maine CFL study)



Step 3. Cleanup instructions

- Put on rubber, nitrile or latex gloves
- Pick up any broken pieces of glass and place them on a paper towel. Fold the paper towel, place it in a zipper-top bag and seal the bag.
- Clean up the beads of mercury. Use a squeegee or cardboard to slowly roll the beads onto a sheet of paper. An eye dropper can also be used to collect the beads. Slowly squeeze mercury from the eye dropper onto a damp paper towel. Put the paper towel, paper, eye dropper, or anything else that has mercury on it, into a zipper-top bag, and seal the bag.
- You can also use duct tape or masking tape to collect smaller hard-to-see beads. Place the tape into a zipper-top bag.



Step 4. Look for mercury that may have been missed during the cleanup

- Take a flashlight, hold it at a low angle close to the floor in a darkened room, and look for additional glistening beads of mercury that may be sticking to the surface or in small cracks. NOTE: Mercury can move surprising distances on hard and flat surfaces, so be sure to carefully inspect the entire room when you are searching.

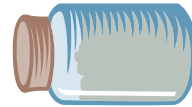
Step 5. Remove mercury from shoes, clothing, and skin.

- If mercury had touched your skin, shoes or clothing, remain still and have someone bring you a plastic trash bag and wet paper towels. Wipe off any visible beads or mercury with the wet paper towels and then put them in the trash bag. Remove contaminated shoes and clothing and place them in a trash bag. Seal that bag and place it in another bag.



Step 6. Properly dispose of contaminated cleanup materials

- Place all materials used in the cleanup, including gloves, in a trash bag. Place the zipper-top bags that contain mercury and other objects into the trash bag. Close and seal the trash bag.
- Trash bag with mercury waste should be placed and tightly sealed in glass jar or HDPE container. (Per recommendation of Maine CFL study) Label container and put in a safe place for storage.



Step 7. Following the spill.

- Keep the area well ventilated to the outside.

Resource 4. Sample labels for mercury waste containers

The label design can be tailored for your hospital and printed on self-adhesive mailing labels (available at a stationery supply store). Keep a supply of printed labels in your mercury spill kit. The labels can then be attached to containers of mercury waste for clear identification of the hazardous contents. The sample shown below is a 4" x 3.33" label.

CAUTION! Mercury Waste	CAUTION!
INFORMATION ABOUT SPILL	SPILL CLEANUP
Location: _____ Date: _____	<ul style="list-style-type: none">• Isolate the spill & ventilate area• Get spill kit• Wear gloves. Pick up broken glass or other contaminated materials. Use cardboard, tape, eye dropper, and/or syringe to collect beads of mercury. Place all waste & cleanup supplies into glass jar.• Use flashlight to re-examine area for missed mercury.• Tightly close jar. Fill out label & give jar to staff responsible for storage of waste mercury.
Who cleaned up: _____	
Source of mercury (brief description of device or product and what happened): _____ _____ _____	

Resource 5. FDI Policy Statement: Mercury Hygiene Guidance (2007)

Available online at: <http://www.fdiworldental.org/media/11271/Mercury-hygiene-guidance-2007.pdf>



FDI POLICY STATEMENT
Mercury Hygiene Guidance
Original version adopted by the General Assembly on October 1998, Barcelona, Spain
Revised version adopted by the General Assembly: 26 th October 2007, Dubai, UAE

Introduction: The FDI Mercury Hygiene Statement includes recommendations on handling both precapsulated and bulk mercury. The use of precapsulated mercury/alloy is the preferred technique. Recommendations that are only applicable to bulk mercury are not necessary when there is no bulk mercury used in the operator.

1. Know the key issues on potential exposure to mercury:
 - avoid direct skin contact with mercury or freshly mixed dental amalgam
 - avoid exposure to the following potential sources of mercury vapour:
 - accidental mercury spills;
 - malfunctioning amalgamators
 - leaky amalgam capsules
 - malfunctioning bulk mercury dispensers
 - during trituration
 - during placement and condensation of amalgam
 - during polishing or removal of amalgam;
 - vapourization of mercury from contaminated instruments
 - open storage of amalgam scrap or used capsules.
2. Train all personnel involved in the handling of mercury and dental amalgam regarding the potential hazards of mercury vapour and the necessity of observing good mercury hygiene.
3. Install impervious, easy to clean surfaces including continuous seamless-sheet flooring extending up the walls
4. Work in well-ventilated areas, with fresh air exchanges and outside exhaust. If the work areas are air-conditioned, replace the air-conditioning filter periodically.
5. Use pre-capsulated amalgam in order to:
 - eliminate the possibility of a bulk mercury spill
 - eliminate the mercury dispenser as a potential exposure source of mercury vapour
6. Use an amalgamator with a completely enclosed arm and which complies with international standard ISO 7488.

Mercury Hygiene Guidance

7. Recap single-use capsules after use if feasible. Store them in a closed container and dispose of them through a mercury reclamation company that handles amalgam waste.

8. Use high-volume evacuation systems (fitted with traps or filters) when finishing or removing amalgam.

9. Clean amalgam contaminants from instruments before heat sterilization or heat disinfection

10. Avoid heating mercury or amalgam or any equipment used with amalgam.

11. Follow Best Management Practices for Amalgam Waste:

- Salvage and send the following to a mercury reclamation company that handles amalgam waste:
 - used single-use capsules
 - amalgam scrap not contaminated with patient fluids
 - amalgam waste that is contaminated with patient fluids such as amalgam debris from restorations after removal
 - chair-side traps containing amalgam waste
 - vacuum pump filters or other amalgam collecting devices if they contain amalgam.
 - extracted teeth that contain amalgam restorations (if the recycler requires extracted teeth to be disinfected then disinfect by immersion the extracted teeth in a disinfectant before recycling them along with chairside trap waste.)
- Do not put amalgam waste in biohazard containers, infectious waste containers or regular garbage.
- Use suction line cleaners (e.g. non-chlorine-containing cleaners) that minimize dissolution of amalgam.
- Do not use bleach or other chlorine-containing cleaners to flush wastewater lines.
- Use an amalgam separator which complies with International Standards ISO 11143, to address environmental concerns.

12. Clean up all mercury spills (regardless of size)

- Pick up droplets using an adhesive tape or hypodermic syringe.
- Mix small mercury spills (less than 10 grams) with alloy powder to form amalgam and add the resultant scrap to the scrap container.
- Use commercial mercury spill clean up kits to manage larger spills (10 grams or more).
- Never use a vacuum cleaner of any type
- Do not use household cleaning products
- Do not pour or allow mercury to go down the drain.
- Do not use a broom or a paintbrush to clean up mercury.
- Prevent people whose shoes may be contaminated with mercury from walking around or leaving the spill area until the mercury-contaminated items have been removed.

13. Handling and use of bulk mercury is to be strongly discouraged. However, if it is used, then:

- Minimize the amount of mercury stored
- Store in unbreakable, tightly sealed containers,
- Store containers in a well-ventilated place away from any source of heat.
- Use mercury and amalgam equipment only in areas that have impervious and suitably lipped surfaces, so that spilt mercury or excess amalgam is confined and recovery is facilitated.
- Exercise care in handling bulk mercury to minimize possibilities of spill (e.g. use a funnel when mercury is being dispensed into an amalgamator; place a lipped tray under the mercury dispenser).
- Use only capsules that remain sealed during amalgamation (Note: this can be checked by wrapping a piece of adhesive surgical tape around the junction of the two halves of the capsule, and doing a test mix. Leakage of mercury will show as a black line on the tape after it is removed).
- Handle mercury dispensers carefully
- Select an appropriate alloy to mercury ratio to minimize the need for removal of excess mercury prior to placement
- Check mercury dispensers periodically for mercury leakage
- Examine the mercury dispenser orifice after use for residual mercury. Any mercury droplet remaining should be disposed of as described in recommendation 12.
- Check the dental operator for mercury vapour, preferably annually or after a spill clean-up.

Resource 6. Workplace controls in dental offices and clinics: preventing mercury exposures

Dental amalgam or bulk mercury should not be rinsed down the drain or disposed of in the trash, infectious waste bag, or with sharps. Why not? If amalgam or mercury ends up in one of these waste streams, the mercury will be released to the environment and can cause downstream exposures to humans and wildlife.

Here is helpful advice for controlling mercury in dental offices and clinics:

Type of Control	Actions
Eliminate the Hazard	<ul style="list-style-type: none">• Use mercury-free dental materials when feasible.• Educate patients on improved oral hygiene to eliminate need for fillings.• Replace other mercury-containing devices, such as thermometers and sphygmomanometers (tensiometers, blood pressure cuffs).
Use Engineering Controls	<ul style="list-style-type: none">• Provide ventilation of work and storage spaces (including waste storage areas) to avoid high concentrations of mercury in air.• Use dental tools that minimize escape of mercury vapor.• Install chair side amalgam separators to capture waste amalgam from waste water and prevent its going down the drain.• Install containment around storage & handling areas to prevent vapor from being introduced to ambient air and to insure that mercury drips or spills are contained.
Improve Systems of Work	<ul style="list-style-type: none">• Phase out bulk mercury and use single-use amalgam capsules to reduce the amount of mercury in use or storage. Keep a supply of different sizes of amalgam capsules so you can minimize the amount of unused amalgam that must be disposed of.• Don't put waste mercury or amalgam in the trash, in infectious waste bags, or in sharps disposal containers (i.e. with syringes or needles).• Use mercury-tight waste containers that prevent airborne mercury exposures. Examples of waste containers:<ul style="list-style-type: none">– Tightly-capped glass jar with a metal cap and rubber gasket, like a canning jar or glass food jar– #2 (HDPE) heavy duty plastic container with tight-fitting screw lid• Make sure that housekeeping practices are timely and effective for keeping mercury out of the drain and trash. Don't rinse tools that contain amalgam or mercury over drains or sinks, or flush amalgam/mercury down the drain or toilet.• Clean up mercury spills quickly and properly using a spill kit and following safe spill clean-up procedures.
Use Personal Protective Equipment	<ul style="list-style-type: none">• Use personal protective gloves, goggles, masks, gowns to protect health care workers from liquid mercury or amalgam particulates.

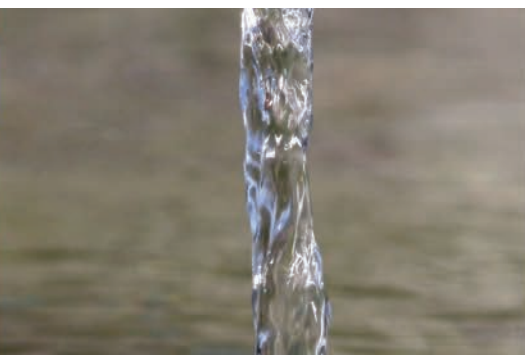
References:

Maine Department of Environmental Protection. (February 2008) *Maine Compact Fluorescent Light Study*. Augusta, Maine, USA: Stahler D, Ladner S, Jackson H. Retrieved from: <http://www.maine.gov/dep/rwm/homeowner/cflreport/cflreport.pdf> (accessed 10/21/11)

University of Massachusetts Lowell, Institute for the Development of Production and the Work Environment (IFA), and University of Sonora (UNISON). (2011) *Occupational Exposure to Elemental Mercury in Odontology/Dentistry*. Lowell, MA, USA; Quito, Ecuador; Hermosillo, Mexico.

Mercury is a persistent, bioaccumulative and toxic material (PBT). Exposure to elemental mercury in hospitals from spills or broken equipment, such as mercury-containing fever thermometers and sphygmomanometers, is a serious problem for hospital employees, patients, and visitors. Waste mercury is also a concern for the global environment, as it can easily escape through the air, water and solid waste streams.

This workbook provides guidance for replacing equipment and processes that utilize mercury with safer alternatives. It is designed for use by hospital staff and has been used successfully in hospitals of Ecuador and Mexico. The workbook will guide you through a systematic hospital-wide approach for education, assessment, and improvement of mercury-containing products and practices in your institution. It is based on a model of continuous improvement so that the workbook is appropriate for healthcare institutions at all different levels of experience in their mercury reduction efforts.



Eliminating Mercury in Health Care

A workbook to identify safer alternatives

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