Best Management Practices for Reducing and Managing Mercury in Florida Medical Facilities: Field Testing, January - July, 1999

A report from the
FLORIDA CENTER FOR SOLID AND HAZARDOUS WASTE MANAGEMENT
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ACKNOWLEDGMENTS

The Florida Center for Solid and Hazardous Waste Management is grateful to the principal researcher for this project, Laurie Tenace. The Center also appreciates all the hospital personnel across Florida who shared their time and experiences. Numerous vendors and distributors provided helpful information about their products and services for inclusion in this report.

The University of Florida TREEO Center, the Florida Healthcare Engineering Association, Ogden/Martin, and many hospital departments deserve thanks for allowing Center staff the opportunity to present this information at various venues. Many contacts around the country provided input and information that was invaluable. Special thanks go to Health Care Without Harm whose members provided information and anecdotes.

The Center would also like to thank Jack Price and David Kelley of the Florida Department of Environmental Protection for their advice and guidance throughout this project.

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ACRONYMS and UNITS OF MEASUREMENT

AHA	American Hospital Association
BMP	Best Management Practices
cc	Cubic Centimeters
CESQG	Conditionally Exempt Small Quantity Generator
CH_3Hg	Methylmercury
CFR	Code of Federal Regulations
DEP	Department of Environmental Protection
DOH	Department of Health
EPA	Environmental Protection Agency
FACS	Florida Administrative Code
FCSHWM	Florida Center for Solid and Hazardous Waste Management
FDEP	Florida Department of Environmental Protection
FS	Florida Statutes
FHEA	Florida Healthcare Engineering Association
H2E	Hospitals for a Healthy Environment
Hg^0	Elemental Mercury
Hg^+	Mercurous
Hg^{++}	Mercuric
MOU	Memorandum of Understanding
MSDS	Material Safety Data Sheet
MSW	Municipal Solid Waste
MWI	Medical Waste Incinerator
mg/m^3	Milligrams per cubic meter
ppb	Parts per billion
ppm	Parts per million
RCRA	Resource Conservation and Recovery Act
RMW	Regulated Medical Waste
TCLP	Toxicity Characteristic Leaching Procedure

EXECUTIVE SUMMARY

Mercury, either in its elemental, silvery liquid form, or as a compound, is found in myriad products worldwide. In the hospital, mercury is found in thermometers, sphygmomanometers, other medical devices, numerous laboratory chemicals, fluorescent bulbs, and in other, non-medical products like thermostats and switches.

Mercury is a persistent bioaccumulative toxin that can cause illness and death in living organisms when it is ingested, especially as the compound methylmercury.

Research has shown that mercury can be released into the atmosphere through incineration. The incineration of medical waste has been identified as one of the major contributors to this atmospheric deposition. In Florida, airborne mercury falls to earth where it may be changed to methylmercury in waterways, and can bioaccumulate in living organisms, primarily causing neurological damage. People who consume mercury-contaminated fish can accumulate enough mercury in their bodies to potentially cause severe illness.

When mercury is used in the hospital, it is often discarded improperly as biomedical or regular waste. After some uses, such as in disposable mercury thermometers for isolation patients, mercury is wrongly considered a biomedical waste and discarded in red bags or sharps containers. Since the primary method for disposing of the biomedical waste collected in red bags or sharps containers is incineration, mercury from this waste stream will enter the atmosphere and begin a cycle that can eventually end in its deposition in a waterway and potential methylation. Regular waste from hospitals is often incinerated, and the fate of any improperly included mercury is the same. Mercury should always be recycled.

Best Management Practices (BMPs) for managing mercury in Florida's medical facilities were developed and tested under a previous contract with the Florida Center for Solid and Hazardous Waste Management. During the first six months of 1999, these BMPs were taken to several facilities around the state to help personnel find ways to better control mercury so it is not improperly discarded. Center staff audited hospitals for mercury product use; reviewed and suggested changes for recycling and spill clean up plans; helped various departments find mercury-free product alternatives; and taught hospital personnel about mercury toxicity, fate in the environment, and actions to take. Presentations were given at several venues, introducing the concept of mercury management to other professional groups and individuals.

This project showed that there is a need for continuing education in the hospital about mercury management. This education needs to reach all levels of personnel. Often, educating administrative and supervisory staff does not ensure that the individuals in actual contact with the mercury receive the information. Center staff feels that the message about mercury use in the hospital needs to be repeatedly presented to overcome preconceived ideas about mercury's uses and toxicity. Additional work planned with Florida's medical facilities will make this information available to more people, addressing the long task of decreasing the amount of mercury deposited in Florida's environment.

1. INTRODUCTION

Mercury is a persistent, bioaccumulative toxin in the environment. Mercury is also a unique element, being the only metal that has liquid properties at room temperature. Because mercury has properties particular only to itself, it has been used in myriad ways over the millennia. Its usefulness has often outweighed its toxicity, which has not always been apparent in many applications. For example, mercury compounds were the best treatment for syphilis up until the 20th Century, and its healing power in this case was more important than its toxic effects.

Mercury's physical and chemical properties depend on its form. Elemental mercury's properties differ greatly from methylmercury's or any other mercury compound, making this element very complex and difficult to understand. A good reference describing the properties of mercury is Critical Review of Mercury Contamination Issues Relevant to Manometers at Natural Gas Industry Sites (1993). For another excellent description of the various mercury species (forms that mercury takes), see page 47 of the Draft Wisconsin Mercury Source Book at http://www.epa.gov/grtlakes/bns/hgsbook/section1.pdf.

Reducing mercury emissions from medical waste incinerators and preventing the improper disposal of mercury-containing items in other waste streams is desirable because of the toxic effects on Florida's ecosystems. When incineration is used for disposal of regulated medical waste, airborne mercury emissions can result from the presence of mercury-containing items. Usually this is mercury that has been improperly disposed of in red bags. Municipal solid waste incinerators use activated carbon injection with subsequent fabric filtration to remove flue gas mercury. This process captures varying amounts of the volatilized mercury. Recent regulations adopted by the U. S. EPA mandating air pollution controls on medical waste incinerators will not go into effect for several years and do not apply to all facilities.

In 1996, because of concerns about mercury emissions from medical waste incinerators, the Florida Department of Environmental Protection (DEP) contracted with the Florida Center for Solid and Hazardous Waste (Center) to conduct a comprehensive review of mercury's use in Florida's medical facilities. The first phase of the research project included a literature review and statewide survey of hospital waste management practices. The survey pointed out the need for more education about proper mercury handling procedures to ensure proper management throughout the state. A report titled Mercury in Florida's Medical Facilities: Issues and Alternatives, Report #S97-15, December 1997 is available at www.floridacenter.org/ under Publications, Special Wastes or call the Center at (352) 392-6264 to receive a copy.

The results of the 1996-7 survey convinced the DEP of the need to continue with the project, and onsite technical assitances was offered to Florida hospitals desiring help. During 1998, the second phase of the project, Center staff visited seven hospitals, reviewing waste disposal and recycling policies, purchasing policies, and the use of mercury-containing products and devices. A booklet, "Managing Mercury: Best Management Practices for Florida Medical Facilities," based on information gathered during phase one, was printed in a user-friendly format. This booklet is available in downloadable PDF format at the Center web site (www.floridacenter.org under Brochures/Bulletins); the text is reprinted as Appendix H of this document; or you can call the Center to order a copy. The complete report on phase two titled Mercury Reduction in Florida's Medical Facilities: Improving the Management of Mercury-Bearing Medical Wastes, Report #S98-7, December 1998, is available at www.floridacenter.org under Publications, Special Wastes.

In June of 1998, the American Hospital Association (AHA) and the Environmental Protection Agency (EPA) worked together to author a Memorandum of Understanding (MOU) (look for the MOU at www.epa.gov/toxteam/ahamou.htm). This collaboration calls for two major changes in waste disposal management for American hospitals. First, hospitals will initially decrease the total volume of all types of waste by one third by 2005 and ultimately by half by 2010. Secondly, hospitals will eliminate mercury from the waste stream by 2005.

It is important to read the above goal carefully. Eliminating mercury from the waste stream does not mean totally eliminating it from the hospital. At least one source of mercury, fluorescent lamps, does not have an alternative at this time. However, careful waste segregation, good recycling programs, and stringent spill clean up procedures and monitoring can prevent mercury from ending up in an inappropriate waste stream.

Originally called the AHA/EPA MOU, this initiative is now called "Hospitals for a Healthy Environment" or "H2E."

The Center's research showed that although some hospitals have been working to eliminate mercury and properly manage the wastes, information is lacking about costs, reliability, and availability of products. Recycling programs can be difficult to set up and maintain for all the various types of hospital trash. Product review committees need to please all departments in the facility. Mercury spills can occur at any time or place, making spill clean-up training necessary for diverse groups. Perhaps the most striking discovery during this project was the need to continually train and educate people at all levels in the hospital about the various uses and guises of mercury in medical facilities.

This report on phase three of the mercury waste reduction project includes information gathered during 1999. The goal of phase three was to provide on-site assistance to environmental and safety managers and other appropriate staff at medical facilities in their efforts to reduce the use of mercury and to improve the management of mercury-containing wastes. Several hospitals were visited, and a detailed plan was developed for helping facilities identify where they need help managing mercury. Better procedures for managing mercury were recommended..Hospitals were shown how to present the information to their personnel and make desired changes.. Presentations were made at pertinent venues; contacts were made with various companies and contractors associated with hospitals.

2. BACKGROUND

2.1 INTRODUCTION

An extensive literature review on the characteristics and effects of mercury can be found in the Center's earlier report, Mercury in Florida's Medical Facilities: Issues and Alternatives (1997). Since one of the most striking findings during this phase of the project has been the public's general lack of basic knowledge about mercury, this chapter will briefly summarize mercury's characteristics and effects.

2.2 CHARACTERISTICS OF MERCURY

Mercury is an element. It is one of the building blocks of the universe. It was formed when the earth was formed. There is a certain amount of mercury on, in and above the earth; the total quantity never changes unless we physically send the mercury into space. The mercury may change form; it may combine with other chemicals to make compounds like methylmercury. But even within these chemical compounds the mercury has not really been altered and can be returned to its elemental state. Unfortunately, some of the compounds mercury makes when combined with other chemicals, for example, methylmercury, are more toxic than the element.

Mercury is a heavy metal. Drop for drop, mercury weighs about 11 times more than water. One gram of mercury is about the size of a small green pea or a piece of shot. Some of its unique properties include its ability to expand and contract evenly with temperature changes, its high electrical conductivity, and its ability to readily combine (amalgamate) with other metals. Each of these properties has made mercury appealing to different

industries. For descriptions of how some industries have used and are using mercury and its compounds, see http://www.epa.gov/grtlakes/bns/hgsbook/index.html.

Mercury is a liquid at room temperature. It is the only metal with this property. It has a melting point of –38.87°C (-37.97°F), and a boiling point of 357°C (675°F). This means that between these two temperatures, mercury will exist as a liquid. Elemental mercury is also 13.5 times denser than water at ambient temperatures. Mercury has a low saturation vapor pressure and high surface tension. The vaporization rate in still air is 0.007 $mg/cm^2 \cdot hr$ for a $10.5cm^2$ droplet at 20°C (68°F). Although this rate is slow compared to many compounds, the physical characteristics and toxic properties should be considered together to get a better picture of mercury's effects on the environment. Also, changes in temperature can have a great effect on mercury's characteristics, and presence of impurities can cause deviations from the reported characteristics (Henke et al., 1993).

Mercury may be dissolved or suspended in water; occur as vapor or on particles in air; be found within organisms; or it may exist as solids, liquids, or vapors in soils, sediments, and rocks. Although we are most familiar with mercury in its elemental state, it can change in the environment to different compounds, or can be discharged as different forms.

> "The most significant forms of mercury in the natural environment include the elemental form (Hg°); inorganic mercury(II) compounds, such as mercury(II) hydroxide ($Hg[OH]_2$), mercury(II) sulfide (HgS), and mercury(II) chloride ($HgCl_2$); and methylmercury, which includes the methylmercury ion (CH_3Hg^+), monomethylmercury compounds ($CH_3Hg^+X^-$, where X=inorganic anions, such as Cl^- and OH^-), and dimethylmercury ($[CH_3]_2Hg$) …The forms in which mercury occurs in a given environment depend on the physical, chemical, and biological conditions at the site" (Henke et al., 1993).

The above begins to show the difficulty in illustrating potential mercury toxicity. Although most hospital personnel use mercury in its elemental form, acute toxicity from elemental mercury is not common. Consequently, one of the most common laments is, "I remember playing with mercury as a child, rolling it in my hand, shining pennies with it. I never got sick." This statement only describes one small component of the total mercury picture and this attitude makes it more difficult to convince people of the need to handle mercury carefully.

The mercury compound with the worst effect on the environment is methylmercury, usually produced when certain microorganisms digest elemental mercury. It has the potential to poison our fish and wildlife, and humans eating these contaminated animals can also be poisoned. Some of the other mercury-containing compounds are extremely toxic and rare. But elemental mercury is not as toxic to life forms, and many of us did play with it as children with no apparent ill effects. The cavalier attitude concerning mercury in the environment that the Center staff repeatedly encountered may be based in these childhood experiences.

2.3 TOXIC EFFECTS

The toxic effects of mercury and mercury compounds vary according to the mercury specie, route of exposure, concentration, length of exposure and the individual exposed. A good source of information about toxic effects of mercury and its various compounds is the US EPA's Mercury Report to Congress; volume 5 is titled "Health Effects of Mercury and Mercury Compounds" (http://www.epa.gov/ttn/oarpg/t3/reports/volume5.pdf). In

general, elemental mercury can be absorbed through the lungs when inhaled, but is poorly absorbed through the gastrointestinal tract or the skin (people have swallowed large quantities of mercury that pass through them with no detrimental effects). Once in the lungs, elemental mercury enters the blood stream and can pass the blood-brain barrier and the placental barrier.

Inorganic mercury (mercury salts like mercuric chloride) can be absorbed through the gastrointestinal tract, but the amount absorbed is dependent on several other factors.

Methylmercury is quickly and easily absorbed through the gastrointestinal tract and is easily transported through both the placental and blood/brain barriers. Methylmercury is relatively stable in the body. Studies indicate that this mercury specie has a half life of about 70 days. In other words, after ingesting methylmercury-contaminated fish, for example, the original amount of methylmercury left in the body decreases by 50% after 70 days. After another 70 days, the 50% amount will decrease by another 50% and so on (Henke et al., 1993). Eventually the mercury load can reach zero if additional methylmercury is not consumed.

Methylmercury is the compound that bioaccumulates in life forms and is the mercury specie associated with environmental toxicity. Bioaccumulation refers to the increased concentration of a compound as it works its way up the food chain. When mercury is deposited in waterways and settles into the bottom sediment, certain bacteria can digest it and transform it into methylmercury. These microorganisms are in turn eaten by larger organisms. Since the methylmercury is excreted very slowly, it becomes more concentrated in larger organisms. Eventually, the methylmercury makes its way to the top of the food chain, where piscivorous (fish eating) birds, large predatory mammals, large game fish, and humans can get concentrated doses of methylmercury that in turn are stored in tissue. In Florida, and indeed all over the US, fish advisories have been posted in waterways, warning people not to eat freshwater fish because of high methylmercury content. (USEPA, 1997). Some large carnivorous fish have methylmercury concentrations more than 100,000 time higher than the water in which they swim (Cole et al., 1992).

Relatively current historical events point out the environmental dangers of mercury and mercury compounds. The most infamous event occurred in Minamata Bay, Japan in the 1950's. Mercury from a vinyl chloride plant was deposited in the Bay over many years. The mercury bioaccumulated as methylmercury in fish which were then eaten by local inhabitants. The industry was slow to respond, even as people were dying from mercury toxicity. Forty people died, and, by 1989, over 20,000 people had been physically effected (Trade and Environment Database, 1997).

Other events have included the poisoning of a family in New Mexico that had eaten a hog fed mercury-contaminated feed (mercury was historically used as a fungicide for non-food seed). In Iraq, 459 people died from eating mercury treated grain in 1971-72. They received the grain seeds after planting season, so instead used it for making bread. (Cunningham et al., 1994).

In 1997, a mercury researcher, Karen Wetterhahn, died of mercury poisoning. Less than a year before, she had been doing research with a very toxic form of mercury, dimethylmercury, a few drops of which apparently permeated her latex gloves. This incident seems to be at one extreme end of possible outcomes from exposure to mercury and mercury compounds (Gainesville Sun, Wed., June 11, 1997, Chemist Dies After Mercury Exposure).

These are the most commonly cited mercury poisonings in the literature. Instances describing poisoning associated with elemental mercury can be found but usually affect only one or a few people. An example is the 1989 death of four people in a Michigan household. They were poisoned by mercury fumes emanating from a basement smelting process used to reclaim silver from dental amalgam, which is 50% mercury. (Mercury Pollution Prevention in Michigan, 1995.) While most short-term exposures to mercury do not result in death, these dramatic examples do illustrate the potential for severe health impacts. Short term or low dose exposure may effect health less noticeably but all exposures to mercury should be avoided.

2.4 USES OF MERCURY

The unique properties of mercury ensured its use through the millennia by various peoples. Cavemen rubbed it on the dead before burial. It has been found in Egyptian tombs. The mercury-related health problems of slaves working in mercury mines were described in documents from the early Roman Empire. People have recognized the inherent danger of working with this element for centuries (Michigan Mercury Pollution Prevention Task Force, 1995).

Many researchers talk about the Mad Hatter of "Alice in Wonderland" fame, claiming that he suffered from mercury poisoning from hat manufacturing. Indeed, mercury poisoning from the felting process during hat manufacture did cause illness and even bizarre behavior in workers until the process was banned in the US in 1941 (Goldwater, 1972). However, there is enough controversy about Lewis Carroll's character to make it an interesting tale to revisit. Story has it that a secret method for rendering fur into felt was passed among hat makers in 17th century France. They had learned from felt makers in Turkey that camel urine added to the fibers made them break down faster. The French hat makers started using their own urine for felting. And when one French hat maker was treated with mercury for a venereal disease (a common treatment during the Middle Ages), his mercury-containing urine caused the fibers to felt even faster and better. This may have been the beginning of "secretage," the carefully guarded secret of French hatmakers for using mercury in the felting process. The Mad Hatter in Alice in Wonderland predated the use of mercury in hat felting in England and so was probably not modeled after a hat maker with mercury toxicity. Some researchers think the book's character was actually taken from a real person in England, one Theophilus Carter, a furniture dealer who was called the Mad Hatter because he always wore a top hat and was known for his eccentric behavior. Although the truth about this famous character and the origin of using mercury in the felting process may never be known, the history surrounding it is a fascinating account of mercury's use in that industry.

Mercury has been used in medicines worldwide. It is a good preservative and it is still used as a drug excipient because of that property. Thimerosal, the most commonly used mercury-containing preservative, is still used in vaccines, eye care products, and many laboratory reagents.

Other industry uses of mercury include agricultural products (this use is decreasing in developed countries), the automotive industry which uses mercury for switches and anti-lock brakes; chemical industry use in manufacturing chlorine and caustic soda, construction and industrial uses in thermostats, lamps, batteries, switches, and other areas; dental amalgam; and thermometers and thermostats in the food industry. These examples were chosen to show how mercury's use is part of many various industries across the world. Mercury control and source reduction depends on several factors, including the availability of alternative products, and the lobbying of groups concerned about reducing mercury's use worldwide. A good source of information about various mercury uses, current and historical, is the Draft Wisconsin Mercury Sourcebook, available at http://www.epa.gov/grtlakes/bns/hgsbook/index.html.

Mercury is a liquid at room temperature. It is the only metal with this property. It has a melting point of –38.87°C (-37.97°F), and a boiling point of 357°C (675°F). This means that between these two temperatures, mercury will exist as a liquid. Elemental mercury is also 13.5 times denser than water at ambient temperatures. Mercury also has a low saturation vapor pressure and high surface tension. The vaporization rate in still air is 0.007 mg/cm^2·hr for a 10.5cm^2 droplet at 20°C (68°F). Although this rate is slow compared to many compounds, the physical characteristics and toxic properties should be considered together to get a better picture of mercury's effects on the environment. Also, changes in temperature can have a great effect on mercury's characteristics, and presence of impurities can cause deviations from the reported characteristics (Henke, et al., 1993).

2.5 JEROME METER

A Jerome meter that measures ambient elemental mercury vapors was used during the site visits. The meter consists of two thin gold films, a reference and a sensor, configured in a wheatstone bridge circuit to detect small changes in electrical resistance. The meter operates on the principle that mercury changes the conductivity/resistivity of gold. When an air sample is collected, it passes through a scrubber, into the flow system, through a filter and finally passes over the gold film sensor. The sensor adsorbs and integrates the mercury vapor, finally comparing it to the reference gold film. The measured concentration of mercury vapor is displayed in milligrams per cubic meter (mg/m^3).

The meter was used to sample randomly in the facilities visited. The meter has some limitations that are primarily caused by the difficult nature of mercury. Because the vapors can waft around a room when doors open and close, measurements were often not reproducible. Since mercury is heavy, the vapor concentration at floor level was often much higher than the meter's reported concentration in an adult's normal airspace. The instrument was valuable in identifying mercury "hot spots," but the practical application of these measurements was complex.

A Jerome meter is not necessary equipment for hospitals in their effort to control mercury and identify problem areas. It is a good tool for researchers and in industry.

3. OUTSTANDING ISSUES

3.1 INTRODUCTION

Information about managing mercury in medical facilities is available from many sources. Appendix I includes a plan that can be used so medical facilities can develop their own mercury waste reduction programs. Appendix C lists many good Web sites that can lend further assistance. In the following section, Florida's regulations pertaining to hospital waste are described. The information in section 3.2 was previously published in a 1997 report by the Center titled "Mercury in Florida's Medical Facilities: Issues and Alternatives." The subsequent sections, 3.3, 3.4 and 3.5, highlight some of the most important or interesting issues or products Center staff encountered. These three sections are not intended to address all the issues a hospital will have to deal with, but can be a quick reference for facilities trying to identify particular problem areas that can easily be addressed, or problems that may not be immediately noticeable in the hospital.

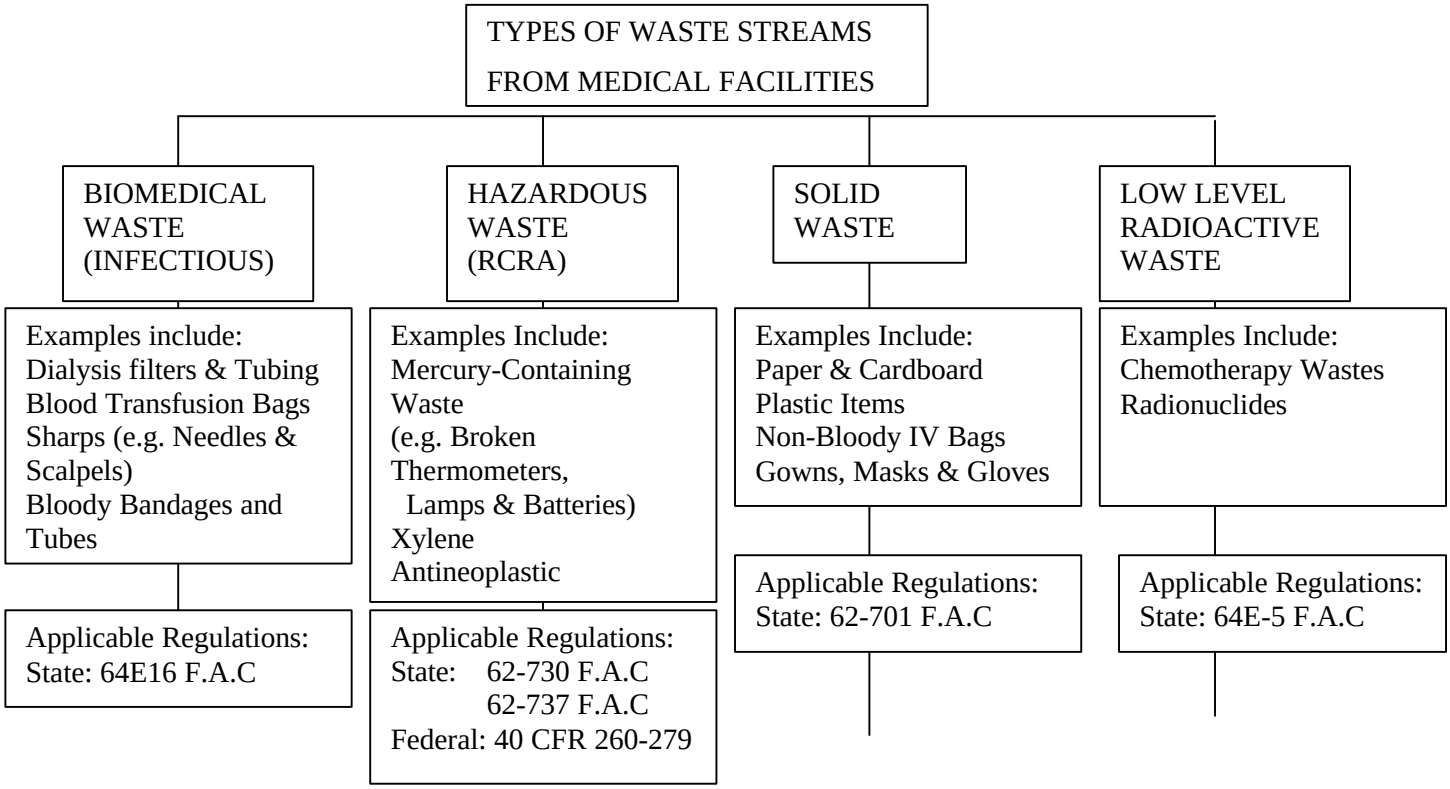
3.2 REGULATION AND TREATMENT OF WASTE FROM MEDICAL FACILITIES

3.2.1 Introduction

Waste generated by medical facilities can be categorized into four waste streams: biomedical waste (commonly known as infectious waste or red bag waste); hazardous waste; solid waste; and low-level radioactive waste. Regulation at the federal, state and local level may all have an impact on the management and treatment of waste from medical facilities. Historically, control of biomedical waste has been the responsibility of state health or environmental departments. The term "biomedical" waste will be used throughout this report as this is the term used in Florida laws governing the management and disposal of infectious waste.

Types and quantities of waste vary depending on the type of facility. For example, waste from a blood bank would consist largely of biomedical waste (e.g syringes and disposable needles), whereas a hospital's waste would include all four types of waste, including a heterogeneous mixture of solid waste (e.g., paper goods, corrugated cardboard, plastics, food scraps, glassware, metals) (Hasselriis and Constantine, 1992). Each of the four types of waste is subject to different regulations in Florida. Figure 3.1 shows the four types of waste, examples of each type, and the regulations that govern the management and disposal of each type. It is important for medical facility personnel to have a clear understanding of the types and quantities of waste generated.

Figure 3.1 Waste Streams from Medical Facilities



Sometimes types of waste may be mixed; for example, a broken thermometer (hazardous waste) may be mixed with infectious waste. The handling and disposal of mixed wastes can be confusing. Medical personnel can call the Florida Department of Health (DOH), the Florida Department of Environmental Protection (DEP), or their county or municipal solid waste department for information and clarification on the proper handling of mixed wastes. Figure 3.2 summarizes the provisions of the Florida regulations that govern the management and disposal of mixed wastes.

Regulations at both the federal level and at the state level in Florida call for mercury-containing wastes to be treated as hazardous wastes. When mercury or mercury-containing items improperly enter the biomedical waste stream, or the solid waste stream, they may be unnecessarily incinerated, thus contributing to the problem of mercury emissions.

Figure 3.2 Management of Mixed Wastes Generated by Medical Facilities

WASTE MIXTURE	TREAT AS:
Solid Waste + Hazardous Waste	Hazardous Waste
Solid Waste + Biomedical Waste	Biomedical Waste
Solid Waste + Low-Level Radioactive Waste	Low- Level Radioactive Waste
Hazardous Waste + Biomedical Waste	Biomedical Waste and Hazardous Waste
Hazardous Waste + Low-Level Radioactive Waste	Low-Level Radioactive Waste + Hazardous Waste
Biomedical Waste + Low-Level Radioactive Waste	Biomedical Waste + Low-Level Radioactive Waste

3.2.2 Florida Regulations

In Florida, the management of biomedical waste, including segregation, handling, labeling, storage, transport, and treatment, is governed by Chapter 64E-16, Florida Administrative Code (F.A.C.). Section 64E-16.001(3) ascribes responsibility for the regulation of packaging, transport, storage, and treatment of biomedical waste to the DOH; the DEP regulates biomedical waste disposal.

Section 64E-16.002(2) defines “biomedical waste” as

> “Any solid or liquid waste which may present a threat of infection to humans, including nonliquid tissue, body parts, blood, blood products, and body fluids from humans and other primates; laboratory and veterinary wastes which contain human disease-causing agents; and discarded sharps. The following are also included:
>
> (a) Used, absorbent materials saturated with blood, blood products, body fluids, or excretions or secretions contaminated with visible blood; absorbent materials saturated with blood or blood products that have dried.
>
> (b) Non-absorbent, disposable devices that have been contaminated with blood, body fluids or, secretions or excretions visibly contaminated with blood, but have not been treated by an approved method.

Section 64E-16.002(3) defines “biomedical waste generator” as

> "A facility or person that produces biomedical waste. The term includes hospitals, skilled nursing or convalescent hospitals, intermediate care facilities, clinics, dialysis clinics, dental offices, health maintenance organizations, surgical clinics, medical buildings, physicians' offices, laboratories, veterinary clinics and funeral homes.
>
> (a)Mobile health care units, such as blood mobiles, that are part of a stationary biomedical waste generator, are not considered individual biomedical waste generators.
>
> (b)Funeral homes that do not practice embalming are not considered biomedical waste generators.

In defining "biomedical waste facility," Section 64E-16.002(9) includes biomedical waste generators described in Section 64E-16.002(3), as well as treatment and storage facilities.

Section 64E-16.003(1) outlines specific waste-handling policies and procedures for the mixing of wastes, requiring that: (a) biomedical waste mixed with hazardous waste shall be managed as hazardous waste; (b) biomedical waste mixed with radioactive waste shall be managed in accordance with the radioactive waste provisions of Chapter 64E-5, F.A.C; and (c) and other solid waste or liquid, which is neither hazardous nor radioactive in character, combined with untreated biomedical waste, shall be managed as untreated biomedical waste. The treatment of mixed wastes can sometimes be confusing. Medical personnel can call the DOH, DEP, or their county or municipal solid waste department for information and clarification on the treatment of mixed wastes.

Section 64E-16.007 states that acceptable treatment options for biomedical waste include steam, incineration, or one of the alternative processes approved by the DOH.

Florida's Hazardous Waste Rule is specified in Chapter 62-730, F.A.C. The rule adopts by reference the RCRA definition of "hazardous waste" as described in 40 CFR Part 261.3. The rule also adopts by reference the federal Universal Waste Rules outlined in 40 CFR Part 273. Hazardous wastes are wastes which are either:

> - listed by the EPA in 40 CFR Part 261 Subpart D; or
>
> - ignitable (i.e., flash point less than 140° or an oxidizer), corrosive (e.g, pH of 2 or less or 12.5 or more), reactive, or toxic, as defined in 40 CFR Part 261, Subpart C. (FDEP, 1991).

The management of spent mercury-containing lamps and devices is described in Chapter 62-737, F.A.C. The purpose of this rule is to encourage the reclamation of mercury from mercury-containing lamps and devices. Chapter 62-737 also establishes criteria and procedures for obtaining permits and criteria for generators, transporters, and storage facilities. Mercury-containing lamps and devices recycled in accordance with the rule do not have to be counted toward a medical facility's hazardous waste generation status, similar to the federal Universal Waste Rule provision. The federal Universal Waste Rule allows states to add other hazardous waste groups at the state level as a state universal waste. On May 20, 1998, the DEP amended Chapter 62-737 to designate mercury-containing lamps and devices destined for recycling as universal wastes in Florida. Mercury-containing batteries and other items managed in accordance with the Universal Waste Rule do not have to be counted toward a facility's hazardous waste generation status.

Section 403.7186, Florida Statutes (F.S.) and Chapter 62-737, F.A.C., contain certain prohibitions on the management of mercury-containing devices and lamps. Mercury-containing devices may not knowingly be incinerated or disposed of in a landfill. Spent mercury-containing lamps may not knowingly be incinerated. Any person who unlawfully dispose of these items will be held liable to the state for any damage caused and for civil penalties.

Section 403.7192, F.S., defines the disposal requirements for consumers, manufacturers, and sellers of batteries. Consumer button dry cell battery containing a mercury oxide electrode or a products containing such a battery may not be distributed, sold or offered for sale in Florida. Larger sizes of mercuric oxide batteries may not be distributed, sold, or offered for sale in Florida unless the manufacturer has implemented a unit management program for take-back or recycling. To date, only one company has submitted such a plan. Also, batteries containing a mercury oxide electrode or a product containing such a battery may not knowingly be placed in a mixed solid waste stream. Any person who violates any provision of this section commits a second-degree misdemeanor and may be subject to a minimum fine of $100 per violation.

3.3 EDUCATION IS THE KEY

Throughout every hospital site visit or training session, Center staff found one common denominator – a need for continuing education. Regardless of the audience's education level or job experience, there was confusion about mercury, its uses, and its toxicity.

A second important component of any mercury management program is networking. Setting aside any conflicting interests between hospitals, professional groups and vendors is the best way to accomplish your goals.

3.3.1 Everyone Can Benefit From Education

Don't assume any one understands what mercury is or where it is used. Most people underrate the toxicity of mercury and are not aware of the various mercury compounds. A statement that was repeated during every site visit, "I used to play with mercury as a child and I'm still here," helps explain this cavalier attitude. Most people assume that because they have handled elemental mercury with no immediate bad effects that there is not much of a problem with it. When they can walk into a drugstore and buy a mercury thermometer, there is little public perception of danger. The differences in toxicity and routes of exposure between the various mercury species make it extremely difficult for the layperson to understand. For more information about the different types of mercury, please return to sections 2.2-2.4.

3.3.2 Talk to All Employees, Not Just Supervisors

Mercury is used in the hospital by all departments and levels of personnel. Often the people in charge of a department do not really know what is going on in their department regarding its use. Numerous times department heads told Center personnel they had no mercury and used no mercury. Making a trip through the department and speaking to random personnel would uncover the fallacy of the claim. It is important to reach the individuals who actually use, maintain, clean up after, and dispose of these devices to know their fate and use. This is not a derogatory statement aimed at department supervisors whose responsibilities encompass much more than management of hazardous materials. Having someone like a Center researcher come in and identify the sources of mercury in a facility is a learning experience for all involved.

3.3.3 The Importance of Networking

Finding people interested in receiving help was at times frustrating. The concern here was that only the people who wanted to change were contacting the Center. The facilities that needed the most help were most likely those that not expressing an interest in making a change.

All hospitals are connected through an invisible web of professional organizations and regulatory agencies. Center staff is available to give presentations or provide information or assistance through these groups also. Ask the professional organizations your facility is associated with to request training, assistance, and/or educational materials.

3.4 POLLUTION PREVENTION ISSUES

Following are some pertinent issues learned by Center staff that may help the hospital find ways to augment their facility's pollution prevention efforts. These sections provide information on ways to reduce the occurrence of mercury spills at a facility, and ideally to reduce or eliminate the use of mercury-containing products that result in the generation of hazardous waste. Contact information for companies mentioned in this section is included in Appendix G.

3.4.1 Baumanometer® Safety Devices

By far the most commonly used sphygmomanometer found by staff in Florida hospitals was the Baum brand wall-mounted sphygmomanometer. Manufactured in New York since 1916, the Baum sphygmomanometer was a technological breakthrough at that time. Since then, it has undergone many modifications and improvements and is considered by some a standard for blood pressure measurement.

Indeed, a testament to the quality of this instrument is the fact that many in use are up to 30 years old. However, this is also one of the problems with the "Baumanometers". The majority currently in use in Florida hospitals were manufactured before Baum began including certain safety devices that greatly diminish the chance of a mercury spill.

Staff found the Baumanometers hanging behind every bed in some facilities. In fact, many patient areas that had been turned into offices still had the Baumanometers mounted on the walls next to people's desks. Additionally, many departments reported using an alternative type of sphygmomanometer, but the Baumanometers were not removed from the walls. These wall-mounted sphygmomanometers were seen in many emergency rooms, treatment rooms, and doctor's offices as well.

The safety issues with these older model sphygmomanometers include two items that are cheap, easy, and quick to fix. One is replacement of the glass mercury tube with a mylar coated tube. The other is the insertion of a small "L" shaped piece of metal that prevents accidental release of the mercury from the tube. Both are included on new Baumanometers.

The Mylar Tube

Older models of the Baum sphygmomanometers used a clear glass tube. Although it is somewhat recessed in the instrument's face, it has always been a potential source of a spill if the tube was broken. Now, hospital personnel can replace the glass tube with one coated with mylar. In event of the tube breaking, the mylar coating will prevent shattering and maintain the integrity of the tube.

The mylar sheath ends close to the tube's top end, and a fingernail can detect the change in the tube's outer diameter. This check can be used to see if existing tubes are mylar coated or not.

These tubes can be purchased from Baum and replacement is not difficult. They are available for all models of Baum brand sphygmomanometers.

The Lever Lock

The second safety device is provided free of charge from Baum.

On the wall mounted Baumanometer, the mercury-containing tube is held in place by a lever on top of the device. The lever is only supposed to be moved when the sphygmomanometer is removed from the wall and lying on its right side. If this lever is inadvertently flipped back while the instrument is upright on the wall, the tube is released and the mercury spills out of the bottom of the tube.

Besides hearing anecdotal stories about this happening in Pediatric Clinics and during room cleaning, staff also tried flipping this switch to see how easily the mercury could be spilled from one of these devices. Considering that many of these devices are hanging above patients' heads, it is too simple.

The lever lock is a simple strip of angled metal that is easily slipped behind the lever to immobilize it. The lock can still be removed with no problem using a screwdriver, but spills are prevented because patients cannot remove the lever lock without some work. The lock simply eliminates the potential to idly flip the lever, which bored and/or curious patients may do. Vigorous cleaning of the sphygmomanometer can also allow inadvertent flipping of the lever.

The lever locks can be ordered from Baum, Inc. and will be sent free. Another benefit of inserting these lever locks is that one person in the facility can make a detailed accounting of where and how many Baumanometers are in the facility, and can make a quick visual maintenance check as well. Appendix G has information about contacting this company.

3.4.2 Mercury vs. Aneroid Sphygmomanometers

The sphygmomanometer most often used as a training device is a mercury unit. Until the last 10-15 years, this was the only accurate sphygmomanometer on the market. In fact, aneroid sphygmomanometers were manufactured outside the U. S. as early as 1970 and imported. These devices were decidedly inferior to the mercury units. Although recent technical developments have given the aneroid sphygmomanometers an accuracy rating similar to the mercury units, it is often difficult to convince some practitioners to change. Compounding the problems associated with the older aneroid units is the vigorous campaign by a major mercury sphygmomanometer manufacturer to maintain their market share by offering nursing staff training in taking blood pressure. During this training, information that is biased towards their mercury-containing products is provided. The average user will not be able to identify the inaccuracies in this information that is freely given.

Some facilities have reported that aneroid sphygmomanometers add to the burden of hospital maintenance staff because of the need for periodic calibration. Mercury sphygmomanometers also need periodic maintenance. The expense and time of managing maintenance, spills and disposal can outweigh the time needed for calibration of the aneroid units.

3.4.3 Replacing Mercury Sphygmomanometers

Many facilities reported that they were replacing mercury sphygmomanometers from attrition or during renovations. Attrition is the worst scenario, as the unit would have to break before being considered for replacement. Waiting for renovations can take years, and Center staff found that often the renovation money ran out before the mercury units were replaced.

One company that manufactures aneroid sphygmomanometers has a policy that makes replacement more economically feasible for hospitals. WelchAllyn sells aneroid sphygmomanometers. They will take back and recycle mercury units on a one-for-one basis when their aneroid units are purchased. The hospital purchasing department can negotiate with the company to get the best price for the number of mercury sphygmomanometers they want to replace. Appendix G has contact information for this company.

3.4.4 Blood Pressure Measurement is Subjective

Technician error in blood pressure measurement can sometimes be attributed to mercury sphygmomanometers. Any blood pressure taken with a stethoscope is bound to be subjective, as people's hearing and response to what they hear may vary. Using the same blood pressure device for all readings on a patient can help ensure accuracy, while having the blood pressure taken by various staff members using different instruments can introduce variation in readings. According to one source (Dick Carson, Personal communication, May 5, 1999), the size of the cuff used when taking the blood pressure can have a great effect on the accuracy of the reading as well. The angle from which a mercury gauge is read can also effect the accuracy. Many hospital personnel reported that they only trusted what they could "hear in their ear" when taking a blood pressure. Unfortunately, what they hear does not guarantee accuracy.

Mercury sphygmomanometers introduce more subjectivity to blood pressure measurement; aneroids can remove that quality. This is a reason to change from mercury sphygmomanometers independent of cost of replacement and waste disposal.

3.4.5 Thermometers from Newborn Nurseries

A possible source of mercury thermometers in the household can be newborn nurseries. Most hospitals give the new mother a kit with commonly needed baby items when upon discharge after delivery.. Previously, these kits would always include a new mercury thermometer. Center staff found that this practice is no longer common, but should be discouraged where ever it is found.

3.4.6 Childbirth Educators Can Provide "Mercury-free" Information

A potential method to "get the word out" about mercury is through childbirth classes. Many hospitals require classes on childbirth and newborn care prior to delivery. Educators can be encouraged to teach expectant moms about alternatives to mercury thermometer use in the home.

3.4.7 Technician Error With Tympanic Thermometers

The difference in accuracy between some temperature measuring devices is often a reflection of the technical expertise of the user. For example, many hospitals use a specific brand of tympanic thermometer. This battery-operated thermometer has a probe that is inserted into the patient's ear. The probe has a disposable cover that

is changed between patients. It is imperative that the probe has the correct angle and depth to get an accurate reading. In one facility, the use of this brand of thermometer caused contention and discord between many on the nursing staff. After surgery, a patient's temperature in the Recovery Room was required to reach a certain point before discharge to the Intensive Care Unit (ICU). In the ICU, staff used the tympanic thermometers and consistently recorded a temperature 2-3 degrees lower than what the Recovery Room recorded when patients were discharged to ICU. Because of this discrepancy, nursing staff reported that some patients might have been treated unnecessarily for a low temperature.

Although company representatives had given in-services on proper use and ruled out instrument error, the discrepancies continued to plague this particular department. Other departments in this same facility used this same tympanic thermometer without problems.

Many facilities reported having trouble with this device and were replacing it. The concern of the Center staff was that some departments would return to using mercury thermometers out of frustration with and mistrust in the tympanic thermometers.

A few thermometers that can replace mercury thermometers are listed in Appendix G.

3.4.8 Esophageal Dilators and Feeding Tubes

Esophageal dilators, feeding tubes, and other devices may use mercury as a weight. There are good replacements available for all the mercury-containing devices that have historically been used in hospital endoscopy departments. The most common of these is the esophageal dilator or bougie. This device is a long, flexible tube containing mercury. It is passed down the patient's esophagus and used to dilate this structure if there are constrictions from various disease processes. Patients may return periodically to the hospital for this procedure if they have a chronic problem. The good news is that there is a mercury-free alternative available. It uses a tungsten gel for weight instead of the mercury. Additionally, the outside surface is silicone which is non-slip when dry and slippery when wet, making handling easier. The mercury-containing bougies are made of rubber.

The silicone tungsten-gel bougies are green, easily differentiating them from the red rubber mercury bougies. At least one company has a trade-in policy that gives you a 10% rebate toward purchase of a new bougie that includes free recycling of the old one. See Appendix G for information about two companies that make mercury-free bougies.

It is important for the endoscopy staff to understand the difference between these two bougie types. At one facility, Center staff noted both types of bougies stored together in a box. Although directions for using two sterilization methods were included, the only difference noted on the directions was the color of the tube. There was no indication on the bougies themselves that one type contained mercury. By law, personnel should always know when they are working with a toxic substance (Florida Right-To-Know Law Works For You, 1992). A simple addition to the cleaning instructions like, "This device contains mercury; ensure proper recycling," would help ensure proper handling.

3.4.9 B-5 Fixative in Histology

The laboratory is probably the most difficult place to control the mercury in a medical facility. One of the compounds historically giving the most problem has been B-5 fixative. This mercury-containing fixative has been used in histology to aid in identification of certain cell types. The tissue would be placed in a container with the B-5

and left until the B-5 had penetrated the tissue. Then the tissue would be processed and made into a slide for examination under a microscope. Mercury got into the rinse water during processing and was often discharged to the sewer.

There are several brands of fixative that have been developed to replace the mercury-containing B-5. Most use a zinc oxide stain instead. Any laboratory supplier should be able to provide at least one possible substitute. Appendix G has contact information for two companies that sell a substitute.

The difficulty may be in convincing pathologists to change. Understandably, doctors are not willing to compromise disease diagnosis by using products that may not deliver the same high quality results they are use to getting with the B-5. However, most hospitals visited during this project have successfully changed. One of the keys to using the B-5 substitutes is to carefully follow the directions, which will differ from directions for B-5 use.

3.4.10 Barometers in Respiratory Therapy

Respiratory therapy may not seem like a place to find mercury. In several hospitals visited, this department had one of the single largest repositories of mercury in the facility. A large barometer has historically been used to calibrate blood gas analyzers in hospitals. The only brand of barometer seen by Center staff holds 14 ounces of elemental mercury. The manufacturer does not sell any kind of safety devices for this barometer.

Most hospitals have gotten rid of these barometers and instead call their local airport every eight hours for barometric pressure readings. If this is not a reasonable change, the barometers can be made less dangerous by a creative engineering department. A simple cage can be placed around the mercury repository at the barometer's base. A clear plastic cover could be attached over the glass tube. Most importantly, the barometer should be placed out of the way and carefully secured to the wall.

Several hospitals reported breaking these barometers in the past. Replacing them with a few simple daily phone calls is an easy fix.

3.4.11 Intraocular Pressure Devices

Prior to ophthalmic surgery, pressure within the eyeball can be reduced to simplify surgery. This has been an historic use for mercury and Center staff found mercury-filled balloons in use for this procedure. At least three devices of this type - the Buys Mercury Reducer, the Wee Bag O' Mercury, and the McIntyre Ocular Presser have been offered for sale in the United States. Around 13 ounces of elemental mercury is poured into a small balloon the size of a large egg, then double or triple bagged. When placed on the eye, the weight of the mercury on the eyeball keeps fluid from accumulating at the normal rate, softening the eyeball prior to surgery.

Newer micro-surgical procedures have relegated this device to forgotten drawer corners in most facilities because pressure reduction is not always necessary. The concern of the Center staff is that the pressure reducer will be easily discarded because of its small and unobtrusive size.

As use decreases, these devices have been found shoved to the back of a cabinet or drawer, often in the Day Stay Surgery area, and forgotten. Being a small, entertainingshape and texture, this device may be taken home as an adult toy. A similar device was seen at one facility's Day Stay Surgery and consisted of a hard, formed plastic egg with one convex side that snapped to a headband. Day Stay staff thought the device inferior. The concern of Center staff is that a less adequate device, like the hard plastic egg, will not be used and the mercury-filled devices will be

brought back into service. Without a replacement available, physicians may request repair of one of the old-style mercury pressure reducers, unnecessarily exposing staff and patients to possible elemental mercury exposure.

No manufacturer could be found that is still making mercury pressure reducers, and no recycling programs are in place for them. It is the responsibility of the facility to find, recycle, and replace these devices. If a replacement is desired, the Lebanon Corporation offers the Honan Intraocular Pressure Reducer or Eye Softener. It is a pneumatic device with a pressure gauge to maintain even pressure on the eyeball. Appendix G includes information about contacting this company.

3.4.12 Mercury-Free Cleaning Products

A small and potentially overlooked source of mercury in the hospital is cleaning products.

The process of chlor-alkali production (manufacture of chlorine products and sodium hydroxide products) can use mercury, resulting in mercury contamination of the products. This process is used for many cleaning products that consequently contain low levels of mercury. Although these quantities are parts per million or billion, the amount of cleansers used in hospitals can result in a significant contribution to mercury in wastewater through normal use. Since Center staff could not find a comprehensive list of cleansers with mercury contaminating them, no product names will be used to prevent apparent discrimination in this report.

The good news is that there alternative products are becoming available that are not only mercury free but also safer for the user and the environment in other ways. One company, located in Boston, sells products over the Internet and through catalog sales, but does not have sales representatives in Florida at this time (see Appendix G).

3.4.13 Home Health Care and Fitness Centers

Look for mercury use outside of the facility, like in fitness centers and home health care. At one facility, mercury thermometers were no longer in use at the hospital, but the home health care they provided used one mercury thermometer per patient. These thermometers were left with the patient after discharge. Additionally, home health care personnel had been instructed to dispose of any thermometer broken in the home in the patient's trash. Even if these thermometers were still intact at the time the patient was discharged, chances were slim that they would be recycled if they broke in the future.

Many hospital fitness centers visited used mobile mercury sphygmomanometers (on a rolling stand) to take blood pressures while patrons were exercising. Because of the activity in these centers, the mobile units were occasionally knocked over and broken. Mobile aneroid units on adjustable stands are available as replacements.

3.4.14 Find a Champion

Every facility seems to have a "champion," someone who has already spearheaded replacement of mercury thermometers in the laboratory, for example. Enlist this person's help. Hospital personnel will be more willing to help if they see that there has already been positive movement toward a goal of mercury reduction. Using someone who is perceived as being just a regular employee will often make others more inclined to get involved.

Multiple Chemical Sensitivity

At one facility, a volunteer was concerned about her own exposure to mercury. This individual had been diagnosed as having Multiple Chemical Sensitivity (MCS). Although hospital staff was working to allay her concerns, it was seasoned with a disbelief in the legitimacy of her complaints and ailments. Her sensitivity was so severe that working under fluorescent lamps caused illness.

Exposure to chemicals in the environment can trigger MCS in some individuals. The symptoms often resemble allergies, but are triggered by increasingly small exposures over time. Symptoms vary between individuals, but usually include fatigue, mental confusion, breathing problems, muscle aches and a weakened immune system (MCSurvivors, 1999).

MCS is not widely recognized and sympathy for sufferers often ends when others can not personally identify the offending toxin. Sufferers of MCS refer to themselves as "canaries in a coal mine" (Olivia Stryker, Personal communication, February 20, 1999). Canaries were used by coal miners to gauge air quality inside the mine – if the fragile canary got sick, it was time to evacuate the mine. It is important for hospitals to recognize the reality and severity of this illness and work compassionately with any employees who are affected.

Since people with MCS are often very concerned about improving working conditions, they may also be an excellent "champion" for a mercury management program.

3.4.15 Use Outside Resources

Although information on mercury waste reduction is readily available in Florida, excellent resources abound in other states. Mercury has become a most pressing issue in states with the most water, and, not surprisingly, some of the best mercury management programs and information have developed in the states surrounding the Great Lakes. A good Web site is http://www.epa.gov/seahome/mercury/src/outmerc.htm. Check Appendix C for other pertinent Web sites.

3.5 COMPLIANCE ISSUES ENCOUNTERED

The following points pertain to the compliance aspect of mercury waste reduction and management.

3.5.1 No Mercury in Red Bags or Sharps Containers

One of the most important messages for all hospital staff to hear – and hear repeatedly – is to not dispose of any mercury or broken mercury devices in red bag waste containers or sharps containers. Any mercury-containing device must be managed as hazardous waste even if contaminated by biomedical waste. Discarding one mercury thermometer in a large red bag renders the whole bag unfit for disposal as biomedical waste.

Center staff found that mercury thermometers were often used for isolation patients because they could be left inside the room and dedicated to a single patient's use. For other patients, most departments use thermometers with a probe having a disposable sheath. These expensive units cannot be left in the patient room or carried from the isolation room unless no patient contact has occurred. Consequently, hospitals need an inexpensive, non-toxic disposable alternative to mercury thermometers for isolation patients (see Appendix G for some alternatives).

According to conversations with environmental services staff at various hospitals around Florida, when a room is cleaned after the discharge of an isolation patient mercury thermometers are sometimes left behind. They may be discarded in a sharps container by cleaning staff because glass is potentially sharp. The thermometers may be discarded in red bags because staff recognizes that the mercury should be treated differently than regular trash. This response would be correct except that, because of the mercury, these thermometers should always be kept separate from all other waste streams.

One easy way to handle these thermometers is to have the cleaning staff carry zip lock baggies on their carts for thermometers and place them with other mercury for recycling at the end of their shift.

3.5.2 Spill Clean Up

Who does spill cleanup? Where does the money come from to pay for spill cleanup? Too often the answer to this question was the department generating the spill. Most hospital personnel have not been trained in proper mercury spill clean up. Handing them a spill clean up kit is not the best way to manage a spill. It is important to have individuals available all the time who are familiar with a management of a mercury spill and use of a spill kit. The kits should be easily accessible.

If spill clean up costs come out of the budget of the department experiencing the spill, there is more of a chance that it will not be properly managed. The department may decide to scrimp on clean up to minimize the effect on their budget.

3.5.3 The Spill Clean Up Kit

Center staff saw a wide variety of kits in use. Any laboratory or safety supplier will have choices available. Some of the components of the kits may include:

Mercury Suppressant – a solution that will prevent vaporization of elemental mercury.

Mercury Indicator – a powder that changes color to indicate the presence of mercury.

Mercury Absorbent – a powder that amalgamates with mercury to facilitate clean up.

Mercury Aspirator or Vacuum – ranging from a syringe to a dedicated vacuum for mercury and used to suction mercury from surfaces. It is very important that regular vacuum cleaners are not used on spilled mercury, as they spread the contamination through aerosolization of the mercury particles.

Gloves, safety glasses, screw cap container, baggies, towelettes, etc.

Mercury spill clean up kits can be made in-house out of separate components or purchased from a safety equipment supplier. It is important to have the kits on hand and available for trained clean up crews in the facility.

A vacuum specifically for mercury can be purchased but the cost may be prohibitive for small or single facilities. Hospital groups may purchase one to share between facilities. Hospitals in a city or district could also cooperatively purchase one mercury vacuum to share. Some emergency response departments or companies have a mercury vacuum available. Be prepared and know whom to contact before the spill occurs.

3.5.4 Follow That Waste Stream

Take new hires on a waste trip through the hospital. Most people have no idea what happens to the trash they generate at work, or the fact that hazardous waste is up to four times more expensive to dispose of. One innovative hospital has included a trip from red bag collection sites to the incinerator or dumpster as part of orientation. Many people no longer think of the trash they generate once it is in a can – out of sight is out of mind. Raising employee's awareness of waste disposal issues in the hospital can benefit total waste minimization and management programs and even decrease the total amount of waste generated by the facility.

3.5.5 Devoted Mercury Collection Areas

Provide a spot for mercury collection. When finding ways to ensure proper recycling of mercury, it is most important to make the process easy for those involved. For example, if a housekeeper has to personally carry a thermometer from a discharged patient's room to a recycling area in Engineering, there is a chance that the thermometer will be improperly discarded to avoid the trip. Some hospitals have a recycling area in each department's storage room. A bucket for batteries and a smaller container for thermometers can be placed in a larger, low plastic pan that could hold other broken or outdated mercury devices. This way the mercury is separate and contained, and the individual mercury-containing items are segregated.

3.5.6 MSDS's and COA's

An issue primarily concerning the laboratory has to do with Material Safety Data Sheets (MSDS's) and Certificates of Analysis (COA's). Manufacturers are required to provide MSDS's for every product they sell that contains a potentially toxic substance. These sheets provide a ready reference for "…the properties and hazards of a toxic substance, including chemical identification, physical and chemical properties, physical and health hazards, means by which the chemical may gain access to your body, safe handling and use, emergency and first aid measures, and control measures." (Florida Right-To-Know Law Works For You, 1992) MSDS's report any substance that occurs as 1% or more of the total. The problem is that many laboratory chemicals contain mercury in parts per million (ppm) or billion (ppb). Since these low quantities do not have to be reported on the MSDS, most laboratory workers are unaware the compounds contain mercury and are not concerned with discharging them to the sewer. Additionally, many analyzers discharge spent reagents directly to a sink drain, making collection of mercury-containing wastes more difficult.

One way to determine if the compounds used in a laboratory contain mercury is to request a COA from the manufacturer or distributor. The COA is like a recipe. It includes a list of every chemical constituent of the compound and its quantity, even listing contaminants in many cases. Because the COA lists all the components, mercury will be included even it is only occurs in ppb quantities. Appendix B includes a letter your hospital can use to request a COA.

3.5.7 Use Certified Recyclers/ Registered Mercury Waste Transporters

Not all recycling and transportation companies are made the same – be sure your facility is using a reputable company to deal with your wastes. If in question, contact, the FDEP (1-800-741-4337) to find out if the company you are using has been identified by them as one which will certify that the mercury is recycled. Check whether the transporter is registered to transport mercury wastes.

3.5.8 Request Vendors Sign a "No Mercury" Affidavit

Tracking down all the mercury in the facility can be a full time job. To help keep more mercury from entering the hospital, send a letter to vendors. This letter will request that they not knowingly sell any mercury-containing products to the facility if there is an alternative, mercury-free product available. See Appendix A for a letter your hospital can adopt for use.

3.5.9 Use Reverse Distribution For Pharmaceuticals

Reverse distribution of outdated or unwanted pharmaceuticals can be a money-maker for hospitals. These companies return some of these products to manufacturers and the hospital will be paid according to what can be re-used. Reverse distributors also handle collection and disposal of unusable products, saving the hospital time and money that would be spent if they managed these products themselves. Center staff did not find any hospitals not using reverse distribution, but it still bears mentioning. These companies offer various degrees of service, with the bottom line being the removal from the facility of any outdated or unwanted pharmaceuticals for recycling or destruction. As a word of caution, not all reverse distribution companies are completely ethical. Before signing the contract, make sure that the company is permitted and insured.

3.5.10 Keep the Mercury Out of the Plumbing

One company, listed in Appendix G, was found that manufactures water treatment products for heavy metals collection. This can help hospitals prevent the discharge of low levels of mercury from laboratory chemicals to the sewer.

As mentioned in Section 3.3.8, laboratory chemicals can contain very low levels of mercury that can be very difficult to identify. Even when found, there may not be a suitable replacement, as some of the reagents, test kits, standards, etc., are specifically manufactured for use in an particular instrument and may not be replaceable.

Mercury may also be introduced through careless handling over an open sink. Attaching a filtration and collection device to drains in the laboratory can prevent the discharge of the low-level mercury-containing compounds to the sewer system.

3.5.11 Replacing Mercury Sphygmomanometers

Many facilities reported that they were replacing mercury sphygmomanometers from attrition or during renovations. Attrition is the worst scenario, as the unit would have to break before being considered for replacement. Waiting for renovations can take years, and Center staff found that often the renovation money ran out before the mercury units were replaced.

One company that manufactures aneroid sphygmomanometers has a policy that makes replacement more economically feasible for hospitals. WelchAllyn (contact information in Appendix G) sells aneroid sphygmomanometers. They will take back and recycle mercury units on a one-for-one basis when their aneroid units are purchased. The hospital purchasing department can negotiate with the company to get the best price for the number of mercury sphygmomanometers they want to replace.

3.5.12 Miller Abbott Tubes With Mercury

One contact called for information about alternatives to using mercury in Miller Abbott tubes. These tubes are passed down a patient's esophagus, through the stomach and into the small intestine to help unblock intestinal obstructions. Historically, these tubes had a balloon containing mercury to guide the tube into place through gravity. Center staff recommended replacing the mercury balloon with a water-filled balloon, or using a different procedure. Most practitioners have stopped using the Miller Abbott tubes and use a combination of drugs and surgery for obstructions.

This conversation came just a little late. The physician wanting to perform the procedure "borrowed" some mercury and inserted the Miller Abbott tube. Unfortunately, the balloon, containing around 15cc of mercury, burst inside the patient. Now the hospital had a mixed stream of biomedical and hazardous waste to be disposed. The waste stream was biomedical because the fecal material had visible blood due to the necessity for a bowel resection after the Miller Abbott tube procedure.

Center staff looked for other instances of similar accidents and found they are not unheard of. One contact told of a comparable accident in her hospital. The fecal material was collected and tested for eight months, consistently showing positive for mercury. The mercury was also visible on x-rays in the patient's intestinal tract. In that case, there was never any resolution of the problem. After eight months, the patient died, still with elemental mercury in his intestinal tract.

The patient in this current case is still collecting stools for disposal with a hazardous waste company. In this instance, it was also difficult for the facility to find how they could properly dispose of the waste. The waste transporter they originally contacted misunderstood the nature of the waste and quantity of mercury involved and accepted it for incineration. That company has since gone out of business, and the waste company that has agreed to dispose of the material will only take it after it is tested to determine the quantity of mercury it contains. Finding a laboratory that would test the material for elemental mercury was also difficult. Several would test hair, blood, or urine, but only one was found that would test for feces.

4. CASE STUDIES

At the start of the project, nearly 100 phone calls were made to hospitals around Florida, offering assistance in mercury management. Whenever possible, these cold calls were directed to contacts that had been established earlier. Many were directed to whoever was identified by the hospital switchboard as the hospital safety officer.

Center staff found that, almost invariably, messages left were not returned. The only hospitals which requested assistance were those where people actually answered the phone and heard first hand about the project.

Several hospitals were visited a single time but did not request long-term, comprehensive assistance. Three hospital groups decided to use the Center's help on a long-term basis, and really made some changes in their facilities.

Letters rather than names identify the hospitals.

4.1 HOSPITAL A

This facility had already committed to removing mercury from the workplace, although they did not have a mercury-free purchasing policy. They had removed all mercury sphygmomanometers from the hospital and did not use mercury thermometers for any application except in the Blood Bank. They had changed to tungsten gel esophageal dilators. Their last reported mercury incident was more than two years previous.

The generator status for this hospital was Conditionally Exempt Small Quantity Generator (CESQG).

The major concern at this facility was the proper disposal of fluorescent lamps. Because they changed the whole facility over to low-mercury lamps, they had been disposing of the lamps as solid waste. They wanted assurance that this was the proper disposal method. Because these lamps pass the TCLP for mercury, disposing of them as solid waste is permissible, so long as their waste in not incinerated and so long as the county allows this. DEP would prefer that these low-mercury lamps be recycled.

4.2 HOSPITAL B

This was a three-hospital group. The safety officer for the group was interested in learning about mercury and the Center's project. He had only been employed by the hospital for a few months and was not personally knowledgeable about many aspects of recycling, spill clean up, or hospital group policy. Like many other hospital groups, some department supervisors were shared between facilities and some were duplicated.

Little assistance was given to this group. Some information was provided about mercury vacuums and tungsten gel-filled esophageal bougies. Additional assistance to this hospital group may be provided during the next phase of the project, after the contact has more time to become familiarized with his job.

4.3 HOSPITAL C

This hospital was part of a large national healthcare corporation. Consequently, many hospital policies are governed by this agency that is not even located in the state.

Their housekeeping was contracted through a large national service company. When staff contacted this company to learn about possible training related to mercury that contracted employees would receive from the service company, the answer was an immediate, “Hopefully none.” He went on to explain that each hospital contract is written specifically for that facility - there is no standard contract. Housekeeping staff is not supposed to handle broken mercury devices or do spill clean up. The individual facility has the authority to decide what scope of services they want covered by their contract. Training for spill clean-up response and routine disposal of hazardous materials is the responsibility of the facility where the staff works.

Spill clean up in this facility was the responsibility of the department head where the spill occurred.

This hospital was an example of how the safety officer may not always have all the information about the facility. He had been told that sphygmomanometers were being replaced with aneroid units, but a facility tour uncovered no aneroid sphygmomanometers. This was not necessarily a bad reflection on the safety officer – the scattered nature of information about mercury was evident in every facility visited. This is one of the reasons it is beneficial to have someone come to the facility and help gather all the mercury-related information in one place.

The esophageal dilators (bougies) in Endoscopy were kept in a closed case. The case included both mercury and tungsten gel filled bougies, distinguishable by the different colors of the outer surfaces. Directions for cleaning both types were taped to the case’s top, but nowhere was there mention of the hazardous material content of the mercury bougies. The nurse who showed the bougies to Center staff did not know that any of them contained mercury, although she did know that they had an expiration date and would eventually be recycled.

A device that was found at this facility was the Honan brand Intraocular Pressure Reducer. This device replaces various brands of mercury-filled bags used for reducing intraocular pressure. For more information about this device, please look in Section 3.4.10.

4.4 HOSPITAL D

This hospital was located on a military base. Policies and procedures that were set by that service branch governed it. It was a 30-some year old facility, originally built to hold 435 beds. Changes over the years have brought the number of beds in use to between 3-40.

No real effort to eliminate mercury had taken place at this facility. Right-to-Know Training for in-coming military members was required. This may or may not have included information about mercury. Troops signed off that they had read and understood safety manuals, but the concern was that the information was not really learned and retained. Another concern of Center staff was that the rapid turnover of hospital staff could prevent the feelings of ownership and pride that can help persuade employees to embrace recycling and waste reduction programs.

Everyone on this military base was instructed to call the base Fire Department for any kind of hazardous spill, regardless of size. After the Base Fire Department cleaned up a spill, the clean up materials were left for the “generating activity” to dispose.

The hospital did recycle their fluorescent bulbs. The hospital environmental program manager collected the tubes. He separated out any broken bulbs and sent all bulbs to Public Works on base. From there, the Base Operating Services Contractor, picked up the bulbs,then sent them for recycling.

The hospital had been using B-5 fixative in histology. They collected the B-5 waste and stored it. The fixative was used over a sink or a counter, so residual waste could have been discharged to the sewer. At the time of this site visit, the histology department was waiting to receive a mercury-free alternative to test.

Plant Operations (maintenance) was all done by contract. Environmental Services (housekeeping) was done in-house with Civil Service employees. The contact at this facility said that these Civil Service employees did not have the same quick turn around as active duty personnel in other hospital positions. This was encouraging, because longer employment times in one facility will enable the hospital to maintain a staff trained in hazardous waste management. Hopefully, long-term personnel would feel an involvement with their work site, and take an active role in waste management.

Only one visit was made to this facility, and Center staff anticipates additional contact to see if any other changes have been implemented.

4.5 HOSPITAL E

Another hospital that had one site visit was licensed for 771 beds, but a typical census was 400. They also had a psychiatric hospital and long term care facility located off campus. The hospital incinerator had been closed for more than ten years.

The contact at this hospital thought that mercury sphygmomanometers were being replaced with aneroid units. A trip around the hospital proved this incorrect, as Baumanometers were in place above all the beds. They were using only mercury-type bougies in endoscopy. The laboratory had removed all mercury thermometers except one that was used for calibration. Histology had successfully switched to a B-5 alternative using zinc chloride.

Maintenance on sphygmomanometers was done in plant operations and a specific maintenance area was shown to Center staff. It included a bottle of elemental mercury for re-filling any sphygmomanometers needing more mercury. This department was also in charge of spill clean up. A contact in plant operations claimed that they had found elemental mercury in old drain traps. Assistance in searching out contaminated traps was offered, but the facility only took some written information about drain trap cleaning instead. The materials offered can be found at http://www.masco.org/mercury/infra/pp.html).

4.6 HOSPITAL F

Initial work with this hospital group was reported in *Mercury Reduction in Florida's Medical Facilities: Improving the Management of Mercury-Bearing Medical Wastes* and identified as Hospital "D." At that time, an audit of mercury use in the facility was made. The hospital education coordinator contacted Center staff in March of 1999 to ask for training for general hospital staff during their "Safety Week."

Two training sessions were given during one day. Good turnout for the morning program was followed by a poor turnout in the afternoon. Center staff feels that offering this training as an option for hospital personnel probably will not ensure good attendance. Throughout the day, while Center Staff was walking around the facility with the Educator, personnel had myriad excuses for not attending the sessions – too much work, people missing from departments, not hearing about it in time.

There were two positive outcomes to these training presentations. First, a contractor at the facility asked to talk about mercury at the sessions' end. A rock collector, this man had previously found garnets in rocks along the railroad beds. Six weeks before, he had taken an unusual reddish rock home and cut and polished it. He wore a particulate mask and safety glasses, but his hands were bare. After a while, he realized that the rock was getting slick

and shiny. His hands were silver. He was very ill the next morning with nausea, lack of coordination, respiratory distress, and swollen, blistered hands. The rock he had found was cinnabar, which can naturally contain mercury. The railroad bed rocks had been imported, including the cinnabar. He had not recovered from acute mercury poisoning after six weeks. The rock, in a plastic bag, was circulated around the room. His short speech impressed the audience.

A Plant Operations worker who attended the morning session approached the Center staff member after the session and asked about the lever locks for Baumanometers. (see Section 3.4.1**)**. He was given a bag of lever locks and for the rest of the day could be seen going from room to room inserting them. His enthusiasm for helping to effect change was noted and appreciated by hospital staff. He had not only placed the lever locks in all patient rooms, but in offices that had been converted to patient rooms as well.

4.7 HOSPITAL G

Initial work with this hospital group was reported in *Mercury Reduction in Florida's Medical Facilities: Improving the Management of Mercury-Bearing Medical Wastes* and identified as Hospital "G." One of the major projects undertaken at this facility was the hospital-wide replacement of mercury sphygmomanometers with aneroid sphygmomanometers.

A contract was made with Welch/Allyn. This manufacturer of aneroid sphygmomanometers will take back for recycling one mercury sphygmomanometer for every aneroid unit purchased.

The hospital had been changing to aneroid sphygmomanometers as they broke or money could be found for a few replacements. Now, they have been able to replace nearly all the sphygmomanometers within one year, and have saved money by recycling the old mercury units.

4.8 HOSPITAL GROUP H

The safety manager for this six-hospital group is one of several real champions of the environment that Center staff met during site visits. Unfortunately, this individual has been the victim of departmental downsizing and is currently the sole safety officer for all six hospitals with combined licensure for around 1400 beds. The facilities are spread over an approximate 60-mile radius, making site visits difficult for anything but emergencies. In fact, the safety officer admitted that most of what was accomplished in this hospital group was retroactive rather than proactive. Although desirous of implementing mercury-reduction changes at all facilities, time constraints and the difficulty of providing reasonable changes for all facilities was discouraging. This hospital group was under the auspices of a national hospital corporation.

Current changes in personnel were due in part to the opening of a new affiliated hospital. Some people were moved to the new facility and replacements were not being hired. This was very apparent in plant operations, and was negatively impacting programs already in place.

The safety officer said that the majority of his job entailed dealing with myriad indoor air quality issues. Major ongoing renovations at the one facility visited made introduction of new waste management plans even more difficult at that time. The first site visit was cut short so the safety officer could respond to a problem at a different site.

Despite all the organizational problems in this hospital group, the safety officer was able to coordinate a presentation by Center staff at a group-wide safety meeting. It was attended by more than 20 safety committee members who were all interested in finding ways to better manage or eliminate the mercury from their facilities.

This hospital was worried about their public image and was not willing to advertise, even to hospital employees, that they were starting on a mercury reduction project. The safety officer expressed a concern that it would be misinterpreted and mercury emergencies would become common.

A nurse told of a study performed by one nursing unit comparing digital and mercury thermometers. The study was slated for publication, and showed that some members of the hospital staff were indeed committed to change even before Center staff visited.

This hospital group is interested in getting more help in the future. Center staff felt that the presentation to the safety committee was a good way to introduce some ideas for change. Change for this hospital group will not happen quickly.

4.9 HOSPITAL GROUP I

4.9.1 Description

This three-hospital group was extremely interested in getting assistance in managing their mercury from the time they first heard of the project. One hospital in this group had been visited in 1997 by Center staff as an example of a "typical" hospital. This hospital group has been visited 7 times since March of 1999.

The bed counts for these three facilities (Hospitals X, Y & Z) are 460, 150, and 60, respectively. The largest facility is also the oldest, and the smallest just opened within the last few years. They have about 70 off-site facilities. Each facility has small quantity exempt generator status.

Like many other hospital groups in Florida, this one had developed over time. Because the two larger hospitals were already in existence before the merger, a rivalry between them had kept them from willingly sharing some policies. Policies about waste management and product use were not the same from one hospital to the next.

4.9.2 Spill Clean Up

Hazwoper-trained spill teams were available at hospitals X and Z but not Y. Hazwoper training was scheduled for later in the year for Hospital Y personnel. Management of hazardous materials was centralized at hospital X with waste sent from the other two hospitals for disposal from this one site. The exception was fluorescent lamps, which were picked up from the generating facility. Each hospital had a hazardous material supply area that was well stocked. Incident reports were kept in the Safety Coordinators' offices and appeared detailed and complete.

4.9.3 Recycling

All three hospitals recycled their fluorescent bulbs and mercury-containing batteries. They also recycled mercury and mercury spill materials. Hospital X collected all the recyclable mercury. At the time of the first site visit, two people had been removing the mercury from sphygmomanometers before disposing of the old units when replacements were made. This was the policy of the recycling company used by the hospital group. Center Staff suggested that they stop this procedure and leave the mercury in the sphygmomanometers until the hospital group decided if they were going to replace them all with aneroids. One aneroid sphygmomanometer manufacturer will take back the mercury sphygmomanometers and recycle them when a hospital purchases a large number of aneroids.

Avoiding this recycling cost can considerably decrease the cost of facility-wide replacement. At the time this report was going to press, the mercury was still being removed from mercury sphygmomanometers for recycling as they were replaced because it was required of the hospital's recycling company.

4.9.4 Sphygmomanometers

Center Staff, using facility plans, visited each patient room in all three facilities. An accurate count of various sphygmomanometers was made, and lever locks were placed in all Baumanometers found (see Section 3.4.1). Center staff was originally told that the Baumanometers were being replaced as nursing units were refurbished in hospitals X and Y, but actually, this was one of the first things deleted from the remodeling plans when money ran short. Consequently, all three hospitals still had Baumanometers in most rooms. Hospital Z patient rooms had unfortunately been built using prefabricated wall modules. These units fit behind the patient beds and were designed with recessed spaces to hold certain equipment, including mercury sphygmomanometers. The rectangular spaces would not accommodate a square aneroid unit, although special aneroids could be purchased from the manufacturer for almost twice the cost of a regular aneroid. Consequently, changing from mercury to aneroid sphygmomanometers in this facility was not planned.

4.9.5 Thermometers

Thermometer use for patients in these three hospitals varied. In hospital X and Z, absolutely no mercury thermometers were allowed. In hospital Y, mercury thermometers were used for isolation patients and given to them on discharge from the hospital.

4.9.6 Environmental Services

In hospital Y, Center staff talked to random environmental service personnel about what they would do if they found a mercury thermometer left behind after an isolation patient was discharged. Each confidently said they would throw it in the sharps container or red bag waste container. Even if these mercury thermometers are sent home with the patient, it is tantamount to throwing them away. Almost no household mercury thermometers get recycled; most eventually break and are discarded with household trash, which is usually incinerated or landfilled.

Environmental Services for these three hospitals was not a contracted service, except in some off-campus sites. The Environmental Services director for all three hospitals used Center Staff to provide in-service training to ES personnel at all three facilities. This was an important group to reach presonally because they were often the ones generating a spill, disposing of broken equipment, or cleaning in areas where mercury was used. Although environmental service personnel at these hospitals reported discarding mercury thermometers in sharps containers or red bags in nursing units, many nursing supervisors told Center staff that no mercury thermometers were being used in their departments.

Nurses in one unit requested a container to hold used mercury thermometers for disposal, but their supervisor adamantly said that no mercury thermometers were ever used and she did not see the need for the container.

4.9.7 Clinical Engineering/Plant Operations

In clinical engineering, one person supervised all three facilities. This individual saw the benefit in changing to a no-mercury purchasing policy and offered to introduce it as a line item at a Capital Item Review Meeting. Acceptance at this meeting would provide money to replace mercury sphygmomanometers in all three facilities. This meeting had not been held before this report was published.

This department provided maintenance for the mercury sphygmomanometers in all three hospitals. At facility Y, little control of the elemental mercury, clean or used, was evident. A box of discarded Baumanometers still containing mercury was found in a storage room. This lack of centralized storage and maintenance of mercury sphygmomanometers was seen in many hospitals.

Plant Operations at all three hospitals stored and recycled fluorescent bulbs. In hospital X, bulb maintenance accounted for 5% of man-hours and 10% of work orders. This hospital recently changed many incandescent bulbs in the facility to short, energy efficient fluorescent bulbs.

One method of stream lining bulb change-outs uses a dedicated bulb cart. These carts can be purchased, but hospital X had fashioned their own with storage spaces and a short ladder. The idea is to have a replacement for every bulb used in the facility on one cart. That way, if someone calls requesting a new bulb, the cart is ready. The bulb can be replaced and the old bulb returned to the new bulb's package to prevent breakage. Some hospitals contract with a company that replaces every light in the facility after most of the bulbs' life expectancy has passed. This system, which is most practical for large hospitals, saves the man-hours that would otherwise be used to change individual bulbs as they burn out.

All three hospitals collected all batteries for recycling. This made it easy for the generators, who did not have to decide if a particular battery needed recycling or not. One person in Plant Operations separated the batteries according to which could be thrown away and which should be recycled.

4.9.8 Dietary Services

The kitchens in all three facilities were visited. Some thermostat probes were still mercury types, but no mercury thermometers were found. Center Staff provided information about mercury-free alternatives and encouraged changing as a risk management process.

4.9.9 Infection Control

One Infection Control nurse oversaw all three facilities. Since she was a vocal and assertive person who had worked in one facility for more than 20 years, Center staff was glad to make her a champion in the effort to reduce mercury use in the hospital group. Her opinion was highly regarded throughout the hospital system.

4.9.10 Training and Education

In-service training was provided for many nursing departments in these hospitals. Still, a call from the Safety Coordinator at hospital Y after the training sessions confirmed that this training is never really finished. A broken mercury thermometer in an isolation room was discarded in the sharps container by a nurse's aid hired after the training sessions were held. Luckily, the bulb end containing the mercury was found in a corner of the room, and the glass in the sharps container was mercury free.

4.9.11 Purchasing/ Products Review

Purchasing proved to be an elusive group throughout the numerous site visits. After one meeting was missed by Center staff, another appointment could not be planned. Anticipated Y2K problems were the main focus of purchasing during this period.

Center staff was invited to a Material Management Meeting during one of the last site visit. A purchaser for the hospital group was in attendance and agreed that the Y2K concerns were most important at this time. An agreement was made to work together in the future when time allows. A list of vendors and distributors will be developed that will be useful statewide for mailing "Mercury-free Purchasing Affidavits" and requests for Certificates of Analysis (see sections 3.5.8 and 3.5.6, respectively).

4.9.12 Nursing Units

Nursing units may be the *raison d'être* of a hospital. Nursing staff's availability and willingness to help during site visits varied. At this hospital group, enter staff let unit supervisors set appointments, but the appointments were often canceled when the supervisors were too busy to meet. Some informal training was done by walking around the floors and speaking to small groups of nursing staff. The hospital safety coordinator accompanied Center staff and helped gather the nursing staff for these 5-10 minute talks.

As has been mentioned elsewhere, the nursing supervisors do not always know everything that is going on in their departments concerning mercury. Sometimes it is more informative to talk to individuals working on the floors to find out the nurses' opinions of the devices used.

4.9.13 Endoscopy

Differences between facilities were found in the endoscopy departments in these hospitals. Hospital X and Z still used mercury-containing bougies, but hospital Y had replaced all of them with tungsten gel-filled units. Hospital Z was interested in making the change, but the department supervisor at Hospital X was certain that staff physicians would not accept such a change and reluctantly took information about tungsten gel bougies. When Center staff said that the tungsten gel bougies might become a facility-wide policy, the supervisor was doubtful that the change would occur without the consent of the doctors.

4.9.14 Laboratory

In the hospitals' laboratories, most thermometers had been changed to non-mercury types. However, on the day of a site visit to hospital X's laboratory, a technician was surprised to see Center staff because a mercury thermometer had just been broken in a paraffin bath and disposed of as red bag trash. The week before, a newsletter

had been distributed directing broken mercury-containing device disposal to the hazardous materials manager. Mercury thermometers in water and paraffin baths were often reported as the cause of mercury spills in hospitals around the state.

Use of B-5 had been discontinued years before. The director for all three laboratories met with Center staff and was interested in discontinuing the use of mercury containing reagents wherever possible. This person offered to contact the most commonly utilized distributors and request disclosure of mercury in any products provided.

4.9.15 Respiratory Therapy

Respiratory therapy departments in hospitals X and Y used a large barometer to calibrate blood gas instruments (see Section 3.4.9). Hospital Y reported breaking one of the two barometers they had in the past. As in other respiratory therapy departments, these barometers were perceived as irreplaceable, but many facilities have replaced them with phone calls to the local airport to get barometric pressure. During the last visit to this hospital group, Center staff found that hospital Y had disposed of their barometer and recycled the mercury it contained because of the safety issues surrounding it.

4.9.16 Associated Offices

Around 70 off-site facilities were associated with this hospital group, but only a few were visited. A fitness center was using only aneroid sphygmomanometers and no mercury thermometers. One doctor's office visited used all aneroid sphygmomanometers except one that was kept for calibration. They had had problems with these aneroids, but no one had taken the initiative to call the service representative about the problems. Consequently, staff at this office felt the aneroids were untrustworthy and preferred using the mercury sphygmomanometer. One call to the service representative procured replacements.

4.9.17 Central/ General Stores

These departments will be the main source of mercury thermometers for patient use in a hospital. At these facilities, Center staff checked to make sure there were no mercury thermometers included in ready-made kits used at admission or for isolation patients. Latex-free kits were also prepared in Stores. No mercury thermometers were found in any kits or on crash carts; in fact, the admission kit use had been discontinued.

In General Stores at hospital X and Z, the only thermometers in stock were disposable digital units. In hospital Y, mercury thermometers were stilled stocked for use for isolation patients.

4.9.18 Future Needs

This hospital group would like additional help managing their mercury, primarily in the form of additional training sessions. They would like to make mercury training videos applicable for different departments so the message can be repeated without calling Center staff. They started this by video-taping an education session with environmental services staff. As mentioned in Section 4.8.11, purchasing will work with the Center Staff to develop a spreadsheet of vendors and distributors for future mailings.

4.10 HOSPITAL GROUP J

4.10.1 Description

This hospital group consisted of three hospitals. Off-campus services included 14 owned and about 25 leased offices/facilities. A fourth hospital was part of their purchasing group but was not included in the site visits. The hospitals will be identified as Hospital K, L, and M. Hospital K has 220 beds, Hospital L has nearly 500. Hospital M was a relatively new facility, about 9 years old, and also has beds for 220.

4.10.2 Spill Clean Up

An initial concern was how well a recent mercury spill had been cleaned up in their Fitness Center. The mercury came from a mobile sphygmomanometer that was knocked over. These units were often seen in fitness and rehabilitation centers where their mobility was important. They were often used while the person was using the exercise equipment. In this case, the Jerome meter was used and showed that there was still some residual mercury imbedded in the carpet; the shape of the spill on the carpet could still be outlined. No mercury was detected above one foot off the ground, and the hospital decided not to remove the carpet from the area. When the spill occurred, no one was available to clean it up, and staff at the fitness center vacuumed the mercury up with a housekeeping vacuum. Although Center staff tested all the vacuums seen at this hospital, the contaminated vacuum cleaner was never found. This is an improper cleaning method for mercury, as a regular vacuum cleaner will break the mercury into tiny droplets and send them airborne.

At hospital L, Center staff was told by one security officer that spill clean up was the responsibility of the department generating the spill. Nursing stations were supposed to have spill kits, but it was found that most of them did not. When Center staff accidentally spilled mercury during one site visit, a security officer immediately brought a spill kit. Spill clean up materials were taken to the laboratory for collection, but poor records were kept and the person in charge of the spill materials claimed that the materials often showed up on a desk with no explanation of their source. Standardizing and organizing spill clean up was high on the agenda of changes this facility was making.

4.10.3 Recycling

At hospital L, the laboratory was responsible for collecting mercury waste and spill clean up materials for disposal. A fire cabinet held a full five-gallon bucket for the mercury waste. A cursory look by Center staff showed that the items inside were in sealed containers and bags, but not identified as to source. By speaking to other hospital personnel, it was found that the security personnel were involved in spill clean up. The exact procedure to be followed was not clear, and incident reports from spill clean up were sent to infection control and not available to Center staff. A more organized plan for dealing with mercury spills was being developed.

4.10.4 Sphygmomanometers

Sphygmomanometers were primarily mercury type in all three facilities. As was found in other hospitals, staff frequently thought that aneroids were in use, but found otherwise when they actually looked around their departments with Center staff.

Wherever aneroid sphygmomanometers were in use, they were liked. Some nurses still claimed that they only trusted a sphygmomanometer that gave them an audible response, and many said they wanted to have mercury sphygmomanometers for back up if patients' blood pressure measurement was critical or outside the normal range.

This hospital group will be introducing a facility-wide sphygmomanometer change as a line item for their next fiscal year, but as with many other facilities visited in 1999, Y2K concerns were of more immediate concern than equipment changes.

4.10.5 Thermometers

A variety of thermometers were used for patients throughout these three hospitals. One of the most commonly seen was a tympanic model. Some departments used these units successfully, but some reported constant problems with replicability of results and deviations by 2-3 degrees (Fahrenheit) from temperatures recorded for the same patient in a different hospital department.

Fifteen disposable digital electronic thermometers had been ordered and this model was being tested as a facility-wide replacement.

4.10.6 Environmental Services

No in-service training was given at these hospitals. Instead, Center staff spoke to housekeeping supervisors who offered to pass the information on to their staff. Environmental services was not a contracted service, and supervisors reported that many of their employees had a long service record with the hospitals.

4.10.7 Clinical Engineering/ Plant Operations

Mercury sphygmomanometers were the rule rather than the exception in this hospital group, and a volunteer had been used for many years at Hospital K to provide maintenance on the units. A desk and bookshelf in an air handling room contained all the equipment necessary for these repairs. Center staff used the Jerome meter to test for mercury in this area. Although the ambient air did not have mercury at the time it was tested, elemental mercury was seen rolling around in the desk drawers. The waste can was highly contaminated as were other work surfaces and containers of supplies. When Center staff met the volunteer who was doing these repairs, it was found that no formal training had been given, and the volunteer, who had little knowledge of the dangers of mercury, felt that the danger of working with mercury was overrated. Waste materials were being improperly disposed of. The hospital safety officer immediately stopped these unregulated repairs and decided that no more sphygmomanometer mercury would be handled in this facility.

4.10.8 Dietary Services

No mercury thermometers were seen in dietary services. Some mercury thermostat probes were still used and their replacement was suggested by Center staff.

4.10.9 Infection Control

Center staff realized that different department's importance and agendas varied between the facilities visited. Contacts at the hospitals in this group did not see any necessary connection between the mercury project and hospital infection control. In comparison, the infection control nurse in hospital group H was a vocal proponent of mercury waste management. At hospital F, the main contact was the infection control nurse. Staff did not meet with anyone in this hospital group's infection control department.

4.10.10 Risk Management

A meeting with risk management will be planned when work with this group of hospitals resumes.

4.10.11 Purchasing/Product Review

This hospital group had recently formed its own purchasing group including one other local hospital. At the time that the site visits were made, they were in the process of moving into a new warehouse that was never visited.

Center staff did meet with three buyers for the hospital group. The initial comment from the buyers was that the hospital group had an unwritten policy to not buy any mercury. Instances of mercury thermometer use in the hospitals had already been found, and the buyers were very surprised to hear about them. Since many nurses had voiced their disapproval of the tympanic thermometers that were standard issue for the nursing units, the buyers started looking for alternatives for those models. Fifteen electronic thermometers were purchased as replacements. After a test period, the hospital would decide if more money should be allocated for additional units.

One concern of the purchasing group was sales representatives that may go to doctor's offices and leave samples unacceptable in the hospital. When Center staff met with the physician's services manager, it was found that complete records of any samples from sales representatives were kept in the doctor's offices.

4.10.12 Nursing Units

At Hospital K, most units had mercury sphygmomanometers (primarily Baumanometers, see Section 3.4.1) both above patient beds and on mobile stands. Center staff placed lever locks in all these units while making an accurate assessment of the number in each unit. In some units, the mercury sphygmomanometers were hanging above the patient's beds even if the unit used an alternate blood pressure device.

In one patient room, the mercury sphygmomanometer was found hanging by one screw above the patient's head while he talked to several visitors. No one had reported this safety violation. Center staff reported it and it was immediately repaired.

Wherever aneroid sphygmomanometers were in use, hospital staff liked them. There were some nurses and other staff who preferred having the mercury units as a back-up because they did not completely trust the aneroids.

Thermometer use varied. Some departments used no mercury thermometers, but most used them for isolation patients and for some other uses, like patients with neutropenia (immune system compromise), hypothermia cases, and infants. These mercury thermometers were given to the patient to take home upon discharge. When Center staff asked random environmental services staff what they would do if they found a mercury thermometer while cleaning a room, they all said they would throw it in a red bag or sharps container.

4.10.13 Endoscopy

Hospital K had all mercury bougies; Hospital L and M had all tungsten-gel bougies. Hospital K received information about the tungsten gel bougies, and a line of communication between the two department supervisors was opened.

In Hospital L, wall-mounted sphygmomanometers were above each patient bed. The supervisor showed Center staff a box of aneroids that had been received some time before. A work order was called in and the mercury units had been replaced by the next visit

4.10.14 Laboratory

The laboratory in Hospital L still used mercury thermometers in a few spots and requested information on alternatives in water and paraffin baths. As happened in many facilities, the contact started by saying mercury thermometers were seldom used, and was proven wrong during the audit.

This laboratory had already switched from B-5 fixative to a zinc chloride fixative. The histology supervisor mentioned that their department had modified the solution to better suit their needs.

The supervisor at Hospital L took the "Request for COA" and "No Mercury Purchasing Affidavit" (see Sections 3.5.6 and 3.5.8) to send to some of the most frequently used distributors for the laboratory.

4.10.15 Respiratory Therapy

This was another hospital group that had a large barometer monitored every eitght hours and used for calibrating blood gas machines. This barometer was attached to the wall inside the entrance to the department break room. It was not securely attached to the wall, and the mercury tube and reservoir were not protected. As mentioned in Section 3.4.9, many hospitals call their local airport every eight hours to get the barometric pressure rather than keep this large quantity of mercury in their facility. Center staff suggested that, if they were not willing to dispose of the device, they should relocate it out of the traffic flow and ensure its secure attachment to the wall.

4.10.16 Associated Offices/Day Stay Surgery

Home health care provided by the hospital group employed around 300 people. These employees were required to use aneroid sphygmomanometers, but each patient was given a mercury thermometer for use during these home visits. Upon discharge, the thermometer was left with the patient. Staff had been directed to dispose of any thermometers broken in a patient's home in the household trash.

When Center staff visited Hospital K's wellness/cardiac rehabilitation center, a mix of aneroid and mercury sphygmomanometers was found. Although these two departments used the same fitness equipment in one big gym, wellness had aneroid sphygmomanometers that cardiac rehabilitation (CR) had never tried. These sphygmomanometers were on stands that raised them to near eye level for use while patients were using the fitness equipment. The mercury sphygmomanometers belonging to CR had been attached to old I.V. poles by engineering staff many years ago. CR staff had priced aneroid sphygmomanometers on poles but thought the poles would not be tall enough for their purpose. They tried the aneroid units belonging to wellness and found them well suited for the job, as the large dials on the aneroid units are easily read from many angles. It was difficult to imagine that people

working in the same room had not shared information about such a basic piece of equipment, and Center staff felt that they had helped open up communication between these two groups of employees.

"Physician's Services," including all off-site offices with single or multiple doctors, was managed by five directors. They used no mercury thermometers, and each office had a mercury spill kit. Fluorescent bulbs were replaced by on-site people and returned to the hospital for recycling. Sphygmomanometers were a mix of aneroid and mercury types.

A concern was how well the hospital could control private physicians in three acute care clinics that were associated with the hospital group. Since the hospital did not own these facilities, it would be harder to control the mercury in these offices. Center Staff suggested that these offices get the same discounted price that the hospital group can negotiate when they do a group-wide sphygmomanometer change-out as an incentive to change.

4.10.17 Central/General Stores

As mentioned earlier, this hospital group had recently formed its own purchasing group. A new storage facility off site had just opened and was not visited by Center staff.

4.10.18 Future Needs

The marketing department for this hospital group saw this as an excellent opportunity for publicity and to increase the good will between the hospitals and the community. They will wait until Administration buys in to the whole program before publicizing the positive results the facilities were having. As mentioned with another hospital group, the fear was that the media would turn the message around to sensationalize it, and that the public would react with fear about the mercury that has historically been used in the hospitals.

This hospital group is well on its way to becoming mercury free. Although mercury-containing products are still in use, the facility's managers are committed to change. Center staff will keep in touch with the hospital group to find what additional assistance is requested, but anticipates that this group will need little help in the future.

5. OTHER COMPONENTS

Center staff offered information about mercury waste reduction to diverse venues. Presentations helped staff introduce the project to various people who could then take it to their facility or professional group. Additional contacts were made and information disseminated to people who might not have learned about mercury in any other way.

5.1 PRESENTATIONS

During hospital site visits, presentations were made to many groups. In-services for nurses, Environmental Services Personnel, Plant Operations Personnel, Purchasing departments, and Safety Officers were given whenever possible. Although the basic message for all these groups was the same, speaking to groups with various job descriptions in the hospital made it possible to tailor the presentations to their particular needs and jobs.

Additionally, presentations were made at larger venues outside the hospitals. In March, Center staff visited the Ogden Martin waste-to-energy plant in Okahumpka, Florida. An interesting tour of the facility was followed by a presentation by Center staff to a group of Department of Health (DOH) Biohazardous Waste Coordinators.

In May, Center staff presented to the Florida Healthcare Engineering Association Annual Spring meeting. Between 70-80 people attended and valuable contacts were made.

In June, staff made a presentation at the Third Annual Pollution Prevention Conference presented by the DEP and the University of Florida TREEO Center (Center for Training, Research, and Education for Environmental Occupations). This conference was geared toward introduction of emerging technology and programs for pollution prevention in numerous industries. More contacts were made that will lead to additional presentations and site visits.

At the time this report was published, additional venues for presentation of mercury management in hospitals were already scheduled. Contact the Florida Department of Environmental Protection for additional information about upcoming presentations or to request a site visit.

Besides making presentations, Center staff attended a seminar held in Michigan titled “Health Care Pollution Prevention Strategies.” This seminar had presentations by some of the most vocal and significant persons currently working in hospital waste management on a national level. The Michigan Health and Hospital Association sponsored the seminar. Because the states contiguous to the Great Lakes have been negatively impacted mercury, some of the significant work to eliminate toxins from these states’ waterways was highlighted at this seminar. Important contacts provided Center staff with ways to help Florida facilities.

5.2 CONTACTS

Contacts made during the project are too many to enumerate. The success of attempts to contact people and groups varied. For example, Center staff wrote letters to all the professional groups associated with the Florida Hospital Association offering to present information about mercury waste reduction to their members. Not one response was returned. However, when staff met a member of one of these groups, the Florida Healthcare Engineering Association, he personally invited the staff member to present to this group, and the subsequent presentation was well received by all participants. This pointed out the importance of making personal contacts rather than offering services to a group that does not know you.

This difficulty in exciting people's interest in mercury waste reduction was apparent when the Center staff made initial contacts with hospitals while enlisting sites to visit. Although over 70 calls were made, most entailed leaving a message on someone's answering machine. Almost none of these calls were returned. Staff noted that if a real person answered the phone and listened to the offer for assistance, almost every call ended in request for help from the hospital contacted.

Center staff also attempted to get a response from two major hospital corporations with many member hospitals in Florida. Since Staff still hopes to work with these national organizations, they will not be identified here. But at this time, no letters or phone calls have been returned. It is imperative to have a personal contact to "get in the door" with large national hospital groups.

An important contact was made with W.A. Baum Co., Inc. This company manufactures mercury-containing sphygmomanometers. They do not manufacture any alternatives to the mercury units. Some of their marketing materials suggest that accurate blood pressure measurement is not guaranteed with anything but a mercury unit. However, Center staff observed that alternatives to mercury units are routinely used and accepted by professionals in Florida medical facilities. Staff found the Baumanometer® wall-mounted units above every bed in many facilities. Two safety devices for these sphygmomanometers are available (see Section 3.4.1). Center staff discussed working with Baum to disseminate information about the safety devices through a mass mail out, Web page, or some other method. This project will be undertaken in the near future.

There are creative methods to get the mercury message to the public. With this in mind, Center staff wrote a letter to the Ford Motor Company's Advertising Department. The letter suggested that Ford could make a public service-type television commercial using Center staff and a new Mercury Cougar car. The ultimate message of the commercial would be that the Mercury automobile was the only type of mercury that should be released in our atmosphere. A form letter was received two months later from Ford claiming that they never use outside sources for advertising ideas and would not even review the idea presented in the letter.

If your facility is determined to reduce its mercury waste and educate employees, try creative methods of disseminating this information. You cannot always predict what will work or who will provide help.

6. CONCLUSION

Very few people understand the problem with mercury. Regardless of education, it should not be assumed that hospital personnel can recognize elemental mercury or that they are aware of its toxicity. Mercury awareness should be taught in Orientation, and reviewed during Right-to-Know training and in-services. Special emphasis should be made to reinforce training for those directly involved in spill cleanup and recycling. The training should not end until there is no more mercury in use.

For the most part, hospital personnel were helpful and receptive concerning the project. Sometimes people would be reluctant to talk to Center staff during site visits, but they generally warmed to the project's concept once they had listened for a few minutes. Many voiced concerns that change would be difficult in their particular area because some physicians, nurses and technicians were not amenable to change. Every facility can start the process of change if only by raising awareness of the problem.

The work to provide assistance to Florida hospitals is not nearing completion, and actually will never be "done." Although several hospitals, professional groups, and other industry participants have been contacted and are working toward reducing the mercury in their waste streams, it is only a start. In the last year, over 20 facilities have been visited and hundreds of people have been introduced to the mercury waste reduction project through presentations. There are more than 250 hospitals in the State. New personnel not familiar with the mercury project are being hired. The training process should never end.

Center staff was satisfied with the number of people positively impacted by this phase of the project. It is anticipated that future training will reach an expanding number of medical personnel and support groups throughout Florida. As more people receive the message about mercury waste reduction, a snowball effect will raise mercury awareness. Eventually we will gain control over the mercury emissions that are threatening our environment.

Appendix A

“No Mercury” Purchasing Affidavit

SAMPLE MERCURY CONTENT DISCLOSURE REQUEST LETTER

Hospital Name
Hospital Purchasing Agent
Address
Telephone
Fax
E-Mail

The above named hospital has the policy of minimizing the use of mercury in products purchased for the hospital. Such products may include:

Barometers
Batteries
Cleansers and soaps
Electrical relays
Gastrointestinal tubes
Laboratory chemicals
Laboratory manometers
Lamps
Pharmaceutical products
Sphygmomanometers
Switches
Thermometers
Thermostat probes
Thermostats

Vendor name:
Vendor's agent:
Address
Telephone
Fax E-mail

The above named vendor agrees to:

Assist _____hospital in obtaining manufacturer disclosures about the mercury content of their products.

Assist _____ hospital in selecting products that are virtually free of mercury.

_____ _____
Signature of Vendor's agent Date

Appendix B

Request for Certificate of Analysis

SAMPLE LETTER REQUESTING CERTIFICATE OF ANALYSIS

As you are aware, mercury is ever increasingly becoming a concern as an environmental pollutant. Mercury released from air and water sources is transformed into methylmercury in lakes or rivers. The methylmercury bioaccumulates in the aquatic food chain making consumption of fish hazardous to those organisms high on the food chain. As a result, regulations on the discharge of mercury to the solid and hazardous waste stream are becoming increasingly stringent

Because of this knowledge, and our concern for the environment, our institution has instituted a mercury reduction policy. This policy requires the elimination or minimization of mercury in all our purchases. Low level concentrations of mercury in products (less than 10,000 PPM or one percent) are not required to be listed on Material Safety Data Sheets (MSDS'S) The contribution from the sum of these low concentration sources accounts for a large fraction of the mercury in the wastewater stream. In order for our purchasing department to be able to make an informed choice on mercury concentration within the products that it buys, we are requesting that all vendors supply us with a certificate of analysis and/or a notarized affidavit describing product mercury concentration and the analytical detection method. This information will be used along with other criteria in the selection process of our vendors.

Please submit the aforementioned information on all products that you intend to supply to our institution. Thank you for your understanding and assistance in this matter.

Appendix C

Web Sites

Here are some Websites about mercury and hospital waste minimization:

http://www.dep.state.fl.us/dwm/programs/mercury/default.htm
Mercury-containing waste management site of the Florida Department of Environmental Protection. Includes the guide, "Best Management Practices for Reducing and Managing Mercury in Florida Medical Facilities: Field Testing, January – July, 1999."

http://www.floridacenter.org
The Florida Center for Solid and Hazardous Waste Management site. Under Special Wastes in Publications, view "Mercury in Florida's Medical Facilities: Issues and Alternatives."

http://pages.prodigy.net/lfairban/artcole.htm
Art Coleman, Jr.'s Bookmarks: a collection of links to myriad mercury Websites

http://www.research.fsu.edu/ResearchR/Fallwinter97/
"Florida's Mercury Menace" by Frank Stephenson. About mercury in Florida and the Everglades - helps bring it home

http://www.epa.gov/grtlakes/seahome/mercury.html "Mercury in Medical Facilities" - developed by Purdue University; contains information on mercury use reduction and waste prevention.

http://www.p2000.umich.edu/mercury_reduction/index.html
University of Michigan Mercury Reduction page

http://www.epa.gov/toxteam/trt_merc.htm
Various mercury links - not just for hospitals

http://www.uml.edu/centers/LCSP/hospitals/index.html
The Sustainable Hospitals Project (SHP) provides technical support to the healthcare industry for selecting products and work practices that eliminate or reduce occupational and environmental hazards, maintain quality patient care, and contain costs. Look here for specific information about managing mercury.

http://www.epa.gov/toxteam/ahamou.htm
The Memorandum of Understanding between the AHA and the US EPA about reducing waste and eliminating mercury from the waste stream.

http://www.epa.gov/OST/fish
Information about fish consumption advisories can be found here.

http://es.epa.gov/oeca/fedfac/fflexp2/hospital.html
Waste minimization for hospitals, including information about mercury wastes.

http://www.masco.org/mercury/
MASCO's (Medical Academic and Scientific Community Organization, Inc.) site includes a comprehensive mercury program for hospitals.

http://www.epa.gov/region01/steward/neeat/mercury/whatis.html
The New England Environmental Assistance Team (NEEATeam) site provides medical facilities with information on mercury pollution prevention.

http://www.epa.gov/grtlakes/bns/hgsbook/index.html
This comprehensive guide on waste management looks at mercury use in many industries, including hospitals.

http://www.deq.state.mi.us/ead/p2sect/mercury/

General mercury information and links to other mercury sites

http://www.epa.gov/oar/mercury.html
This eight volume document also has a short overview and the "Mercury Study White Paper" which summarize the report.

http://www.ada.org/topics/amalgam.html
The American Dental Association's stance on mercury-containing amalgam

http://freeweb.pdq.net/ezmckinley/9513.HTM
Links to pro and con articles about mercury-containing amalgam.

http://www.state.nj.us/health/eoh/survweb/odispubs.htm
Spill cleanup, health effects, testing for mercury, and more.

Lever Locks from Baum Co., Inc.

Baum will send you FREE lever locks for your Baumanometers (wall-mounted Baum brand mercury sphygmomanometers). Contact them at:

620 Oak Street
Copiague, NY 11726-3292
PH: (516) 226-3940
FAX: (516) 226-3969.
E-mail: info@wabaum.com

See insertion instructions at:
http://www.wabaum.com/Docs/product.html
under "schematics"

Appendix D

DEP FAQ Sheet –

Managing Discarded Mercury-Containing Devices (MCD's) in Florida

Managing Discarded Mercury-Containing Devices (MCDs) in Florida

A Fact Sheet For Florida Businesses and Government Agencies

Mercury-containing devices are electrical products or other devices, excluding batteries and lamps, that contain mercury as a necessary component for their operation. Some examples include mercury thermostats, thermometers, electric switches and relays, marine float switches and manometers. Due to the decline of mercury use in batteries and lamps and the larger quantities of this toxic heavy metal found in these products, mercury-containing devices are expected to be the largest source of mercury in municipal solid waste by the year 2000.

Mercury-containing devices do present special disposal considerations due to the quantity of mercury they contain and since they are usually considered to be hazardous wastes when disposed of. The amount of mercury in a device is relatively large. For example, a thermostat can contain as much mercury as 75-100 fluorescent or other mercury-containing lamps. Mercury is a toxic metal that in its various forms can accumulate in living tissue and cause adverse health effects. When a device is broken and is disposed of in a solid waste landfill or incinerator, the mercury can contaminate the air, surface water, and ground water. Mercury contamination in Florida is most evident from the Department of Health's warnings of high mercury levels in fish in a number of our lakes and in the Everglades.

Because of this, these types of devices, including those from households, have been banned from disposal at solid waste facilities, including landfills and incinerators, since January 1, 1996, in any quantity.

Florida businesses and other generators discarding mercury-containing devices ("Generators") have two options for managing them: either recycling or hazardous waste disposal. For either of these options, if a pound of more of mercury is contained in a shipment container (e.g., a little more that 100 mercury thermostats would contain this much mercury), the generator will need to ship the devices in accordance with the US DOT Hazardous Material Regulations.

1) You are encouraged to recycle mercury-containing devices by following the Chapter 62-737, Florida Administrative Code regulations outlined on the back of this fact sheet. Devices destined for recycling and managed in accordance with these regulations are considered to be universal wastes in Florida and do not count toward your facility's hazardous waste generator status. In addition to the following requirements and guidelines, check with the receiving storage or recycling facility for its guidelines on packaging and transportation. A list of recycling facilities in Florida can be obtained by calling 1-800-741-4337. *RECYCLING IS THE RECOMMENDED MANAGEMENT OPTION FOR THESE DEVICES!*

2) Mercury-containing devices may be managed at permitted hazardous waste treatment and disposal facilities and would count toward your facility's hazardous waste generator status. Before they can be disposed of at a hazardous waste landfill, however, they will need to be shipped and treated at a permitted hazardous waste facility (e.g., a mercury recovery/reclamation facility) to remove most of the mercury in accordance with the EPA's land disposal restriction regulations.

MERCURY-CONTAINING DEVICE RECYCLING REQUIREMENTS & GUIDELINES

Generator Requirements

- Does not place used devices from business, industry, or institutions in the regular trash.
- Stores devices in an area and in a manner that will prevent them from breaking. *Does not stuff too many or too few devices into the shipping container and use adequate cushioning material for packing.*
- Labels the devices or each container as *"Spent Mercury-Containing Devices for Recycling" or "Universal Waste Mercury Devices", or "Waste (or Used) Mercury Devices". For thermostats, substitutes*

"Thermostats" for "Devices" in the last two labeling categories.

- If devices are accidentally broken, immediately contain the breakage and store them in a tightly sealed container. It is recommended that you mark the container as *"Spent Broken Mercury-Containing Devices For Recycling"*.
- Trains employees in the proper device handling, packaging and emergency cleanup and containment procedures. Non-device residues containing mercury and that are generated as a result of a device cleanup are to be managed as hazardous waste.
- Does not intentionally break, treat or dispose of devices.
- If on-site storage is not feasible, devices may be transported to a central accumulation point at one of your own facilities, to a registered handler facility, or directly to a permitted recycling facility. If you transport your own devices, you also need to comply with the Department's transporter regulations. *See the Transportation Requirements and Transporter Requirements below.*

Handler Facility (Non-generator) Requirements

- Annually registers with the Department as a small or large quantity handler and receives or renews a DEP ID number.
- *Small quantity handler accumulates* up to 100 kilograms (220 pounds) of devices indoors at any one time for no longer than one year.
- A *large quantity handler facility* accumulating more than 220 pounds of devices at any one time must also register as such and submit to the Department: *a one-time $1,000 registration fee, an operational plan, and a closure plan including financial assurance.*
- Follows other requirements listed above for *Generators*.

Record Keeping Guidelines for Generators & Handlers

- Keep receipts for shipments of devices off-site to show DEP and local inspectors that devices were properly handled. Receipts should have the following information: the quantity of devices shipped or received, the date of shipment or receipt, and the name and address of the handler or recycling facility receiving the shipped devices.
- Records of receipts and shipments of devices are required for large quantity handler facilities (including generators) and shall be kept for 3 years from the date of shipment or receipt

Reverse Distribution Program Requirements

- Sponsored by a device manufacturer or distributor (which may include a business distributing devices to its facilities).
- Sponsor assumes responsibility for collection and recycling of discarded devices.
- Annual registration with the Department, receipt or renewal of a DEP ID Number, and submission of a program description including all participating transporters, handlers and recycling facilities.

Transportation Requirements

- When shipping devices within Florida, a hazardous waste manifest and a licensed hazardous waste transporter are not required for shipments to a handler or recycling facility within Florida in accordance with these requirements.
- When shipping out of Florida, follow the intermediate and receiving states' requirements.
- When shipping into Florida, you may use a shipping paper *unless* your state or an intermediate state requires a hazardous waste manifest; then you must follow those states' requirements.

Transporter/Transfer Facility Requirements

- Annually registers with the Department and receives or renews its DEP ID number.
- Uses only totally enclosed trucks in good condition.
- May store properly packaged devices on the truck or at a another area of a registered transfer facility for up to 10 days.
- Trains drivers in proper handling, packaging and emergency cleanup and containment procedures & keeps these procedures on the trucks.
- Complies with any applicable Department of Transportation (DOT) regulations, including the Hazardous Material Regulations.

For a listing of recycling facilities or for further information or questions, contact the Florida Department of Environmental Protection's Hazardous Waste Management Section at:

1-800-741-4DEP (4337) or at its Internet website at www.dep.state.fl.us Revised May 1998

Appendix E

DEP FAQ Sheet – Managing Spent Fluorescent and High Intensity Discharge (HID) Lamps

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Managing Spent Fluorescent and High Intensity Discharge (HID) Lamps

A Fact Sheet For Florida Businesses and Government Facilities

Fluorescent or High Intensity Discharge (HID) lighting is a good business choice. Compared to incandescent lighting, fluorescent and HID lighting use less energy and produce less heat. Less energy and heat not only result in lower lighting and cooling costs, but they also result in utility power plants emitting less air pollutants such as mercury, lead, nitrogen oxides, and sulfur dioxides. If you are considering switching to high-efficiency fluorescent or HID lighting, don't hesitate to make the change.

Although fluorescent and HID lighting save energy and money, they do present special disposal considerations. Fluorescent and HID lamps (as well as some types of neon lamps) contain mercury and in most cases are considered to be hazardous wastes when disposed. Mercury is a toxic metal that in certain forms can accumulate in living tissue and cause adverse health effects. Although the amount of mercury in each lamp is small, several million lamps are discarded by Florida businesses each year, making these lamps one of the largest sources of mercury in our garbage. When a lamp is broken or placed in a landfill or incinerator, the mercury can contaminate the air, surface water, and ground water. Mercury contamination in Florida is most evident from the Department of Health's warnings of high mercury levels in fish in a number of our lakes and in the Everglades.

Because of this, these types of spent lamps, excluding those from households, containing any amount of mercury have been banned from solid waste incineration since July 1, 1994, in any quantity. Since most of these types of lamps contain hazardous levels of mercury, they should not be disposed of at solid waste landfills in Florida if more than 10 lamps per month are generated by a business from any one location. Local solid waste departments are the final authority for landfill disposal and may decide to refuse to accept any spent lamps from generators, regardless of the amount of mercury contained in the lamps, especially in those counties or municipalities that also operate solid waste incinerators.

Florida businesses and governmental facilities generating spent fluorescent and HID lamps ("Generators") have two options for managing them: either recycling or landfill disposal.

1) You are encouraged to recycle fluorescent and HID lamps, even those with lower mercury content, by following the Chapter 62-737, Florida Administrative Code regulations outlined in this fact sheet. Hazardous waste lamps destined for recycling and managed in accordance with these regulations are considered to be universal wastes in Florida and do not count toward your facility's hazardous waste generator status. Check with the receiving storage or recycling facility for its guidelines on packaging and transportation. A list of recycling facilities in Florida can be obtained by calling 1-800-741-4337. *RECYCLING IS THE RECOMMENDED MANAGEMENT OPTION FOR THESE LAMPS!*

2) (a) Generators of 10 or less spent lamps per month per location may dispose of these lamps with the regular trash going to a permitted, lined solid waste landfill. Low mercury, non-hazardous waste spent lamps may also be disposed of at permitted, lined solid waste landfills in any quantities. However, contact your local solid waste management department for any final guidance or restrictions on the landfill disposal of these lamps.

   (b) If more than 10 spent hazardous waste lamps are generated per month, they may be disposed of at a permitted hazardous waste landfill and would count toward your facility's hazardous waste generator status.

RECYCLING REQUIREMENTS AND GUIDELINES (Continued on Back)

Generator Requirements (Continued on Back)

- Does not place used lamps from business, industry, or institutions in the regular trash.
- Stores lamps in an area and in a manner that will prevent them from breaking. *Does not stuff too many or too few lamps into the shipping container. Recycling facilities request that you do not tape lamps together for storage or shipment and may not accept lamps that are taped together.*

- Labels the lamps or each container as *"Spent Mercury-Containing Lamps for Recycling" or "Universal Waste*
- A business or institutional generator location may accumulate and store up to 5,000 kilograms of lamps (20,000 lamps) at any one time and for up to one year, *if the lamps are destined for recycling,* without being subject to notification requirements (EPA Form 8700-12).

- If lamps are accidentally broken, immediately contain the broken lamps and store them in a tightly sealed container. It is recommended that you mark the container as *"Broken Spent Mercury-Containing Lamps For Recycling"*.

- Trains employees in proper lamp handling, packaging and emergency cleanup and containment procedures. Non-lamp residues containing mercury and that are generated as a result of a lamp cleanup are to be managed as hazardous waste.

- Do not intentionally break or crush lamps unless you are complying with the *"Drum-top Crushers" requirements below.*

- If on-site storage is not feasible, lamps may be transported to a central accumulation point at one of your own facilities, to a registered handler facility, or directly to a permitted recycling facility. If you transport your own lamps, you also need to comply with the Department's transporter regulations. *See the Transportation Requirements and Transporter Requirements below.*

Drum-top Crusher Requirements (For *Generators* Only)

Most recycling facilities prefer unbroken lamps, and they may charge more to accept crushed lamps. Mercury may adhere to the drum, the container, or the metal end caps causing mercury contamination and increased costs for recycling or disposal especially under humid conditions or longer storage times. However, use of this equipment is allowed by a generator only per paragraph 62-737.400(6)(b), F.A.C., as long as the crushed lamps immediately enter the final accumulation container from the drum-top crusher equipment and crushing is done under the following conditions:

- Crushing poses employee health and environmental risks if mercury vapors are released. Releases of mercury vapors or other contaminants shall be prevented, and the user shall comply with all applicable OSHA standards.

- The crushing unit shall be properly maintained (e.g., adequate filter changes), operated per the manufacturer's written procedures, and the employees using this equipment shall be thoroughly familiar with these procedures.

Handler Facility (Non-generator Collection) Requirements

- Annually registers with the Department as a small or large quantity handler and receives or renews a DEP ID number.

- *A small quantity handler facility* accumulates up to 2,000 kilograms (8,000) of lamps indoors at any one time for no longer than one year.

- A *large quantity handler facility* accumulating 8,000 or more lamps at any one time must also register as such and submit to the Department: *a one-time $1,000 registration fee, an operational plan, and a closure plan including financial assurance.*

- Follow other requirements listed above for *Generators* except that crushing of lamps as described above is only allowed by generators without a permit.

Mercury Lamps", or "Waste (or Used) Mercury Lamps".

Record Keeping Guidelines for Generators & Handlers

- Obtain and keep receipts for shipments of lamps off-site to show DEP and local inspectors that lamps were properly handled. Receipts should have the following information: the quantity of lamps shipped or received, the date of shipment or receipt, and the name and address of the handler or recycling facility receiving any shipped lamps.

- Records of receipts and shipments of lamps are required for large quantity handler facilities (including generators) and shall be kept for 3 years from the date of shipment or receipt

Reverse Distribution Program Requirements

- Sponsored by a lamp manufacturer or distributor (which may include a business distributing lamps to its facilities).

- Sponsor assumes responsibility for collection and recycling of spent lamps.

- Annually registers with the Department, receives/renews a DEP ID Number, and provides a program description including all participating transporters, handlers and recycling facilities.

Transportation Requirements

- When shipping lamps within Florida, a hazardous waste manifest and a licensed hazardous waste transporter are not required for shipments to a handler or recycling facility within Florida.

- When shipping out of Florida, follow the intermediate and receiving states' requirements.

- When shipping into Florida, you may use a shipping paper *unless* your state or an intermediate state requires a hazardous waste manifest; then you must follow those states' requirements.

Transporter/Transfer Facility Requirements

- Annually registers with the Department and receives or renews its DEP ID number as a transporter and/or transfer facility.

- Uses only totally enclosed trucks in good condition.

- If registered as a transfer facility, may store properly packaged lamps on a truck used in the actual transportation of lamps or at an indoor location for up to 10 days.

- Trains drivers in proper handling, packaging and emergency cleanup and containment procedures and keeps these procedures on the trucks.

- Complies with any applicable Department of Transportation (DOT) regulations, including the Hazardous Material Regulations.

Note: Transporters and handlers collecting lamps from generators of 10 or less lamps per month and who do not accumulate more than 100 kilograms (400 lamps) at one time are exempt from the annual registration requirements outlined above.

PCB and Other Light Ballasts

- Ballasts containing PCBs (polychlorinated biphenyls) cannot be disposed in Florida. Send to a processor for removal of PCB components and disposal at approved facilities outside of Florida. Non-PCB components may be managed and recycled in Florida.

- About 25% of non-PCB ballasts contain DEHP (di (2-ethylhexyl) phthalate) which is classified by EPA as a hazardous substance. Disposal of about 1600 of these ballasts would trigger the reportable quantity requirement under the federal Superfund laws. The Department recommends that ballasts of this type not be disposed of at solid waste landfills.

- The Department recommends the recycling of all discarded light ballasts.

For a list of recycling facilities or for further information or questions, contact the Florida Department of Environmental Protection's Hazardous Waste Management Section at: 1-800-741-4DEP (4337) or at www.dep.state.fl.us.

Revised June 1998

Appendix F

DEP FAQ Sheet –

Reclamation Facility and Product Stewardship Contacts for Mercury-Containing Lamps and Devices

FLORIDA RECYCLING FACILITY AND PRODUCT STEWARDSHIP CONTACTS FOR MERCURY-CONTAINING LAMPS AND DEVICES

Solely as a service to the public and Florida businesses, the Florida Department of Environmental Protection (DEP) maintains the following list of Florida companies that have been issued facility operating permits under Chapter 62-737, F.A.C., by the DEP, or are manufacturers that have notified the DEP of their product stewardship services. Florida-permitted mercury recovery facilities separate mercury-containing lamps and devices into recyclable components and mercury-containing components that will be processed at a mercury reclamation facility to reclaim the mercury. Florida permitted mercury reclamation facilities reclaim commercial grade mercury from mercury-containing lamp and device components. The information was obtained from the DEP's permitting files or voluntarily supplied by the companies and is not necessarily a complete list of available services. A company's absence from the list does not imply prejudice or impropriety. The DEP does not endorse specific equipment or companies. The DEP, by providing this list, does not imply that the companies are in compliance with applicable laws. Users of this list are responsible for ensuring that products, equipment, or services comply with the requirements of local, state, and federal law. The DEP cautions users to personally evaluate the services and compliance status of any company they use. The list is updated periodically and subject to change without notice. The DEP welcomes information from other companies who wish to have their services or stewardship programs listed.

*** Envirolight, Inc.**
Jack Ahearn, Vice President
1967 West 9 Street
Riviera Beach, FL 33404-6425
(561) 840-9111
FAX (561) 844-0936

**** MTI**
Laurie Chase, Account Representative
Jim Kington, Production Manager
4317-L Fortune Place
West Melbourne, FL 32904
1-800-808-4684
(407) 952-1516
FAX (407) 952-1060
Homepage: www.aerc-mti.com

*** P-3, Inc.**
Ralph Mann, Operations Manager
2611 Sammonds Road
Plant City, FL 33566
1-800-777-4635
(813) 707-8887
FAX (813) 707-5609
Email: onesource@p-3.com

*** Florida Permitted Mercury Recovery Facility**
**** Florida Permitted Mercury Recovery and Mercury Reclamation Facility**

Revised November 1999

*** Quicksilver Environmental Inc.**
Mike Flynn, President
P.O. Box 25178
Tampa, FL 33622-5178
1-800-376-7888
(813) 249-0608
FAX (813) 249-1233
Email: qsenviron@aol.com

*** Recyclights, Inc. (Lakeland)**
Dionne Dykes, Operations Manager
4960 Lakeland Commerce Parkway
Lakeland, FL 33805
(941) 668-9105
FAX (941) 665-8142

**** Recyclights, Inc. (Tallahassee)**
Jay Schlotthauer, National Distribution Mgr.
Jeff Kirk, Operations Manager
4972 Woodville Highway
Tallahassee, FL 32311
1-800-831-2852
(850) 878-2259
FAX (850) 878-3349
Homepage: www.recyclights.com

<u>HID Lamps Only</u>

HID Recycling, Inc.
32000 Aurora Road
Solon, OH 44139
1-800-200-9716
FAX 1-800-200-9718

CONTACTS FOR
LIGHT BALLAST MANAGEMENT

The Florida Department of Environmental Protection (DEP) maintains the following list of companies that manage ballasts solely as a service to the public and Florida businesses. The information was voluntarily supplied by the companies and is not necessarily a complete list of available services and a company's absence from the list does not imply prejudice or impropriety. The DEP does not endorse specific equipment or companies. The DEP, by providing this list, does not imply that the companies are in compliance with applicable laws. Users of this list are responsible for ensuring that products, equipment, or services comply with the requirements of local, state, and federal law. The DEP cautions user to personally evaluate the services and compliance status of any company they use. The list is updated periodically and subject to change without notice. The DEP welcomes information from companies who wish to have their products or services listed.

Eastern Enviornmental Tech.
Mr. Neil Farans
47 Purdy Avenue
Port Chester, NY 10573
(914) 934-2100

Luminaire Recyclers, Inc.
Mr. Josh Wlaschin
2161 University Avenue, West
St. Paul, MN 55114
1-800-553-8429

MWS Lamp and Ballast Recycling, Inc.
Mr. Aaron Watts
2112 Northwest Parkway SE
Marietta, GA 30067
1-800-699-2895

National Environmental Services, L.L.C.
Mr. Dale Boerjan, Manager
Post Office Box 131866
Saint Paul, Minnesota 55113-0021
(651) 415-9016
FAX (651) 481-0044

Salesco Systems
Ms. Kathy Salzman
1680 Winding Creek Circle
Snellville, GA 30278
(770) 982-0963

Salesco Systems
Mr. Frank Sales
40 Messina Drive
Braintree, MA 02184
(617) 843-1224
FAX (617) 843-1227
1-800-368-8878

Salesco Systems
Mr. Frank Sales, Jr.
5736 W. Jefferson
Phoenix, AZ 85043
1-800-368-9095
FAX (602) 278-0608

Trans-Cycle Industries, Inc.
Mr. George Jackson
4155 Pittman Road
Atlanta, GA 30349
(404) 349-4569
FAX (404) 344-8333

Transformer Service, Inc.
Mr. Andy Serzans
74 Regional Drive
Concord, NH 03302
(603)224-4006

November, 1999

Appendix G

Vendor List

Vendor List

To receive safety devices for your hospital's Baumanometers (see Section 3.4.1), contact:

W.A.Baum, Co., Inc.
620 Oak Street
Copiague, NY 11725
PH: 516-226-3940

Three alternatives to mercury thermometers for patient use (see Section 3.4.5 and 3.4.7) are:

Geratherm® mercury free thermometer

http://www.twg.de/kontact.html#adress
(this company is based in Germany)

Temp-a-Dot thermometers
3M Health Care
3M Center
St. Paul, MN 55144-1000
PH: 651-733-1110

System 101 Individual Patient Digital Electronic thermometer
Steridyne Corp.
Riviera Beach, FL 33404
PH: 800-327-6185

Two companies selling tungsten-gel bougies (see Section 3.4.8) are:

Pilling Weck Surgical
420 Deleware Drive
Fort Washington, PA 19034
PH: 800-523-6507

Medovations
W194 N11340 McCormick Drive
Germantown, WI 53022
PH: 800-558-6408

Two companies selling B-5 replacements (see Section 3.4.9) are:

Amresco
30175 Solon Industrial Parkway
Solon OH 44139
PH: 800-829-2805

Anatech Ltd.
1020 Harts Lake Road
Battle Creek, MI 49015
PH: 800-ANATECH
(262-8324)

Information about the Honan intraocular pressure reducing device (see section 3.4.11) is available at:

The Lebanon Corporation
1700 North Lebanon Street
P.O. Box 588
Lebanon, IN 46052-0588
PH: 765-482-7273

For information about technology to prevent discharge of mercury waste down drains (see Section 3.5.10), contact:

SolmeTex, Inc.
29 Cook Street
Billerica, MA 01821
PH: 978-262-9890
e-mail: Jcannon@solmetex.com

For information about aneroid sphygmomanometers (Sections 3.4.2, 3.4.3, and 3.4.4), contact:

WelchAllyn
4341 State Street Road, P.O. Box 220
Skaneateles Falls, NY 13153-0220
PH: 800-535-6663

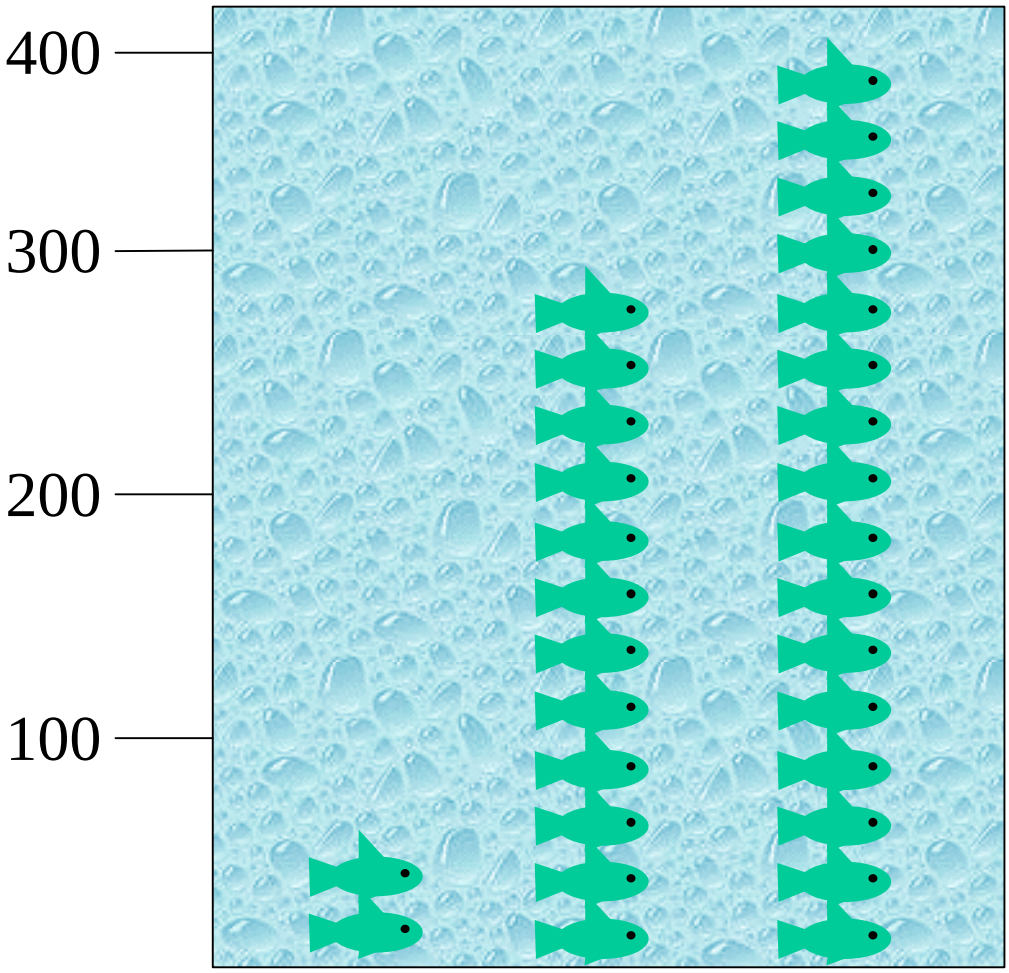
For information about mercury-free cleaning products for the hospital (see Section 3.4.12), contact:

SafeScience, Inc.,
31 St. James Avenue, Suite 520
Boston, MO 02116
PH: 617-422-0674
Web: www.safesci.com

Appendix H

Managing Mercury:
Best Management Practices
for Florida Medical Facilities

A very small amount of mercury can be extremely toxic. This graph illustrates the number of fish potentially poisoned by the mercury contained in a few common hospital items. For example, a typical fever thermometer holds 0.5 grams of mercury, enough to poison 50 fish weighing 36 ounces.[1]



= 25 poisoned bass

[1.] The Terrene Institute, *The Case against Mercury: Rx. For Pollution Prevention*, 1995.

Why should I care about managing mercury in our facility?

Studies have identified Florida hospital incinerator emissions as a significant source of mercury pollution in our environment.

Hospitals have a responsibility not only to their patients but also to their communities, and can play an active role in preventing illness. Two ways to do this are through recycling and reducing the use of hazardous materials in the facility.

Mercury is present in the hospital in many forms - thermometers, sphygmomanometers, thermostats, switches, gauges, batteries,fluores-cent lamps, laboratory stains and solutions. Mercury in broken or outdated equipment is often improperly discarded as red bag waste or trash and sent to the incinerator. Incineration causes mercury vapors to escape into the air, starting a trail of pollution with the smallest creatures at the bottom of the food chain and ending with those at the top – like us.

This booklet outlines five steps for reducing mercury and mercury wastes in your hospital:

1. communication and education efforts
2. Identification of sources of mercury in the hospital environment
3. proper handling of mercury-containing items to minimize spills
4. keeping mercury out of the biomedical waste stream
5. identification of substitutes and alternatives for mercury-containing products

1. COMMUNICATION AND EDUCATION

... are the first steps in a plan to increase awareness about handling and disposing of mercury and reducing its use in the hospital. The following steps are a good starting point:

- Develop a broad-based communications program to increase the awareness of the human health and environmental dangers of mercury. Use memos, meetings, newsletters or a combination of these.

- Include articles about mercury reduction, handling, and proper disposal in staff newsletters.

- Include information about the proper handling of mercury in employee orientation and “Right-to-Know” Training.

- Ensure all personnel - including temporary workers - are familiar with mercury-handling procedures to prevent the disposal of mercury-containing items in sharps containers, red bags or solid waste containers.

- Include information about waste reduction and pollution prevention during in-service training sessions.

- Encourage personnel to be “label readers”.

- Place placards or labels stating “NO MERCURY” on or above red bags, sharps containers and solid waste containers.

- Provide recognizable disposal containers for discarded mercury waste items.

- Make sure mercury spill kits are available in all laboratories, nursing stations, ICU/ER/Surgery suites, patient rooms and storage/maintenance facilities.

- Monitor your program to find strengths and weaknesses and make necessary changes.

2. IDENTIFY SOURCES OF MERCURY

...by visiting all hospital departments. Although thermometers and sphygmomanometers are the most widely used mercury-containing items, mercury is also used in many other products and devices. Employees should know about all the mercury-containing lamps, devices, batteries and substances used in their work areas.

The following pages list the products and devices often found in specific areas within a hospital. Using these lists as a guide, you can develop specific lists including only the mercury-containing items used in each department in your facility.

Post your lists near any biomedical or solid waste container which should not receive mercury-containing wastes. Include instructions on properly managing mercury-containing wastes, for example: “Put these items into the hazardous waste container.”

MERCURY SOURCES IN ICU/ER/SURGERY

DO NOT PUT THESE ITEMS IN REGULAR OR RED BAG WASTE

Cantor Tubes
Feeding Tubes
Lamps
- **High Pressure Sodium Lamps**
- **Fluorescent Lamps**
- **Metal Halide Lamps**
- **Ultraviolet Lamps**

Mercuric Oxide Batteries
Used in
- **Defibrillators**
- **ECG Monitors**
- **Fetal Monitors**
- **Hearing Aids**
- **Hofler Monitor**
- **Oxygen Monitors**
- **Pacemakers**

Miller Abbot Tubes
Sphygmomanometers
Thermometers
Treatments
- **Antifungal/Anti-Infectious/Bacteriostatic Enzyme/Ammonia**
- **Thimerosal**
  - **Merthiolate**

MERCURY SOURCES IN LABORATORIES

DO NOT PUT THESE ITEMS IN REGULAR OR RED BAG WASTE

- **Fixatives**
  - **Mercuric Chloride**
    - **B5 Fixative**
    - **Carnoy-Lebrun**
    - **Helly**
    - **Ohlamacher**
    - **Shardin**
    - **Zenker's Solution**
- **Manometers**
- **Mercuric Oxide Batteries**
- **Reagents**
  - **Camco**
  - **Hitergent**
  - **Immu-sal**
  - **Mercuric Chloride (used in SMAC AU2000)**
  - **Mercuric Oxide (Stabilur Tablets)**
  - **Mercury Iodide**
  - **Mercury Nitrate**
  - **Mercury Sulfate**
  - **Mercurochrome**
  - **Mercurophyline**
  - **Million's Reagent**
  - **Nessler's Solution**
  - **Phenol Mercuric Acetate**
  - **Takata's Reagent**
  - **Thimerosal (Buffers, Merthiolate, Mucolex)**
- **Sewage Traps**
- **Stains**
  - **Alum Hematoxylin (Solution A)**
  - **Cajal's**
  - **Carbol Gentian Violet**
  - **Gomori's**
  - **Golgi's**
  - **Gram Iodine**
  - **Mercury Chloride**
- **Thermometers**

MERCURY SOURCES IN NURSING STATIONS

DO NOT PUT THESE ITEMS IN REGULAR OR RED BAG WASTE

Barometers
Cantor Tubes
Electrical Equipment
- Nursing Incubators
- Refrigerators
- Relays
- Switches

Feeding Tubes
Lamps
- Fluorescent Lamps
- High Pressure Sodium Lamps
- Metal Halide Lamps
- Ultraviolet Lamps

Mercuric Oxide Batteries Used In:
- Blood Analyzers
- Defibrillators
- Fetal Monitors
- Hearing Aids
- Hofler Monitors
- Pacemakers
- Pagers
- Picker Caliber
- Spirometer Alarm
- Telemetry Transmitter
- Temperature Alarm

Sewage Traps
Sphygmomanometers
Thermometers

MERCURY SOURCES IN PATIENT'S ROOMS

DO NOT PUT THESE ITEMS IN REGULAR OR RED BAG WASTE

Electrical Instruments
- Nursing Incubators
- Thermostats

Mercuric Oxide Batteries Used In:
- Defibrillators
- ECG Monitors
- Hearing Aids
- Oxygen Monitors
- Pacemakers
- Temperature Alarm

Sphygmomanometers
Switches
Thermometers

MERCURY SOURCES IN STORAGE AND MAINTENANCE **DO NOT PUT THESE ITEMS IN REGULAR OR RED BAG WASTE**
Antifouling Agents Cleaning Chemicals Degreasers Outdated Mercury-Containing Equipment Paints Preservatives Sewage Traps Solvents Spent Batteries Spent Mercury-Containing Lamps Spent Mercury-Containing Thermostats

3. PROPER HANDLING OF MERCURY-CONTAINING ITEMS

...can reduce the amount of mercury improperly disposed of in red bags, sharps containers or solid waste containers. The following lists can be adapted for the departments in your facility.

- Never place any mercury-containing item into a red bag, a sharps container or a solid waste container.
- Provide separate waste containers for mercury-containing wastes
- For sphygmomanometers with glass tubes, contact the manufacturer to obtain some inexpensive mylar sheaths that can be easily placed around the tube to prevent spills.
- Keep an up-to-date inventory of mercury-containing materials, their arrival, history of use, and final destination.
- Prevent spills. Even small spills result in clean up and disposal costs. Avoiding spills of large quantities of mercury can save thousands of dollars in labor, clean up, and disposal costs.
- Keep an accurate log of mercury spills. Review the log frequently to identify areas where spills occur frequently.
- Keep spilled mercury or broken mercury-containing items in a sealed container such as a sealable plastic bag. Then place that container in a secondary container with a tight-fitting lid.
- Transport mercury-containing substances and devices in a secondary container that can be easily cleaned if a spill occurs. Transfer mercury within the secondary container.
- Ensure the proper equipment is available to clean up spills. Equipment must be appropriate for the size of the facility and types of spills anticipated. If your facility does not have a mercury vacuum aspirator, purchase one.
- Place mercury spill kits in areas where spills are likely to occur.

- When spill cleanup equipment is located in a central location, such as the safety manager's office, be sure all personnel know who to call when a spill occurs.

- When spill kits are located in various areas in the hospital, be sure all personnel are familiar with the location and proper use of the nearest spill kit.

- Collect spill cleanup materials and send them to a mercury recycler or a hazardous waste contractor. They should not be disposed of in red bags or solid waste containers.

- Monitor changes in the volume of mercury on hand – any reductions in use, spill incidents, or mercury recovered.

- Ensure your hospital has a contract with a certified hazardous waste disposal company for all non-recyclable mercury-containing wastes.

- Handle all mercury-containing lamps, batteries and devices as outlines in the "Universal Waste Rule" (40 CFR 273) and "Management of Spent Mercury-Containing Lamps and Mercury-Containing Devices Destined for Recycling" (Chapter 62-737, F.A.C.). Handle all other mercury-containing items as hazardous waste under the Hazardous Waste Rule (Chapter 62-730, F.A.C).

- If blood has come in contact with an invasive mercury-containing tube or another mercury-containing device, use an OSHA approved method to remove the blood and other potentially infectious components before disposal.

- For further information on recycling and disposal for mercury-containing lamps and mercury-containing devices, call the Florida Department of Environmental Protection's toll-free hotline:

  1-800-741-4DEP
  (1-800-741-4337)

- On the following page is a "Do & Don't" list for handling mercury-containing items, This effective and strongly recommended educational tool can be posted in all areas where mercury-containing items are used.

PROPER HANDLING OF MERCURY

DO

Do prevent mercury spills.

Do transport mercury-containing substances and devices in secondary containers that can be easily cleaned if a spill occurs.

Do know who to call when a spill occurs.
Call:_____

Do know where the nearest spill kit is and how to use it.

Do keep containers of spilled mercury closed tightly.

Do record all mercury spills on a log sheet.

Do record the amount of mercury in use, stored, recovered and discarded.

Do place discarded, damaged, or broken mercury-containing devices and lamps and used mercury absorbent in special mercury collection containers.

DON'T

Don't place used mercury absorbent material in red bags or solid waste containers.

Don't place discarded, damaged or broken mercury-containing devices and lamps in red bags or solid waste containers.

Don't pour spilled mercury down the sink.

4. RECYCLING

...is available through several permitted companies in Florida. They accept a wide variety of mercury-containing lamps, devices, chemicals, spill kits, and pourable mercury. Recycling costs depend on the type, amount, and containment of the mercury. If lamps, batteries and devices are recycled in accordance with Florida's Universal Waste Rule, they do not have to be counted toward a facility's hazardous waste generation.

Florida law (Chapter 62-737, F.A.C.) states any mercury-containing device shall not be disposed of in landfills. It also states mercury-containing lights from businesses, including medical facilities, may not be knowingly incinerated. By recycling, the facility can reduce its hazardous waste disposal costs and decrease future liability associated with improper disposal.
Here are some steps you can take:

- Provide separate collection systems for mercury-containing items that are recyclable or reusable.
- Mercury in spill kits can be reclaimed and recycled at some facilities but still must be treated as a hazardous waste.
- Contact your facility's mercury recycler about recycling spilled mercury.
- Recycle all metallic mercury.
- Mercury from many mercury-containing devices and items - including thermometers, sphygmomanometers, switches, gauges, batteries, Maloney and Hurst bougies, Miller Abbot and Cantor tubes and dental amalgam can be reclaimed.
- If mercury-containing batteries are used, ensure they are being properly collected for disposal. Recycle batteries when possible, or contract with a hazardous waste contractor. In Florida, manufacturers and marketers of mercuric oxide batteries must have a program for proper disposal or recycling of the batteries they sell.

- Lamp Recycling

  Handle and store fluorescent lamps and HID lamps properly for recycling:

  Store lamps in an area and in a way that will keep them from breaking,such as in the boxes they are shipped in.

  Mark the lamp storage area with the words “Mercury-containing lamps for recycling.”

  Do not crush or intentionally break lamps because mercury may be released.

  If lamps are accidentally broken, store them in a sealed container. Pick up any spilled powder with a cleanup kit and dispose of it in the same container.

  Take lamps to a consolidation site or recycling facility, if available, or arrange with a transporter to take them to a recycling facility.

  To protect the hospital from future liability, save the invoices that track your lamps and include the date, number of lamps, your hospital’s address, shipping destination with permit number, and transporter name with identification number (if applicable) on the invoice.

  For information on recycling and disposal for mercury-containing lamps and other mercury-containing devices, call the Florida Department of Environmental Protection toll-free hotline:

  1-800-741-4DEP
  (1-800-741-4337)

5. MERCURY REDUCTION: SUBSTITUTES AND ALTERNATIVES

...are available for many mercury-containing items. The health and economic benefits of finding and using them are worth the effort.

It may be best to phase out mercury-bearing items gradually. Mercury-free alternatives are available for some existing items without loss of quality. Replacement decreases the need to recycle, saving money and reducing liability.

Some ideas for starting a mercury reduction program:

- Replace mercury-containing thermometers:

Electronic digital thermometers and thermometers filled with alcohol or mineral spirits meet the calibration standards of the National Institute of Standards & Technology. If you must purchase mercury thermometers, buy those with a Teflon7 or mylar sheaths can help prevent breakage or spills.

Consider including non-mercury thermometers like tympanic or Temp-A-Dot in new baby kits.

- Replace sphygmomanometers with non-mercury units. Replace the glass tubes of existing mercury units with an inexpensive mylar-coated tube, available from the manufacturer, to prevent a mercury spill in the case of breakage. The mylar tube can be installed quickly and easily by the hospital's biomedical engineering staff.

- Replace manometers and other pressure gauges, dials and switches with digital electronic models. Pressure transducers, filled with a variety of high-density liquids other than mercury can substitute for manometers. Alternatives to mercury-containing thermostat switches include electronic, snap action, reed switch, bimetal, and vapor-filled diaphragm thermostats. These items are accurate, reliable, and inexpensive.

- Solid-state or hard-contact switches can be substituted for mercury switches in some applications. When replacing or installing new switches, contact the manufacturer about mercury-free alternatives.

- Replace mercury-containing batteries:

Alternatives to mercuric oxide and mercury-containing button batteries exist. If product performance is not affected, replace them with alkaline, zinc-air, rechargeable nickel-cadmium, or lithium batteries.

Zinc-air batteries can often be used for cardiac telemetry monitors. They may perform better and last longer than mercury-containing batteries. Always verify the suitability of zinc-air batteries for cardiac monitors before making a change as they are used for emergency care. Zinc-air batteries, which continue to discharge while in storage, may be especially appropriate for monitors that are in constant use.

- Mercury's use in the laboratory can be phased out in many areas such as histological stains and fixatives. Obtain information from vendors and review Material Safety Data Sheets for alternative products. Using some substitutes, such as copper-, tin-, and chromium-based chemicals, is less of an environment risk than mercury-based products and can reduce disposal costs.

- Require mercury disclosures on all products purchased by the facility, and request the use of recovered mercury in products which do not yet have alternatives.

- Purchasing personnel can leverage their buying power with other hospitals to increase availability of mercury-free alternatives.

- Substitute mercury-containing esophageal dilator tubes with tubes containing water-based or Tungsten compounds.

- When possible, replace Canter tubes with Anderson tubes which contain no mercury and can be an acceptable substitute.

- Replace conventional fluorescent tubes. T-8 fluorescent lamps with electronic ballasts contain 20% less mercury than other types of lamps.

MERCURY-CONTAINING ITEMS	ALTERNATIVES
B5 Solution Zenker's Solution	Zinc Formalin, Freeze Drying
Cantor Tubes Feeding Tubes Miller Abbot Tubes	Tungsten-weighted tubes.
Hematoxylin	Sodium Iodate Gill's Hematoxylin Mercury-free Hematoxylin
Lamps	Because mercury-containing fluorescent lamps are more energy efficient, they account for less mercury pollution than other types. Ensure they are properly recycled.
Mercuric Chloride	Magnesium Chloride/Sulfuric Acid Proclain, Zinc Formalin, Freeze Drying
Mercuric Oxide	Copper Catalyst
Mercuric Oxide Batteries	Lithium, Zinc Air, Alkaline Batteries
Mercurochrome	Neosporin, Mycin
Mercury Iodide	Phenate Method
Mercury Switches	Bimetallic Strips, Electronic Strips
Mercury Nitrate	Ammonia/Copper Sulfate Neosporin, Mycin
Mercury Sulfate	Silver Nitrate/Potassium/Chromium-(III) Sulfate
Nursing Incubator Thermostat	Thermostats that contain alcohol instead of mercury
Sphygmomanometers	Electronic Vacuum Gauge Expansion, Aneroid Models
Thermometers	Electronic (Digital), Expansion Temperature Strips, Tympanic Gallistan, Red Bulb (Alcohol) Aneroid Models
Thermostats	Electronic Models, Snap Switches

Thimerosal	Proclain, Thimerosal-Free Bactericides

Appendix I

Basic Training &

Management Guidelines

Basic Training and Management Guidelines

One thing Center staff learned was that every facility has different needs from and expectations of a mercury management program. Use this appendix as a guide to develop a program that will work for your facility. Above all, be flexible and ready to change the program if it shows signs of losing effectiveness. Be ready to look for fresh ideas from the resources provided.

1. Get Support from the Top

It is important to have support of top hospital management. Equally important is the support of each department supervisor. As you get into the project, you will find that each department can uniquely effect its success.

2. Each Department has a Role to Play

Purchasing/ Product Review Committee

Purchasing can establish a "no mercury" purchasing policy for your hospital.

Product Review Committees will need to look at new product suggestions to assess whether the product will perform well enough in its application.

Engineering/Plant Operations

This is often where recycling is done. Review the programs already in place, such as fluorescent bulb and battery recycling. Make sure the recycling company certifies that the mercury they collect is sent to a reclamation company and not disposed of illegally (or unethically).

Some retrofits to make mercury-containing devices safer can be done here. Replacing glass tube in mercury sphygmomanometers with mylar coated tubes, inserting lever locks in Baum brand mercury sphygmomanometers, and relocating respiratory therapy's barometer to a safe and secure area are some suggestions.

Identification of mercury-containing switches, thermostats, barometers, manometers, etc. that are used in the facility infrastructure is most easily done by a hospital engineer.

Environmental Services

Cleaning the hospital may also mean dealing with mercury spills or disposing of mercury devices like thermometers. Staff in this department needs to be educated about where the mercury is and what to do if confronted with a spill or disposal problem.

In many cases, Environmental Services is a contracted service. In this case it is important to know what training they have already received through the contractor. If training is not provided by the contractor, suggest that it be included. Ensure that the training is given in the hospital setting if not by the contractor.

It is also important to make sure the message is getting to all the staff. In many Florida hospitals, some of the Environmental Services Staff do not speak English. Some education materials are available in Spanish. No matter what language is spoken, pictures and cartoons can be used to make sure all personnel are getting the word about recycling and especially about not discarding mercury-containing devices in red bags or sharps containers.

Laboratory

The laboratory has become the most difficult area to find all mercury sources. Some problems in the laboratory are described in Section 3.3.8 and 3.4.7. Identifying all the compounds containing small quantities of mercury can be a daunting if not impossible task for laboratory staff. Requesting Certificates of Analysis (see section 3.5.6) instead of MSDS's from distributors can help, but there may be hundreds to contact. Start with the most commonly used distributors, and pick up on others as new orders are placed. Another alternative is to collect the mercury from the wastewater before it leaves the lab, as described in Section 3.4.10.

Many facilities use the laboratory as a collection site for mercury wastes. If this is true in your facility, ensure that complete records are kept and containers are labeled to properly identify the source of the mercury. Doubling the containers used for storage of waste can provide added insurance that vapors do not escape during storage.

Nursing Units

Center staff had more problems speaking with individuals in nursing units than anywhere in the hospitals. Because nursing units can go from slow to swamped in a matter of minutes, getting the undivided attention of nursing staff can be a difficult task. Nursing supervisors were more apt to have an inaccurate idea of what was used in their departments than any other hospital department. Unfortunately, Center staff also found a lot of friction and competition between nursing departments, and not enough communication between different nursing units.

Address nursing personnel at mandatory in-services. Encourage cooperation between units. You may want to help the individual units set up their own committees to help consolidate product use information for all the nursing staff. Or you may want to use the competition between departments to foster some friendly rivalry in finding and getting rid of mercury-containing devices within the units.

Associated Doctor's Offices

Many hospitals said they would have the most difficulty enforcing product changes in office space leased by physicians. The response of one hospital group's safety officer was "If they are going to use our facility waste disposal, then we are going to control what they throw away." Read your lease agreements to see what limitations you have. Consider amending the lease agreements to fit your new policies.

Endoscopy

Make sure Endoscopy staff has the opportunity to compare non-toxic alternatives to esophageal dilators (bougies). This is another department where the physicians may not want to try a new product when the old one has worked so well. Many people think that a bougie is a safe device, but reported instances of tubes breaking inside patients are in the literature (see Section 3.5.12 to learn what happened at one facility). The concept of source reduction comes into play here. If physicians claim that the devices have a small risk of breaking, they may not see the importance of removing them from use. Instead, you may want to appeal to the need to quit manufacturing mercury-containing devices as a method of decreasing the total amount in use and in manufacturing facilities worldwide.

Dietary Services/Food Services

Documentation of least one instance of a mercury thermostat bursting in a kitchen oven with subsequent expensive clean up pointed out that even the hospital kitchen is not exempt from possible problems with mercury. Replacing mercury –containing thermostats and switches in the kitchen will probably not cost a lot, and can be a relatively easy preventive measure.

Infection Control

Center staff found that the hospital infection control nurse/s were an important ally in the facility. Since they are seen as experts in safeguarding the health of hospital personnel, their attitude toward the mercury issue can have a facility-wide effect.

Risk Management

Getting support in a mercury management program in the hospital entails convincing people to change from using devices that have been part of normal hospital procedure for decades. In many instances, the importance of changing to mercury-free alternatives is difficult to quantify for an organization that must always evaluate all aspects of a change before it can take place.

Mercury management has a large risk management component. Large mercury spills can cost facilities thousands of dollars to clean up. The risk of using a mercury-containing product should be considered when comparing the cost of changing to a mercury-free alternative.

Florida Hospital Association/Professional Organizations

Networking with other hospital professionals can help make your mercury management program work. Sharing ideas about waste management makes good sense for everyone. Although competition between hospitals is inevitable, ensuring that everyone has the best possible information about waste management should be separate from those rivalries. The elimination of toxins from our environment should be of equal concern to everyone and can help foster teamwork that is not possible in other areas of hospital management.

The Florida Hospital Association can be a clearinghouse for information sharing between facilities. With 19 affiliated professional groups covering Florida, every hospital in the state is connected in some way. Encouraging cooperation and exchange of ideas in all waste management areas benefits everyone.

Day Stay Surgery

Next to the Emergency Room, this can be the busiest department in the hospital. Also, it may not physically be part of the facility, making control of mercury-containing devices more difficult.

As discussed in section 3.4.11, look for the mercury device for reducing intra-ocular pressure in this department, as well as mercury thermometer and sphygmomanometer use. Work with extremely busy departments like this one during their slow period or it will be difficult to get information on the use of mercury-containing items.

Hospital Corporations

If your hospital or group is part of a larger corporation, work to get policy changes at the corporate level. Although it is a goal of Center staff, this has been a difficult door to open. With the signing of the Hospitals for a Health Environment memorandum by EPA and American Hospital Association in 1998, hospital

corporations will be compelled to adjust their policies to conform to the changing atmosphere about mercury and waste management.

3. Get Involvement from all the Staff

Every facility can identify someone who is a "champion" in making recycling programs work. It may be someone who has already taken the initiative to get rid of mercury-containing products in their department. Talk to individuals, not just department heads and supervisors. Eventually someone will tell you about that champion. Since this program can only be successful with the support of everyone in the hospital, don't underrate the help you can get from individuals at any level.

In some facilities volunteers may be enlisted to help with the project. One hospital visited used an elderly volunteer for sphygmomanometer maintenance. When mercury contamination in his work area was found by Center Staff, the hospital immediately suspended any maintenance for mercury sphygmomanometers. Since the volunteer was still interested in working in the hospital, he became part of the group doing the mercury audit instead.

4. Identify Sources of Mercury

A facility-wide audit of mercury-containing devices and products should be made.

One approach to an audit is to assign one person the task of inserting lever locks in all the Baumanometers (see Section 3.3.1) in the facility. Use a copy of the hospital floor plan and different color marks to identify where various types of sphygmomanometers are seen, regardless of their use (often mercury sphygmomanometers are left in rooms even if the rooms or the sphygmomanometers are no longer used).

Center staff found that asking supervisors to identify what mercury devices they have in their department often resulted in a quick and inaccurate guess rather than a real audit.

The audit is an important first step that can be used by Purchasing to determine the cost of replacement. Its accuracy and completeness will help facilitate change.

5. Set Goals

Short and long term goals should be established. If your long-term goal is to completely remove the mercury from your facility, you must have short-term goals to help you gauge your progress.

The mercury audit is an important part of establishing these goals. You may find that there are simple fixes, like making sure there are mercury recycling areas set up in all departments, or ordering mercury-free B-5 replacement products for trial in Histology, that can give project members a sense of accomplishment that fuels a continued effort.

6. Make it Fun!

Appendix J includes a few word games that Center staff developed for use in hospital newspapers. You can organize a "scavenger hunt" for mercury products to develop a little friendly rivalry between departments. Try offering a prize for the best mercury reduction idea. Work with the community on a thermometer exchange. Your marketing department can help think of ideas that can work for your facility.

7. Adopt Best Management Practices

Appendix H contains Best Management Practices that Florida medical facilities can use. These practices will help you set goals for your hospital. Please print them and make copies of pertinent sections for distribution throughout your hospital.

Use the Web sites in Appendix C to find more ideas that may work better for your facility. The best approach to use will vary from hospital to hospital, and even hospitals within the same group will not have the same needs or agenda. Be flexible with your program to ensure the most success.

8. Measure Your Success

If you did your homework up front, measuring your success will be easy. Be sure to consider even the smallest changes as successes.

There will not be much money saving associated with a mercury waste reduction project, especially at first. Look for non-monetary ways to measure your success, like how many hospital personnel have gotten training about mercury management.

9. Advertise Your Success

Go back to your marketing department for ideas that will be most appropriate for your hospital or hospital group. Administrators will also need to be apprised of any advertising of the program to the community.

Some hospitals are reluctant to let local media learn of a program like this in the fear of having it turned around and depicted in a negative light. Center staff found this reluctance based on a worry that the media will advertise to the community that mercury is and has been a problem that the hospital is contributing to in the community. Instead of applauding the success of a program, local media may see this as chance to be sound the alarm about the possibility of historic mercury use and improper past management of mercury wastes.

9. It Can Never End!

The hospital environment is not static. Personnel and policies change, products are tried, approved, and discarded. Technology never stands still, and will also have a part in the possible re-introduction of mercury-containing products.

With the plethora of information hospital personnel need to assimilate about safety in the workplace, it is inevitable that knowledge about controlling mercury will be forgotten after training is complete.

Be sure that mercury management becomes part of yearly Right-to-Know training and Orientation. Make it part of someone’s job description to keep abreast of new regulations, technology, and programs dealing with mercury.

Mercury will be a part of our hospital and natural environment for the rest of our lives. We can all have a positive impact on the amount released into the environment in the future, but worldwide, decreases of mercury in the atmosphere and water probably will not be significantly noticeable for a long time. Take pride in the positive contributions

Appendix J

Mercury Word Games

MERCURY IN THE HOSPITAL

C	R	T	R	X	S	E	V	I	T	A	N	R	E	T	L	A	E	N	S
L	P	O	I	E	M	S	R	E	H	T	N	A	P	I	O	E	R	B	H
Y	B	R	E	D	C	K	L	J	I	O	P	N	F	Y	H	L	E	V	A
T	A	C	L	Y	M	Y	C	L	K	A	E	A	N	A	F	K	T	T	R
R	T	M	E	R	T	M	C	Y	U	J	V	H	Z	T	L	L	E	U	P
Q	T	V	M	U	O	N	O	L	R	T	E	A	R	G	U	O	M	M	S
S	E	N	E	C	D	Y	N	U	E	Y	R	H	D	H	O	P	O	R	C
E	R	C	N	R	V	T	M	N	D	D	G	S	S	S	R	N	N	P	O
V	Y	E	T	E	X	R	R	I	O	L	L	E	C	O	E	M	A	D	N
I	G	Y	S	M	E	E	D	U	E	G	A	R	E	L	S	E	M	T	T
T	I	K	L	L	I	P	S	Y	A	E	D	T	G	U	C	Y	O	Y	A
A	J	T	D	N	J	B	U	B	I	N	E	N	F	T	E	I	M	K	I
X	K	H	F	R	O	B	D	C	T	M	S	B	L	I	N	G	G	I	N
I	E	G	R	U	T	E	Q	U	T	N	Y	V	S	O	T	S	Y	L	E
F	O	P	G	C	R	S	G	T	M	O	T	T	K	N	K	I	H	X	R
Y	I	I	N	B	D	U	C	B	V	Y	X	M	E	S	I	H	P	N	R
T	E	T	H	E	R	M	O	E	T	E	R	I	J	F	H	A	S	B	D
S	E	T	Q	E	R	T	Y	U	I	K	L	C	C	M	A	F	T	R	A
B	V	G	H	G	F	T	A	T	S	O	M	R	E	H	T	S	I	S	Z
S	S	E	M	R	L	B	A	V	E	I	L	E	R	B	N	U	N	Y	U

Can you find all of the underlined words in the cryptic above? They may be written backwards, forwards, top to bottom, bottom to top, or diagonally.

Mercury is a toxic chemical that is hazardous in our environment. It has caused the death of Florida panthers in the Everglades as well as causing periodic warnings not to eat certain fresh and saltwater fish. You may be using mercury, an element, in the hospital if you use a sphygmomanometer, thermometer, thermostat, fluorescent bulb, battery or esophageal bougies. In the laboratory, stains, solutions and fixatives may contain mercury. There are alternatives for almost all mercury items in the hospital. Mercury must be disposed of as hazardous waste and should be kept separate from other types of waste. It should never be discarded in a redbag or sharpscontainer. Instead, use a spillkit to clean up spilled mercury, and deliver it to your hospital safety officer or _____. Recycle mercury whenever possible.

Mercury Word Jumbles

Mercury is a toxic chemical used in many items in the hospital. Some common sources are fluorescent bulbs, thermometers, thermostats, and many laboratory chemicals. Mercury evaporates at room temperature. The mercury vapor escapes into the environment and poisons our wildlife, our fish and us – it has even been the cause of death in Florida panthers. It is important to know where the mercury is in your work area, what to do if it spills (never put mercury in a red bag or sharps container), how to recycle it, and especially what alternative products exist for various mercury-containing products.

Our hospital is starting a mercury reduction program. You can help by learning about mercury. Here are some word jumbles, using words that appear in the paragraph above.

xicto	toxic
rsthaepn	panthers
ceeycrl	recycle
braged	redbag
mmoterrthee	thermometer
pravo	vapor
scontulfree	fluorescent
antiseletrav	alternatives

Mercury Quiz

What do you know about mercury and its use in the hospital? Take this short quiz to see.

1. It is safe to handle liquid mercury (like from a broken thermometer), and children should be given mercury to learn about it. TF
2. A broken mercury thermometer should be disposed of in a sharps container. TF
3. No blood pressure gauges (sphygmomanometers) that hang on the wall contain mercury. TF
4. There are good alternatives available to mercury-containing medical devices. TF
5. Fluorescent lights contain mercury, but the mercury is gone when the light is burned out. TF
6. If mercury is spilled in your work area, clean up the spill with damp rags and discard them in a solid waste container. TF
7. Mercury has been blamed for the deaths of some Florida panthers. TF
8. It is dangerous to eat fish because of mercury contamination. TF
9. If mercury is poured down the drain, it will not get into the atmosphere. TF
10. There is nothing I can do to decrease the mercury in our environment. TF

1. False – Liquid mercury is very dangerous. It vaporizes at room temperature, and, when inhaled, can cause both short-term and chronic illness. Children and women of childbearing age are most susceptible.
2. False – Anything containing mercury should be cleaned up as hazardous waste and kept separate from other types of waste.
3. False – if you can see a silver liquid column in the gauge, it contains mercury.
4. True – New technology has made it possible to replace mercury in almost every area of use in the hospital.
5. False – Every fluorescent lamp has some mercury and care should be taken not to break them and release the mercury – even when they're "burned out." Our hospital has a bulb-recycling program.
6. False – Our hospital has a mercury spill cleanup procedure to follow. Make sure you know what to do or whom to call if there is a spill.
7. True – These big cats were dining on fish and raccoons that had high mercury levels. Many types of animals, birds and fish in the Everglades and other water bodies are suffering because of high mercury levels in the water.
8. False – Mercury advisories are posted when fish are too contaminated to eat. It may be safest to limit the amount of large game fish you eat, especially fresh water species like large mouth bass. But fish has excellent nutritional value, and should not be completely avoided.
9. False – As an element, mercury never really goes away, it just changes form. It is toxic whenever it is released, into air or water.
10. False! – We need everyone's help to reduce the amount of mercury in our hospital. Learn where the mercury is in your department, find out about alternative products that don't use mercury, and make sure you know how to properly dispose of mercury waste. Spread the word, not the pollution!

How did you score? Do you need to learn more about mercury and its dangers? Would you like to know where mercury is in your department and how to get rid of it forever? Our hospital is starting a mercury reduction program that will help protect our employees, patients, and our community. Contact XXX at XXX to see how you and your department can get involved.