Environmental and Safety Advances for Health Care Facilities

A Compendium of Best Practices in Mercury Awareness, Waste Management, and Safety Innovations

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Table of Contents

Preface **2**

Introduction
Extending the Commitment: Sustainability at Bristol-Myers Squibb Company 3

Environmental Management in Health Care
Environmental Self-Audits for Health Care Facilities 4
Waste Reduction and Recycling in the Health Care Setting 5
Environmentally Preferable Purchasing (EPP) 6

Safety and Ergonomics
An OSHA Perspective 8
Needle Stick Safety 9

Strategies for Managing Mercury and Silver
Pollution Prevention in Hospitals 10
Case Study: Mercury Replacement and Other P2 Activities at Strong Memorial Hospital 12
Case Study: Mercury Reduction in Hospital Wastewater Streams 13
Pollution Prevention in the Dental Industry 14

Conference Speakers **15**

Sponsored by:

Onondaga County Department of Drainage and Sanitation

Bristol-Myers Squibb Company

Preface

The health care industry serves a vital role in helping to improve the well being of all members of society. Yet some practices long accepted in medicine and dentistry are now recognized as having potential negative impacts on the health of people and the environment. For example, hospitals and clinics generate medical and hazardous wastes; medical equipment, such as thermometers and blood pressure equipment, may contain hazardous materials; and needle sticks carry the threat of spreading bloodborne pathogens. One of the challenges of the health care industry is to develop innovative approaches to deliver cost-effective services to patients without compromising the environment or worker health and safety.

In order to help health care professionals make better-informed environmental and safety decisions, the Onondaga County Department of Drainage and Sanitation teamed with Bristol-Myers Squibb Company to sponsor *Communities Committed to the Environment: A Conference for the Health Care Industry on Mercury Awareness, Waste Management, and Safety Innovations*. The conference took place in Syracuse, New York, on May 15 – 16, 2001. The meeting reflected the overall goals of Onondaga County and Bristol-Myers Squibb to improve the environment through pollution prevention and waste reduction.

The day and a half conference featured state and federal regulatory officials along with other experts in a variety of health care fields. Topics covered included:

- Environmental Management in Health Care
- Safety and Ergonomics
- Strategies for Managing Mercury and Silver

The conference provided participants with a clearer understanding of how to meet state and federal requirements as well as tools to meet the common challenge of protecting employees and the environment. It drew from the growing body of information on best management practices and case studies.

The Onondaga County Department of Drainage and Sanitation and Bristol-Myers Squibb are sponsoring the development of this compendium to provide a summary of the conference and share information on the latest environmental and safety advances for the health care industry. It is their intent that wide distribution of this document will promote real progress in reducing the unwanted environmental and safety impacts of health care facilities.

The following pages in this compendium summarize the presentations given during *Communities Committed to the Environment: A Conference for the Health Care Industry on Mercury Awareness, Waste Management, and Safety Innovations*. The editors have tried to capture the wealth of information and experience shared during the conference. In some cases, the material from the conference has been reorganized to fit the format of the compendium. For additional copies of the compendium, contact:

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Introduction

Extending the Commitment: Sustainability at Bristol-Myers Squibb Company

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Bristol-Myers Squibb is keenly interested in working with health care facilities to raise awareness of environmental and safety issues. They share a common purpose: bringing health care to the people who need it. In her welcoming remarks, Susan Voigt, Bristol-Myers Squibb's current vice president of EHS, explained how the company takes seriously its responsibility to the health care community.

Living the Pledge

As a leading pharmaceutical and related health care products company, Bristol-Myers Squibb's mission is to extend and enhance human life. The company's core values – as embodied in the Bristol-Myers Squibb Pledge – center on sustaining and improving the lives of people throughout the world. This specifically includes customers and consumers within the health care industry.

The Bristol-Myers Squibb Pledge is a formal commitment to conscientious citizenship. In it, the company pledges to support environmental progress, a safe work environment, and policies and practices that fully embody the responsibility, integrity, and decency required of free enterprise if it is to merit and maintain the confidence of our society.

Every policy within Bristol-Myers Squibb flows from and supports the Pledge. The company's environmental, health, and safety (EHS) policy articulates its promise to protect the environment and the health and safety of employees, customers, and the public.

Product Responsibility

For many years, the company has worked to reduce the EHS impacts of its products throughout their life cycle, from design through manufacturing, use, and ultimate fate. For example, Bristol-Myers Squibb has developed a Green Chemistry program that promotes innovative and cost-effective approaches for identifying and reducing waste generation, solvent releases, and the use of hazardous materials in the manufacturing of pharmaceuticals. Through Green Chemistry, the company is protecting the health and safety of the people who use our pharmaceutical products, while demonstrating our commitment to being an industry leader in product stewardship.

Partnership with Customers and Communities

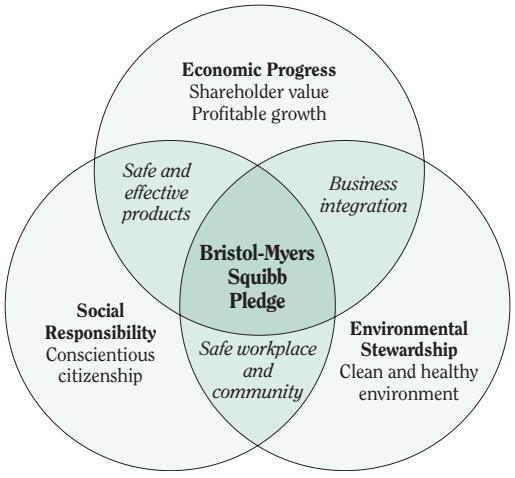
The company is an active partner with customers and local communities, as evidenced by its sponsorship of numerous forums – such as this conference – to exchange best practices, publications and resources for customers, and educational programs and research.

Sustainability 2010 Goals

In support of the EHS policy, Bristol-Myers Squibb recently established sustainability 2010 goals that encompass a broad range of interconnected social, community, and business issues. The company's 2010 goals fit into three broad classifications:

- Continuous improvement
- Leadership expectations
- Environmental stewardship

Each of the above categories contains several specific leadership objectives. For more information on Bristol-Myers Squibb's 2010 goals, programs, and EHS performance, visit its Internet site at *www.bms.com/sustainability.*



Bristol-Myers Squibb Pledge promotes economic progress, social responsibility, and environmental stewardship.

Environmental Management in Health Care

Environmental Self-Audits for Health Care Facilities

Based on a presentation by:
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Given the increased identification, regulation, and enforcement of health care facilities as multimedia point sources, and sensitivity towards environmental impacts, self-audits are a useful tool to discover and determine appropriate management of environmental risks. The support of upper management and the various department heads is critical to ensure an audit that is effective and fully catalogues potential environmental impacts. The inspection should follow an assessment form or checklist and objectively observe work practices and equipment operations and maintenance.

Key Audit Issues

The major concerns for health care facilities are: wastewater (sewer), solid waste (general trash and regulated medical waste), air emissions, and Occupational Safety and Health Administration (OSHA) issues. For each emission source, the audit should identify:

- Applicable permits and regulations
- Internal policies and procedures
- Testing and inspection reports
- Waste manifests
- Chemical inventories

The audit should review the following media-specific topics. The area of solid waste management requires assessment of waste disposal techniques for general wastes, regulated medical waste, sharps, chemical and hazardous wastes, and radioactive materials. In addition, the audit should review procedures regarding waste segregation, minimization, reuse, recycling; waste collection, storage, and transport; labeling; and record keeping.

Waste Management

On-site treatment of waste necessitates a review of permits and compliance records for on-site incinerators, shredders, chlorinators, and solvent distillation units.

Air

Air quality issues covered in the audit should include indoor air quality – fume hoods and biosafety cabinet systems – as well as exterior discharge points such as ethylene oxide sterilizers, chillers, boilers, anesthetic gasses, incinerators, and autoclaves.

Wastewater

For wastewater discharges, topics to cover include mercury management, incinerator and boiler blowdown, sterilization and waste treatment equipment, x-ray developing equipment, laboratory sinks and equipment, and laundry and food service facilities.

Safety

Several OSHA compliance standards should be addressed in the self-audit, including laboratory safety, ethylene oxide management, formaldehyde management, and hazard communications.

Report Requirements

A critical aspect of an audit is the summary report. This report should contain the audit findings, the inventory of point sources and permits, a compendium of SOPs and applicable regulations, and recommendations for improvement on the issues noted.

Continuous Improvement

It is important to keep in mind that the audit should be part of a comprehensive plan, such as an ISO-style management system that includes a plan-do-check-act cycle. Action plans resulting from the self-audit should become part of an ongoing continuous improvement process. High priority areas for improvement, such as mercury management, should be explicitly addressed in the action plans.

Resources

NYSDEC Pollution Prevention Unit:
www.dec.state.ny.us/Web site/ppu/p2pub.html
OSHA Compliance Services
Outside consultants

Waste Reduction and Recycling in the Health Care Setting

Based on a presentation by:
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There are many opportunities within a health care facility to save money by managing the waste stream. These generally fall into three broad categories: reduction, recycling, and purchasing. Given the average hospital's waste stream, as presented in the table below, a number of waste reduction opportunities were identified. The presenter reminded participants of the availability of Onondaga County Resource Recovery Agency (OCRRA) specialists for no-cost waste management consulting.

Opportunities to reduce waste

- Eliminate mercury thermometer from new parents pack ($2/thermometer)
- Use reusable diapers
- Eliminate plastic trash bag liners in administrative areas (savings of $20,000 annually for one NY hospital)
- Buy bulk cleaning solutions, refilled by the supplier
- Use concentrated cleaning solutions
- Use washable mop heads, rather than disposable
- Replace paper towels with air dryers
- Eliminate unused items from custom surgical packets (savings of $30,000 for a Portland hospital)
- Reprocess operating room bowls and instruments
- Use washable surgical and isolation gowns and sterilization trays ($60,000 savings for a Sacramento hospital)
- Use washable linens, bed pads, and gowns ($15,000 savings for one hospital)
- Switch to washable from disposable plates and cups
- Encourage two-sided photocopying
- Use email to distribute documents
- Institute a hospital-wide resource exchange for old binders, folders, cassette tapes, etc.
- Collect sharps in reusable containers
- Eliminate single use regulated medical waste (RMW) containers, implement bulk RMW collection
- Use reusable pharmacy totes

Opportunities for recycling wastes

- Appoint a recycling coordinator to track the effort and work with departments when they have a problem
- Post clear signage for separation of red bag waste and needles
- Recycle paper
- Recycle or compost food waste
- Donate used furniture
- Donate unused surgical supplies overseas
- Recycle x-ray film

Opportunities to minimize waste through purchasing

- Establish a waste management team with representatives from all departments to identify new opportunities
- Select vendors with minimal packaging; ask about recyclability of packaging and refill options; buy in bulk
- Require all vendors to supply their product on a standard size pallet
- Replace egg-crate foam mattresses with permanent waterproof mattresses
- Monitor purchases to ensure that over ordering and spoilage are not common issues
- Buy recycled paper goods

Resources

Waste reduction activities for hospitals:
www.ciwmb.ca.gov/BizWaste/Factsheet/Hospital.htm

Pennsylvania businesses recycle: Thomas Jefferson University Hospital
www.dep.state.pa.s/dep

Guides to pollution prevention for selected hospitals' waste streams
http://es.epa.gov/fedfac/fflexp2/hospital.html

Mercury pollution prevention in health care
www.nwf.org/greatlakes/resources/mercury.html

Case study: Staten Island University Hospital
www.nycwasteless.com

Sustainable hospitals
www.sustainablehospitals.org/cgi-bin/DB_Index.cgi

American Hospital Association. *An Ounce of Prevention: Waste Reduction Strategies for Health Care Facilities*. To order call (800) AHA-2626.

Minnesota Hospital Association. *Waste Not Book*. To order call (800) 462-5393.

Environmentally Preferable Purchasing (EPP)

Based on presentations by:
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The EPA defines a persistent bioaccumulative toxin (PBT) as one that is persistent (i.e., never degrades) and is bioaccumulative (i.e., accumulates in living tissue and is not metabolized and excreted from the body). Many products used by health care facilities contain PBTs or can generate or release PBTs into the environment when they are manufactured, used, discarded, incinerated, or recycled. Fortunately, environmentally preferable alternatives are often available.

A case study of environmentally preferable purchasing with respect to polyvinyl chloride (PVC) and di-2-ethylhexyl phthalate (DEHP) was presented. This life cycle assessment of PVC reveals hazards throughout its manufacturing process (vinyl chloride monomer, dioxins, and furans), use (DEHP exposure), and disposal phases (incineration produces dioxins, furans, hydrochloric acid). Dioxin is a PBT, a carcinogen, and a reproductive and development toxicant. DEHP is also a reproductive and development toxicant and a potential toxicant to the liver and lungs.

Three main elements of a PVC reduction program were outlined: conduct a PVC audit, create a change policy, and reduce the use of PVCs. Tubing, bags, and gloves represent 43 percent, 42.5 percent, and 12.5 percent of total PVC medical products on average. Example actions in change policies include: mandating purchase of latex- and PVC-free medical gloves, requiring annual meetings with major suppliers, establishing a hospital-wide PVC reduction policy, and considering PVC reduction in durable products (e.g., furniture and construction materials). Examples of use reduction or substitution opportunities are on the Health Care Without Harm Web site (*www.noharm.org*).

Resources

- How-To Guide on Environmentally Preferable Purchasing *www.geocities.com/EPP_How_To_Guide*
- Hospitals for a Healthy Environment *www.h2e-online.org/tools.asp*
- Environmental Specifications and Purchasing Policies used by Health Care *www.state.ma.us/ota/support/medspecs.htm*
- Product Specifications on Environmental Attributes Collected by the EPA *www.epa.gov/oppintr/epp/database.htm*
- Sustainable Hospitals Project *www.sustainablehospitals.org*
- Health Care Environmentally Preferable Purchasing Newsletter *www.state.ma.u/ota/specprog.htm#health*
- The Health Care Environmental Purchasing Tool *www.ahrmm.org/info/HCEPT/index.html*
- MASCO Mercury Resources Including Mercury Test Results Database *www.masco.org/mercury*
- Health Care Without Harm *www.noharm.org*
- Healthy Hospitals: Environmental Improvements Through Environmental Accounting *www.tellus.org/general/publications.htm*
- Janitorial Pollution Prevention Project *www.westp2net.org/Janitorial/jp4.htm*

Alternative for common products containing PBTs may be found in the table below.

Product	PBT(s)	PBT-free Alternative
Batteries	Antimony, Cadmium, Lead, Mercury, Nickel	PBT-free batteries and other power sources (such as fuel cells) are available for some equipment. Set up a battery-recycling program in your facility. For more information about recycling or rechargeable batteries, see *www.rbrc.org*.
Blood-pressure equipment	Mercury	Mercury-free aneroid and electronic blood-pressure units (sphygmomanometers) are accurate, available, and widely used.
Diesel fuel used to power generators, vehicles (non-emergency) and other equipment	Antimony, Arsenic, Beryllium, Cadmium, Cyanide, Dibutyl phthalate, Di(2-ethylhexyl) phthalate (DEHP), Dioxins, Lead, Mercury, Naphthalene, Nickel, Phenol, Polychlorinated dibenzofurons (PCDFs), Polycyclic aromatic hydrocarbons (PAHs), Selenium. Diesel exhaust contains all of the PBTs listed plus other cancer-causing substances.	Institutions that buy or lease shuttle buses and other vehicles should specify that they run on compressed natural gas (CNG) whenever feasible. For more information on the advantages of CNG, see INFORM's Bus Futures report (2000). For existing diesel-powered vehicles and equipment, consider adding biodiesel fuel. Some generators and other equipment may be able to be powered with hydrogen fuel cells or other energy sources.
Fever and laboratory thermometers	Mercury	Electronic, gallium-tin, and other types of thermometers are available for most medical and laboratory uses. Avoid replacing mercury thermometers with instruments that contain mercury batteries or have PVC (vinyl) casing.
Gastrointestinal and feeding tubes	Mercury	Tubes weighted with tungsten or water are used in many hospitals today.
Laboratory chemicals	Mercury	Many laboratory reagents use mercury-based preservatives for calorimetric assays and tissue fixing. Mercury-free alternatives are available for almost all of these applications. Mercury can also be a contaminant in many reagents. Massachusetts has created a database listing the mercury content of chemicals used in hospitals (see *www.masco.org/mercury*).
Vinyl IV and feeding bags	Di(2-ethylhexyl) phthalate (DEHP), Dioxins	When incinerated, vinyl (PVC plastic) may create dioxins that are released into the air. Vinyl also typically contained DEHP or other phthalate plasticizers, which can leach into bag contents. Polyolefin plastic or other alternatives to PVC are available for many medical applications.

Safety and Ergonomics

An OSHA Perspective

Based on a presentation by:
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The overall strategic goals of OSHA are to reduce injuries, illnesses, fatalities, hazards, and exposure and to increase employer and worker awareness of, commitment to, and involvement in safety and health issues. OSHA has programs specific to each industry as well as for specific type of injury or illness.

Ergonomics

The focus on ergonomics for health care facilities encompasses three groups of employees – office staff, housekeeping, and nurses. Office staff recommendations are similar to office staff in other fields and deal with the arrangement of desks, chairs, and computers. Housekeeping issues cover handle length on mops and brooms, the storage of heavy items, and the use of powered cleaning tools.

Nursing is a physically demanding job and specific mechanical support as well as protective policies can help minimize the strain. Engineering controls include mechanical lifts, lifting hoists, slide boards, pneumatic beds, gait belts with handles, transfer belts, ramp style, weighing scales, shower and toilet chairs, inflatable pelvic lifts, and tub lifts.

OSHA has specific policy recommendations to encourage safe lifting practice for nurses. Health care facilities should have policies to require two person lifts, limit the number of lifts per day, arrange furniture to facilitate lifting, and require nurses to set the brakes on chairs and beds.

Workplace Violence

Attacks on health care employees are a serious issue given that the work involves isolated work with patients or residents during examination or treatment. Additionally, staffs are often not trained to recognize and manage escalating hostile and assaulting behavior.

Workplace violence is the leading cause of job-related deaths for women and the second leading cause for men, claiming over 1,000 lives in 1994 and 106 health care workers between 1980 and 1990. Workplace violence is defined by OSHA as any physical assault, threatening behavior, or verbal abuse occurring in the workplace, which may be any location either permanent or temporary where the employee performs a work-related duty.

Non-fatal assaults are also a significant concern – the highest number of these occurs in the health care and social service sectors, primarily patients assaulting nursing staff in health care institutions. There were over 4,900 incidents against employees in nursing homes in 1994, most involving kicking, hitting, and beatings.

In 1996, OSHA developed a set of voluntary guidelines intended to prevent workplace violence, covering psychiatric facilities, hospital emergency rooms, drug treatment centers, community care and mental health facilities, pharmacies, and long-term care facilities.

Tuberculosis (TB)

Health care facilities were identified by the Center for Disease Control (CDC) as workplaces with high incidences of TB. The CDC and OSHA have established guidelines and requirements for these high incidence locations specifying the need to determine risk of exposure; provide early diagnosis, isolation, and treatment; train workers; perform skin testing; provide respirators; and develop appropriate signage and record keeping.

Chemical Hazards

The use of caustic cleaners and disinfectants requires appropriate personal protective equipment (PPE), eyewash stations, a hazard communications program, Material Safety Data Sheets (MSDSs) to be available, and appropriate training.

Bloodborne Pathogens and Needle Stick Safety

Bloodborne pathogens are pathogenic organisms that are present in human blood and can cause disease in humans (e.g., Hepatitis B virus or Human Immunodeficiency Virus – HIV). OSHA regulations (29 CFR 1910.1030) spell out the following specific requirements: hospitals must develop an exposure control plan (exposure determination, evaluating exposure incidents) – to be reviewed annually; engineering

and work practice controls, PPE, and housekeeping issues must be in compliance with the regulations; Hepatitis B vaccinations must be provided, free of charge and within ten days of assignment; and confidential post-exposure evaluation and follow-up must be provided.

Other Hazards

Other hazards of concern for the health care industry include exits and egress; wet floors, slips, and falls; maintenance activity and confined space issues; respiratory protection; and infection control for contractors.

Resources

- www.osha.gov
- NYS consultation service:
  - Syracuse: (315) 479-3205
  - Utica: (315) 793-2319
  - Rochester: (716) 258-4570
  - Binghamton: (607) 721-8019

Needle Stick Safety

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It is estimated that 600,000 to 800,000 needle stick injuries occur annually, 365,000 in US hospital settings. On average, there are 30 needle stick injuries per 100 beds per year, though only half of these are reported. The Needle Stick Safety and Prevention Act took effect in November 2000 and specified revisions of OSHA's bloodborne pathogens standard. The new requirements stipulate that employers must select safer needle devices, as they become available, and must involve employees in selection of these devices. Employers must also maintain a log of injuries from contaminated sharps.

Preventing Needle Sticks

Given the economic costs to the employer – treatment ($300–$1,000), employee assistance, and replacing an employee – and the significant emotional stress on exposed workers, preventing needle sticks is a top priority. There are several steps to decrease the occurrence:

- Eliminate the use of needles where possible – e.g., non-needle connectors for IV delivery systems
- Use devices with sharps prevention features – e.g., shields and sheaths
- Modify work practice – e.g., hands free exchange, prompt removal of filled sharps containers
- Raising awareness and asking for feedback on safety improvements

Needle-Free Technology

In a needle-free injection, the medicine is driven at a high speed by compressed carbon dioxide (CO_2) through a tiny orifice penetrating the tissue, taking one-half of a second or less. These devices are capable of intramuscular and subcutaneous injections. This technology meets both the OSHA and NIOSH recommendations to use safety products to minimize needle stick injury and to use needle-free alternatives when available.

The product is latex-free and is capable of delivering small molecules, proteins and peptides, and vaccines, with no reformulation required. Due to the amplified dispersion, jet injectors can have enhanced effectiveness. In addition, needle-free syringes can be disposed of as standard medical waste, eliminating the need for sharps containers.

Strategies for Managing Mercury and Silver

Pollution Prevention in Hospitals

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Pollution prevention reduces the source of the pollution; it is cleaner, cheaper, and smarter than recycling or treatment of the waste stream alone. Pollution prevention ranks waste management options in order of preference: source reduction, recycling, treatment, and disposal or release as a last resort. Savvy firms prevent pollution through increased efficiency, product reformulation, process modifications, product substitution, improvements in "housekeeping" or maintenance, and training and technical assistance programs.

The Onondaga County Department of Drainage and Sanitation (OCDDS) began its pollution prevention program in January 1999 seeking to reduce target pollutants (including mercury, silver, grease, and anti-freeze) without reverting to a command and control mechanism. Below are summaries of recent efforts and case studies for pollution prevention of silver and mercury.

Silver

Silver is a regulated hazardous waste under the Resource Conservation and Recovery Act and also regulated under the Clean Water Act for wastewater disposal. The OCDDS pollution prevention program seeks to manage releases of silver through the Code of Management Practices (CMP), a practical, industry-specific set of recommended operating procedures, which represent best management practices (www.silvercouncil.org). Participants are self-regulated and allowed to decide which minimization and recovery method is most appropriate (including metallic replacement, electrolytic, and precipitation recovery). Firms embracing the CMP are held to recovery standards and periodic testing based on size of facilities (90 percent/annual, 95 percent/6 months, or 99 percent/3 months for small, medium and large facilities, respectively). The OCDDS held a workshop for 140 attendees in August 2000 on the Silver CMP.

Mercury

Since 1968, mercury use has decreased by 85 percent in the US, with new emission controls expected to reduce usage by 90 percent. However, given mercury's extremely low reference dose in Methyl Mercury form (0.1 µg/kgbw/day), and significant impacts of long-term exposure to the brain, kidneys, and developing fetuses, there is still much to do. Mercury is a pollutant of concern on a national (e.g.,

Environmental Protection Agency, in its multimedia focus), regional (e.g., Great Lakes Initiative), state (e.g., Vermont, Oregon, Texas, New York), and local (e.g., Duluth, MN, San Francisco, CA, Freeport, ME) level.

There are many sources of mercury in the health care field – thermometers, blood pressure cuffs, dental amalgam, esophageal dilators, cantor tubes, feeding tubes, medical batteries, pharmaceutical preservatives, cleaning solutions, fluorescent lights, thermostats, pressure gauges, electric switches, and in laboratory chemicals. Medical waste incinerators are the fourth largest known source of mercury emissions to the environment.

Currently, command and control style legislation at the national and state level sets limits for municipal wasterwater treatment plants. Onondaga County's preferred option is voluntary reductions through pollution prevention and product substitution or elimination. Health care professionals are being asked to help by developing a mercury policy, establishing a baseline inventory of mercury containing products and equipment, seeking to substitute with non-mercury alternatives, and segregating their waste streams.

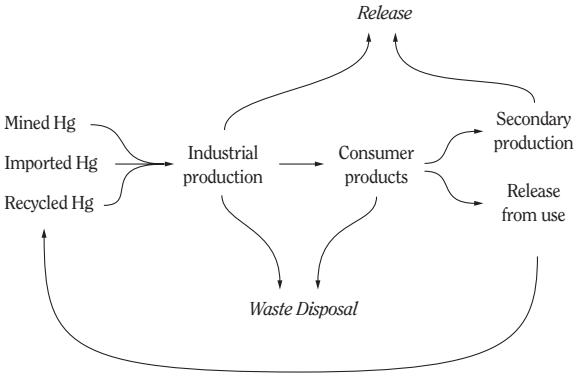
A Pollution Minimization Program (PMP) is required in some cases (when water quality-based effluent limitations are less then the practical qualification limits). The requirements for a PMP include annual review of sources, semiannual monitoring of sources, quarterly influent monitoring, submission of a control strategy, cost effective controls, and annual status reports.

The EPA has established the Hospitals for a Healthy Environment (H2E) program, asking all hospitals to pledge to:

- virtually eliminate mercury waste by 2005
- reduce total waste volume by 33% by 2005 and by 50% in 2010
- identify hazardous substances in hospitals for pollution prevention and waste reduction opportunities

The H2E program has created a Web site to recognize best practices and communicate its model plan for chemical waste minimization (www.h2e-online.org).

Mercury use and release life cycle



Case Study: Mercury Replacement and Other P2 Activities at Strong Memorial Hospital

Based on a presentation by:
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Strong Memorial Hospital is a part of the University of Rochester with 750 beds, an ambulatory center, a large dental clinic, the regional trauma center and is affiliated with the medical school and its large research complex. As part of its recent pollution prevention (P2) efforts, Strong pursued a number of waste reduction activities:

- Became an EPA Green Lights Partner (installed energy-efficient lighting)
- Replaced chromate glass cleaners in the labs
- Replaced ethylene oxide
- Redistilled xylene in histopath and explored xylene substitutes in other labs
- Established battery and fluorescent light collection programs
- Instituted a computer recycling program
- Segregated medical waste more stringently
- Now recycle 147 tons of mixed paper annually
- Historically incinerated approximately four million pounds/year, now they have reduced their regulated medical waste (RMW) by two-thirds, have closed the incinerator, and only autoclave their waste.

An EPA grant helped sponsor Strong's mercury reduction project, which included input from external stakeholders, such as the Monroe County DOH and DES, the National Wildlife Federation, the Western Lake Superior Sanitary District, and a local dental clinic. Strong established a multi-disciplinary task force which sought to prepare guidance on reducing mercury both for internal and external use, as well as providing education for dentists on options for recycling amalgam.

The first stage was to perform an audit to identify the uses of mercury and establish a baseline, then to select an appropriate action plan with the greatest documented benefit. Once these targets were identified, the program included revisions to training procedures and related policies. There were several foci of the reduction effort:

- Thermometers: the audit revealed that Neonatal Intensive Care Unit and Birthing used the most mercury-based thermometers; suitable replacements were found and given away, and the policy for purchasing was changed.
- Collection: Strong sought to improve proper waste segregation by installing point of use labels on sharps shelters reminding staff not to dispose of mercury thermometers in medical waste containers.
- Sphygmomanometers: Strong replaced these mercury-containing devices with aneroid units in phases, e.g., during renovations, with over 900 non-mercury sphygmomanometers now in use – a reduction of 255 pounds of mercury.
- GI tubing: The mercury reduction project discovered that Tungsten-filled GI-tubing was a suitable replacement for the old mercury-filled product, saving 45 pounds annually.
- Lab Waste: Before the mercury reduction project, histopathology and others labs generated 51 pounds per year. The current total is less than 1 gallon per year – the result of revisions to the laboratory manuals and the instituting of mercury-free stains.

Keys for P2 Programs

Several lessons can be learned from this case study about keys for successful implementation of a pollution prevention program. It is imperative that the program has upper-management support and that an active multi-departmental materials committee is established and held responsible for improvement. External drivers for the project include the inspections of the Joint Commission for the Accreditation of Healthcare Organizations, Monroe County's recycling laws, and the Department of Health securing an EPA grant for the pilot project, local pressure due to publicity about mercury contamination, and the financial costs of spills and disposal. The experience of Strong Memorial demonstrates the importance of presenting the project as value-added and tracking progress with frequent reporting.

Challenges that the project had to overcome included indifference, over-commitment, and objections to change among the staff and the lack of champion for the project. The scarcity of seed money and space and the limited choices of approved products were also concerns that had to be addressed.

Results of the project have included a drop in waste disposal costs for mercury and mercury spill debris from approximately $24,000 per year to less than $1,200 and winning the 1999 US EPA Environmental Quality Award and the 1999 Governor's Award.

Case Study: Mercury Reduction in Hospital Wastewater Streams

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The MASCO (Medical Academic and Scientific Community Organization) hospital workgroup consists of 28 world-class institutions, representing over 30 million square feet of buildings, 6,000 beds, and more than 40,000 employees. The group has over 5 million outpatient visits and 300,000 admissions annually, with revenues of $5 billion. In 1992, the Massachusetts Water Resources Authority (MWRA) began permitting hospitals for their releases of mercury, with violations eventually totaling over $300,000.

In 1992, MWRA was facing increased scrutiny on the output from its new treatment plant under the regional/state policy of virtual elimination of mercury. Currently, the MWRA prohibits the discharge of mercury by industrial facilities to its sewer system and imposes an effective discharge limitation for mercury of 1.0 part per billion (ppb) from its regulated sources, including hospitals and institutions.

Meeting the MWRA's standard for sewer discharge presented a formidable challenge for hospitals due to the nature of the equipment used by health care providers. Key substances used in research and diagnostic work, reagents in particular, often contain trace amounts of mercury that are usually not listed in the content descriptions. To address this complex issue, the MWRA established a Mercury Products Work Group (involving 28 hospitals) in the fall of 1994 to examine the problem and develop strategies to reduce the amount of mercury being discharged.

One of the innovative aspects of this project involved the MWRA and hospitals' willingness to suspend their usual rules of engagement by moving beyond the traditional use of enforcement mechanisms, including fines as the primary means of pursuing compliance. Specifically, the MWRA distributed a memorandum stating that the MWRA would not fine a hospital for mercury violations if they were actively participating in the Work Group. This not only provided direct economic relief to some of the institutions, but also served to create a climate in which all parties were able to focus more clearly on the search for solutions. This paradigm shift caused institutions to change from competing to bringing their collective resources to the table. This collective approach to addressing common concerns has thus far saved those institutions more than $2 million through the elimination of duplicate efforts.

MWRA Mercury Influent Loadings

Infiltration	33%
Unknown commercial	20%
Residential sewage	13%
Dental offices	13%
Inflow	11%
DITP recycle stream	7%
Permitted industries	3%
Septage	<1%
Corrosion	<1%
Water supply	<1%

The MWRA/MASCO Work Group focused on three main issues: to identify sources of mercury contamination and develop recommendations for their control, to develop guidelines for the removal of residual mercury from wastewater systems, and to identify and evaluate potential mercury pretreatment systems.

As a result of implementing lessons learned during the Work Group process, the average hospital mercury discharge has fallen by 83% since 1994 and from approximately 8 ppb in 1997 to less than 4 ppb in 1998. In 1997, the MWRA issued another memorandum creating penalty "safe harbors" for those institutions that continued to make progress toward compliance with the mercury

discharge prohibition under enforcement orders and schedules.

The MWRA/MASCO Mercury Work Group has produced several important documents and resources:

- A database containing information on the mercury content of products commonly used in hospitals and the available mercury-free alternatives, which is available on the Web site: www.masco.org/mercury.
- The Facilities Loadings report describes the levels of mercury discharge from five types of facilities.
- The Pretreatment Guidance manual contains information to help facilities with selection, design, installation, and operation of an industrial wastewater pretreatment system.
- The Technology Identification report presents information on the chemistry of mercury in wastewater and the results of feasibility tests of six pretreatment technologies on clinical laboratory wastewater.
- The integrated mercury discharge reduction summary – the Mercury Management Guidebook – aims to help all types of facilities in overall management of mercury.

Pollution Prevention in the Dental Industry

Based on presentations by:
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A 1997 MWRA study measured discharges to the sewer of mercury (and other metals) from fifteen dental facilities, including three large dental schools, two hospital clinics, one medium-sized clinic, and six small general practice dental offices. The report demonstrated that dental discharges are a significant source of mercury. Most of the samples exceeded MWRA's discharge standard of 1 part per billion (ppb), ranging as high as 41,400 ppb. MWRA estimates that dentists are contributing at least 10% of MWRA's mercury load.

According to the MWRA study, suction lines, with average concentrations of 4,781 ppb for those with air-cooled pumps, and 826 ppb for water-cooled pumps, had the highest mercury levels of any sources within dentists' offices, suggesting that segregation and removal of the mercury in these wastewaters would be a significant step toward reducing the loading of mercury. Other examples of mercury sources include amalgam wastes in the form of non-contact amalgam (scrap), contact amalgam, chair-side traps, amalgam sludge, and empty amalgam capsules.

Although mercury in the form of dental amalgam is very stable, amalgam should never be disposed of in the garbage or infectious "red bag," nor flushed down the drain. Some communities incinerate municipal garbage, medical waste, and sludge from wastewater treatment plants. If amalgam waste ends up in one of these incinerated waste streams, it can volatalize at high temperatures, and the mercury will be released into the environment.

Composition of a Common Dental Amalgam

Mercury	49%
Silver	35%
Tin	9%
Copper	5%
Zinc	1%

When properly segregated from the waste stream, amalgam can be recycled to reduce mercury emissions – the mercury can be recovered through a distillation process and reused in new products. After extensive review, waste regulators in the Great Lakes states recommend recycling amalgam as a best management practice for dental offices. Note that when managing the waste from these sources, remember to always use gloves, masks, and protective eyewear and contact your amalgam recycler about special requirements for storage and collection. The American Dental Association and the New York State Dental Association recommends the use of pre-capsulated amalgam alloy and the recycling of bulk mercury.

A listing of amalgam waste recyclers in New York may be found on the New York State Dental Association Web site: www.nysdental.org.

Communities Committed to the Environment

A Conference for the Health Care Industry on Mercury Awareness, Waste Management, and Safety Innovations

Speakers

Tuesday, May 15, 2001

Welcome
Edward Kochian, Onondaga County Deputy Executive; Richard L. Elander, Commissioner, Onondaga County Department of Drainage & Sanitation (OCDDS); Susan Voigt, Vice President of Environmental, Health & Safety, Bristol-Myers Squibb Company

How to make Health Care Facilities more Environmentally Healthy
Tom Murray, United States Environmental Protection Agency

Safety Issues Pertinent to the Health Care Industry – An OSHA Perspective
Diane Brayden, Occupational Safety and Health Administration

How Pollution Prevention Benefits Business and the Environment
Joseph J. Mastriano, OCDDS; David Ellis, NYS Water Environment Association; David Colbert, OCDDS

A Look at Environmental Issues in the NY State Health Care Industry
Ken Lynch, NYS Department of Environmental Conservation

Workshop 1: Hospital Pollution Prevention
Marvin Stillman, University Rochester; David Eppstein; Medical Academic and Scientific Community Organization (MASCO)

Workshop 2: Safety Program Success Story/Making Ergonomics a Profit Center
Irene Rathke, Gilmore Health Care Facility; Dr. David Thorpe, Workmed Medical P.C.

Workshop 3: Waste Management
Suzanne LaLonde, Onondaga County Resource Recovery Agency

Workshop 4: Pollution Prevention in the Dental Industry
Susan Borea, Silver Council and Borea Consulting; Kevin McManus, Massachusetts Water Resources Authority; Jerome DeSnyder, DDS

Panel: Q&A/Discussions
Marvin Stillman, University of Rochester; Jerome DeSnyder, DDS; Irene Rathke, Gilmore Health care Facility

Wednesday, May 15, 2001

OSHA Compliance Assistance for the Health Care Industry
Gordon DeLeys, US Dept. of Labor

NYS Efforts to Assist the Health Care Industry
George Estel, NYS Department of Health

Workshop 5: Environmentally Preferable Purchasing
Lara Sutherland, INFORM Inc.; Mark Rossi, Health Care Without Harm

Workshop 6: Driving Reductions in Needle and Sharps Accidents/Advances in Needle-Free Technology
William Owens, Roswell Park Cancer Institute; Kurt Lynam, Bioject, Inc.

Keynote Summary – Ethics, Economics, and the Environment
Tony Schifano, Wasteworks

Notes

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