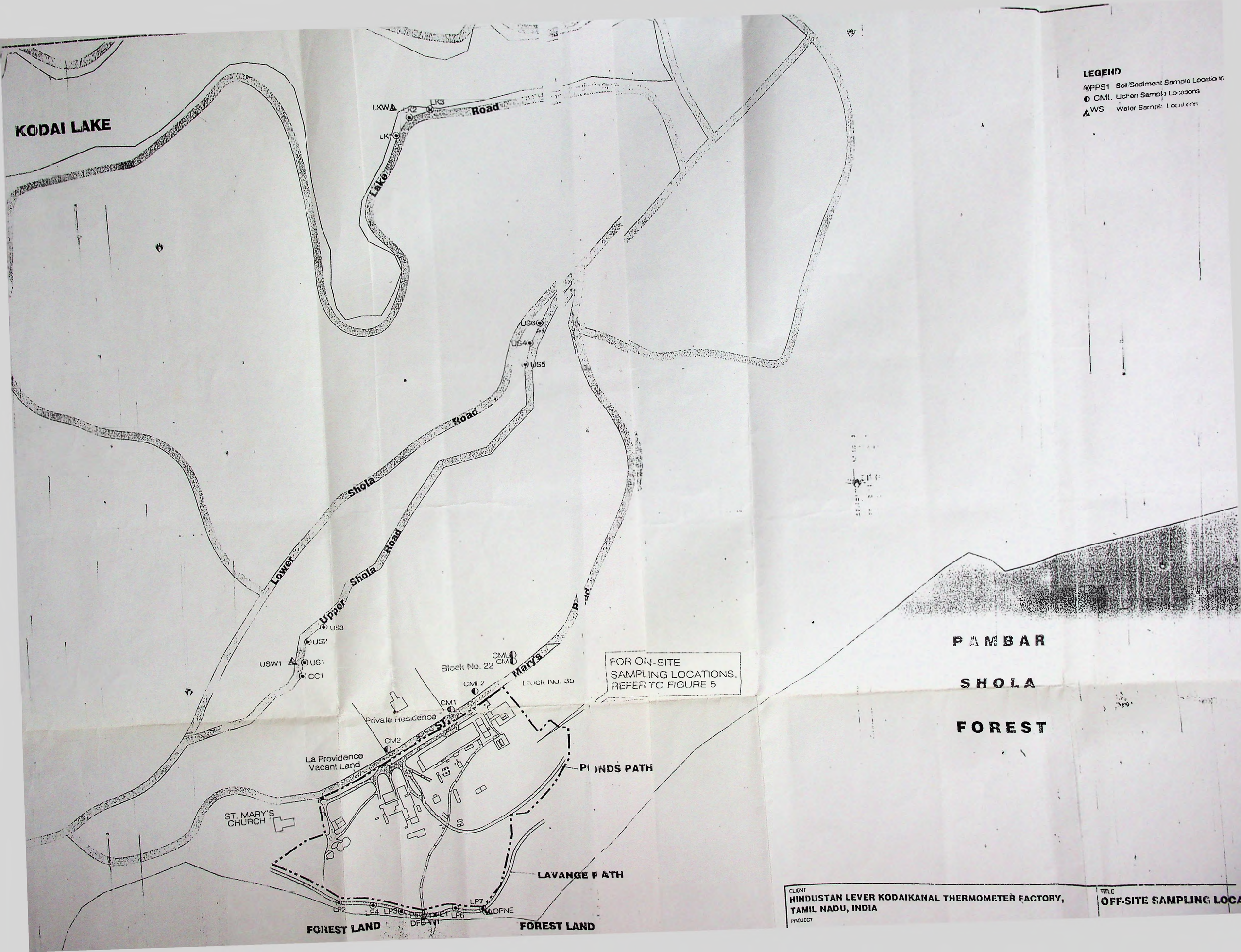
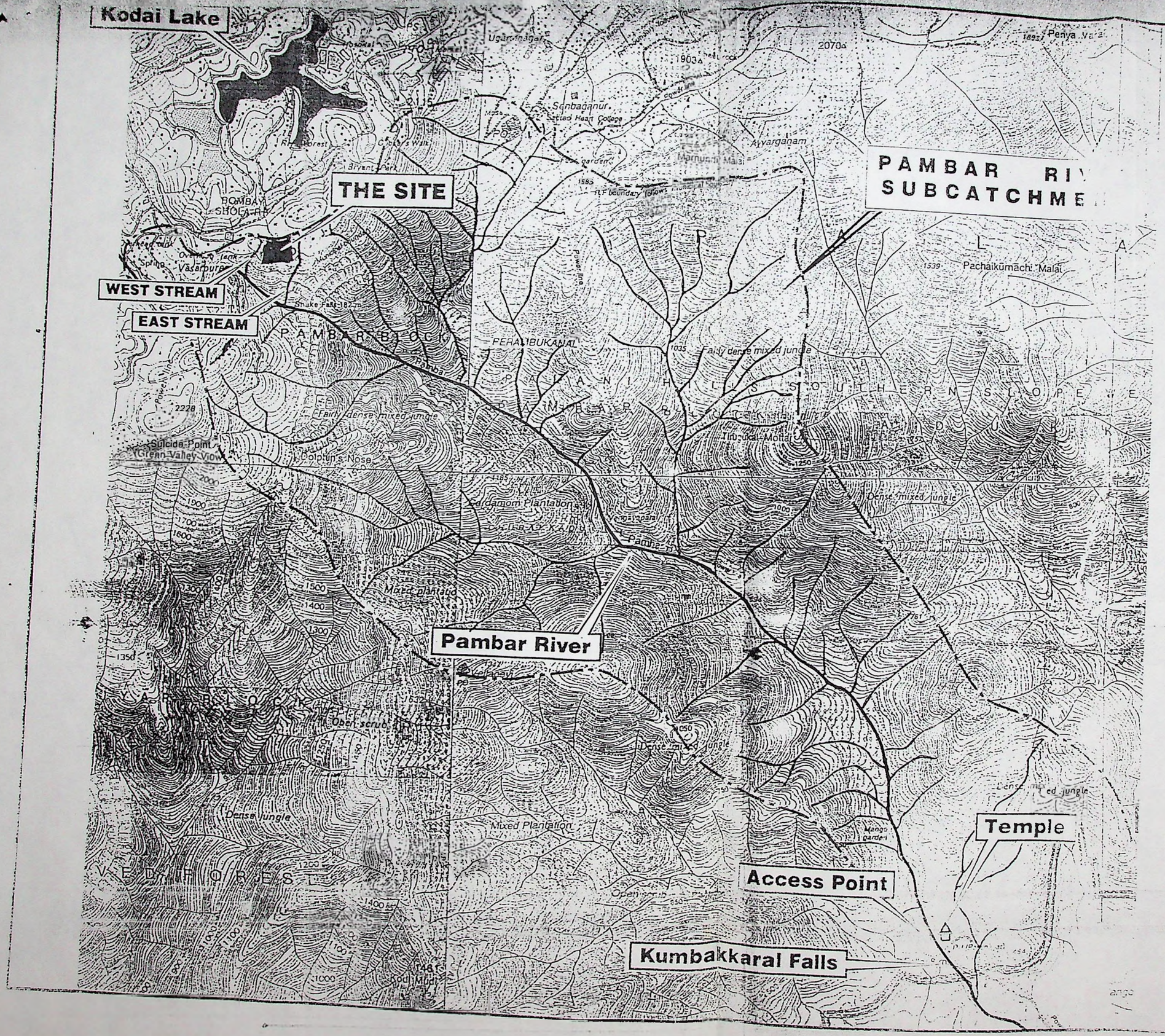

KODAI LAKE
LKW
LK2
LK3
LK1
Lake Road
US6
US4
US5
Shola Road
Lower Shola Road
Upper Shola Road
US3
US2
USW1
US1
CC1
CML
CM
Block No. 22
Block No. 35
CML 2
CM1
CM2
Private Residence
La Providence Vacant Land
ST. MARY'S CHURCH
FOR ON-SITE SAMPLING LOCATIONS, REFER TO FIGURE 5
PONDS PATH
LAVANGE PATH
LP2
LP4
LP3
LP5
LP6
LP7
DFNE
DFSW
FOREST LAND
FOREST LAND
LEGEND
PPS1 Soil/Sediment Sample Locations
CML Lichen Sample Locations
WS Water Sample Locations
PAMBAR
SHOLA
FOREST
CLIENT
HINDUSTAN LEVER KODAIKANAL THERMOMETER FACTORY, TAMIL NADU, INDIA
PROJECT
TITLE
OFF-SITE SAMPLING LOCAT



DESIGNED DSW
DRAWN HC
CHECKED
APPROVED
DATE
STATUS FINAL

PROJECT 49032_002_353
CAD FILE 49032_002_004
REVISION A

0 500 1000
metres

SOURCE
DINDIGUL AND TENI DISTRICTS (TOPOGRAPHICAL MAPS 58F/6NE AND 58F/2NE)
PUBLISHED BY SURVEYOR GENERAL OF INDIA

CONTOUR INTERVAL 40 METRES

SITE ELEVATION 2130 METRES (APPROX)

LEGEND

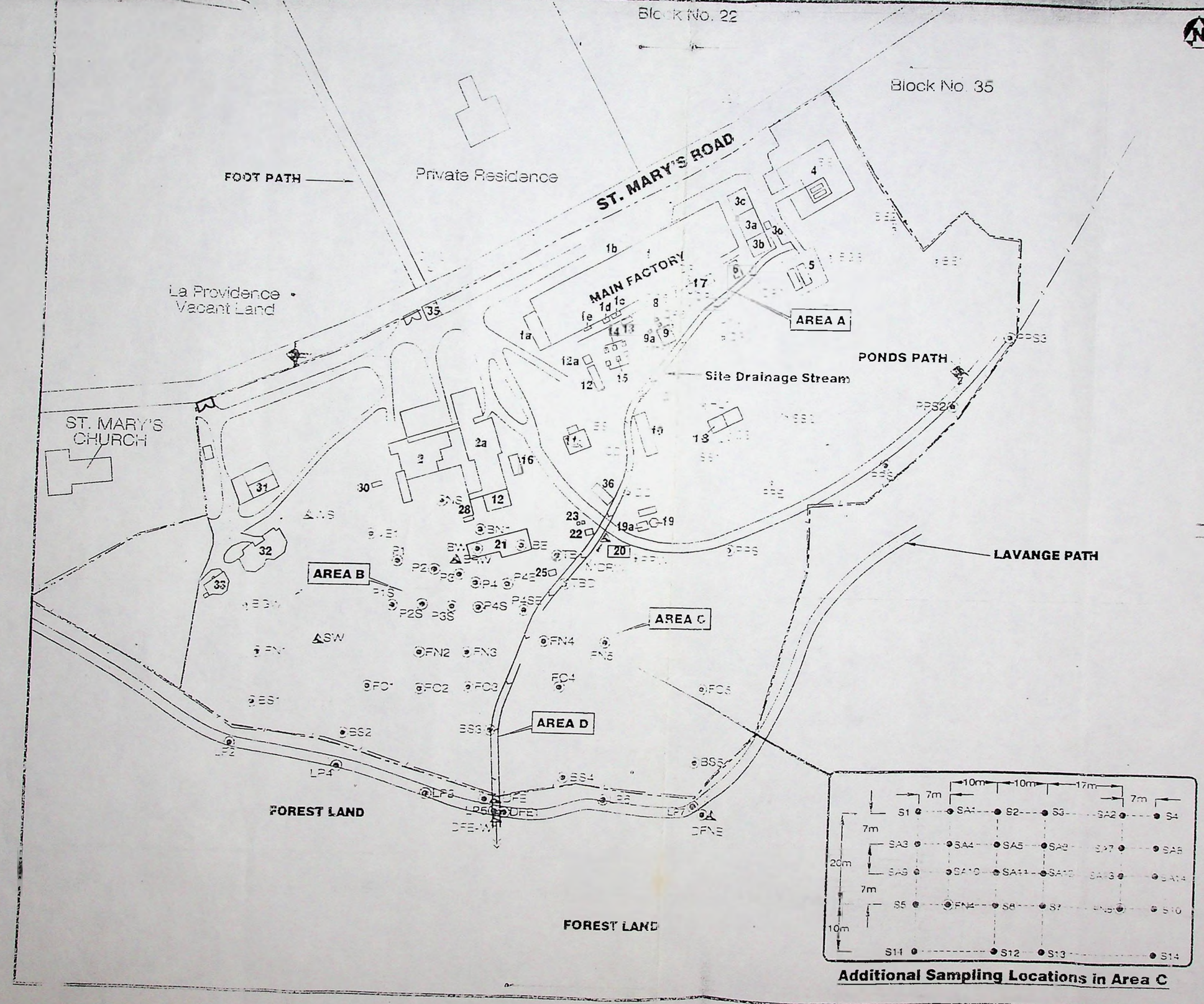
SUB-CATCHMENT BOUNDARY

CLIENT
HINDUSTAN LEVER KODAIKANAL THERMOMETER FACTORY TAMIL NADU, INDIA

PROJECT
ENVIRONMENTAL SITE AND RISK ASSESSMENT FOR MERCURY

TITLE
TOPOGRAPHY MAP

URS



Additional Sampling Locations in Area C

DESIGNED: DSW | APPROVED
DRAWN: HC | DATE
CHECKED | STATUS: FINAL
PROJECT: 49032_002_353
CAD FILE: 49032_002_001
REVISION: A

0 20 40 60 80
metres

Existing Building Numbers

1. Main Factory
2. Old Admin Block
3. Generator
3b. Switch Room
4. LPG Storage Yard
5. Diesel Storage Yard
6. Compressor Cooling Tower Water Collection Tank Sump
8. Collection Treatment Settling Tank
9. Aeration Tank
9a. TW Collection Sump
10. Crusher/Recovery Area
11. Existing Well & Pump House
12. Rain Water Collection Sump
12a. Pump Shed
13. Sump
14. Rain Water Collection Sump
15. Cooling Water
16. Eastern Spring Tank
17. Distillation Plant
18. Sludge Storage Area
19. Septic Tank
20. Domestic Sewage Treatment Plant
21. Waste Glass Store
22. Incinerator (Not in use)
23. Sump
27. Canteen Water Collection
28. Kitchen (Fire Wood Fuel)
30. Compressor Room
31. Servant Quarters
32. Staff
33. Staff Quarters
34. Transformer Yard
35. Security Room
36. Spring Tank

LEGEND

- SA2 Additional Soil Sample Locations
- PPS1 Soil/Sediment Sample Locations
- CML Lichen Sample Locations
- WS Water Sample Locations
- Proposed Remediation Areas

CLIENT
HINDUSTAN LEVER KODAIKANAL THERMOMETER FACTORY, TAMIL NADU, INDIA

PROJECT
ENVIRONMENTAL SITE AND RISK ASSESSMENT FOR MERCURY

TITLE
SITE LAYOUT AND SAMPLE LOCATION PLAN

URS

FIGURE 5

E 8A-5

How to Hold a Mercury Thermometer Roundup

The Problem with Mercury Thermometers

Mercury thermometers have been used for decades as a first step to care for someone who isn't feeling well. Ironically, mercury fever thermometers can be a risk to the health of families and communities. Public health officials report over 15,000 calls a year to poison control centers about broken mercury thermometers. A thermometer contains about 0.7 to 1.5 grams of mercury. Fever thermometers are one of the largest single sources of mercury discarded annually in municipal solid waste, estimated at 17 tons of mercury.

Why Hold a Mercury Thermometer Exchange??

Exchanges are easy to hold with big payoffs. Depending upon how big or elaborate you envision your event, coordinating an exchange is relatively easy. The benefits of an exchange are numerous:

- When given the information about the hazards of mercury thermometers, people are more than willing to find a safe place to get rid of them.
- Providing a free non-mercury alternative is a big bonus; people are always thankful to get free things, especially when the associated benefits are so positive.
- The public image and media opportunities should not be overlooked. This is a win-win situation for everyone and the public will be receptive to that message.

Planning your Exchange

The success of a roundup depends on the successful promotion of the event. If people do not know about the event, not only will they not turn in their thermometer, but the opportunity for education on the health and environmental impacts of mercury will be lost. A hospital exchange is relatively simple to undertake. Primarily, this is because your audience is easily defined. You have a few straight-forward means to promote the event. Promotion is therefore simple and inexpensive. In addition, the audience is a known quantity. Based on the number of employees, a simple formula can be used to estimate the number of exchange thermometers needed for purchase and disposal. Experience has shown that 15%-20% of hospital employees will bring in their home thermometers.

Choosing a Non-Mercury Thermometer

While there are a variety of mercury-free thermometers available in the market place, there are primarily two types that fall within the budget of an exchange. These alternatives are the geratherm thermometer, and the digital thermometer. Your purchasing department can easily get prices on these two alternatives.

Funding

Before you go looking for funding it is important to know what you are asking for. Is it money for thermometers, or other in-kind support? The simplest exchange requires thermometers, disposal, and perhaps some money for printed promotional materials. Compared to many programs, the funding budget for a thermometer roundup is rather small.

Pub 2-05 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*.
For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.
This version: October 15, 2001

High profile events will typically require a higher budget to fund food, receptions, etc. Including these niceties can mean adding the task of intensive fundraising to the work of organizing an event.

Mercury Thermometer Disposal

Those helping with the exchange and those turning in their thermometer will want to know the eventual fate of the mercury in the thermometers. Currently, the mercury in fever thermometers and other mercury-containing devices is recycled using a process called "roast, retort and distillation." Basically, the mercury-containing items are crushed, and heated so that the mercury evaporates and is thus separated from the glass and other debris. The gaseous mercury is then retorted or condensed back to a liquid state. The liquid mercury is then distilled to remove impurities and can be used again in new mercury-containing products.

Publicity

- Fliers
- Table tents – dining room, staff lounges
- Newsletters
- E-mail announcements (the day before event, post an automatic announcement – "don't forget your mercury thermometer tomorrow!")
- Announcement in payroll checks

Safety and Environmental Logistics

It is important to make sure that in all promotional materials participants are told to bring in thermometers in rigid containers. This can help protect against problems should the thermometer break on the way to the exchange event.

Work with workplace or state safety or hazardous materials specialists during the event planning process to ensure regulatory and compliance issues are being considered. If you are going to transport the collected thermometers to the disposal facility it is important to ensure that transport and labeling regulations are being followed. Mercury debris treated for reclamation is considered a "universal waste", but contact your state's hazardous materials section to ensure you will be in compliance with your state's environmental requirements.

Someone with mercury spill cleanup training should be on hand at the event with mercury spill equipment.

Reception

A workplace reception can be a great way to help promote the exchange, but at the same time has the potential to use a lot of planning time. In the hospital setting, by virtue of medical profession involvement, a reception can help draw attention to mercury as a public health issue. At a reception it is useful to have a display on mercury, mercury–free alternatives in the home and workplace, and mercury pollution prevention literature.

Options for speakers include physicians or clinicians that can speak to the health hazards of mercury, state or federal speakers addressing the status of mercury legislation, and local environmental organization representatives and workplace staff on what that organization is doing to address mercury reduction/elimination.

Educational Opportunities

Before the event, collect enough educational materials to distribute. In addition to the mercury publications included in this resource kit, you may want to provide:

- Your state fish advisories
- List of other mercury-containing items in the home
- Local and state contact information about disposal options for other mercury-containing household items

Location and Schedule of the Exchange

It is important to time your exchange so that is convenient for those participating in the exchange.

In a workplace with shift workers, try at a minimum to schedule the exchange over one shift change. It is easy for exchange participants to trade in their thermometer at the beginning or end of their shift. If possible try to hold the exchange over at least a two-hour minimum. The longer the event, the greater the chance the internal word of mouth will remind workplace staff of the event.

Holding the event in a popular community meeting area will also help the success of the exchange. Typically, the most successful meeting place is the cafeteria. Setting up the "exchange table" outside the cafeteria doors will guarantee a steady stream of people. In many hospitals there is a shift change at the lunch hour. Accounting for location and timing will help the exchange tremendously.

Other Considerations

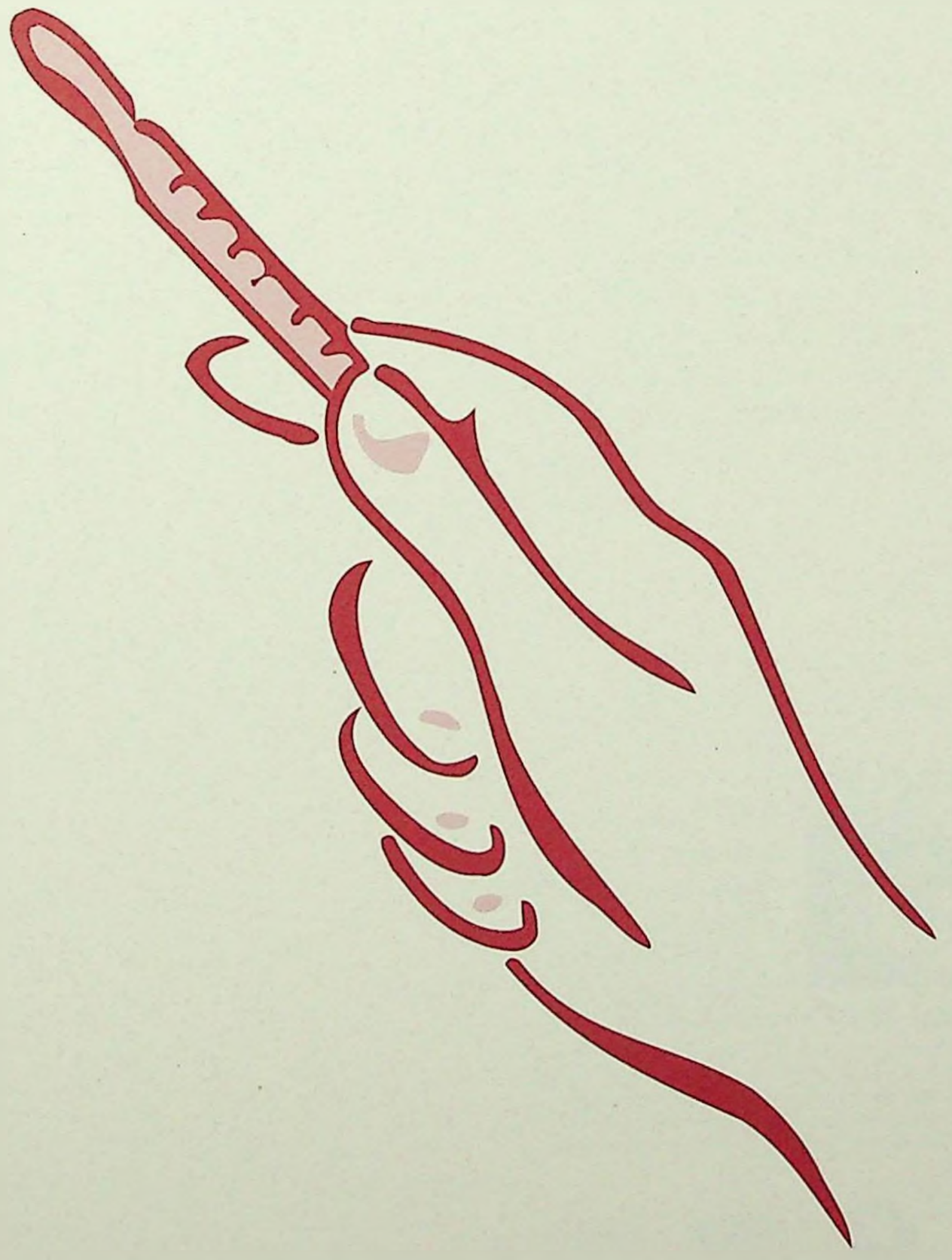
Either due to good promotion or a small budget you should also be prepared with a contingency plan should you run out of thermometers. Will you offer a voucher that the participant can redeem in the future, will you turn them away, or do you promote the exchange of free thermometers only "while quantities last?"

You can involve your hospital pharmacy and local drugstores by asking them to provide discount vouchers for mercury-free thermometers if your supply runs out. At the same time, you can ask them to no longer sell mercury thermometers. If you are organizing an exchange in a hospital, you can prevent embarassing questions by assuring people that the hospital pharmacy has ended the sale of mercury thermometers.

Collection Procedure

1. Participants remove unbroken thermometer from rigid container. Dispose of container in a recycling bin and place thermometer on a piece of bubble wrap spread on a tray.
2. Keep track of the number of thermometers collected and the number of families participating. A flip chart may be used to visually show progress throughout the exchange event.
3. When the tray "fills up," wrap the stack of unbroken thermometers in bubble wrap, secure with rubberband and place in a collection container. The collection container should be labeled "Mercury Thermometers" and any rigid container that has a lid will work. (Five gallon containers used in food service or for dry-wall spackle work well.) Participants should not reach in or place their thermometers directly into the container.
4. Broken thermometers should be placed directly into the collection container without removing them from their rigid plastic container.

For more detailed information, see HCWH's 12-page booklet *How to Plan and Hold a Mercury Thermometer Exchange*.



Battery Round-Ups: Get Charged!

The Problem With Batteries

Many different types of batteries are in use in hospitals. Pagers, infusion pumps, fetal monitors, portable EKG monitors, flashlights, smoke detectors, hearing aids, and portable generators are just a small sampling of devices that use batteries in hospitals. Several types of batteries contain mercury and may also contain other heavy metals such as lead and cadmium.

Many hospitals have battery-recycling programs for a portion of their batteries. Unfortunately, there is considerable confusion on proper management methods for batteries. This confusion can lead to poor capture rates, and improper disposal of batteries into red bag waste.

A battery round-up is an excellent way to provide education on the hazards associated with batteries, and on proper battery management to hospital staff and their families. It is also an excellent way to initiate, or improve upon, an ongoing, comprehensive battery collection program. Finally, they are an excellent follow-up to a mercury thermometer collection program.

What is a Battery Round-up?

A battery round-up is a permanent hospital-wide battery collection and recycling program for employees and their family members. All non-mercury containing batteries are collected for proper disposal (they will not be incinerated) and all mercury-containing batteries are recycled.

Within a hospital, a number of different types of batteries are utilized. Special care should be taken to separate each type individually, as they are disposed of in different ways, depending on their content. Batteries should not be incinerated. The battery types to look for in your facility include:

Mercury-Containing Batteries

- **Mercuric-oxide** (button, some cylindrical, and rectangular) Mercuric-oxide batteries contain the highest percentage of mercury, and are classified as hazardous waste. Businesses and institutions are required to manage these hazardous materials through recycling or hazardous waste treatment/disposal.

  Common uses: pacemakers, defibrillators, fetal monitors, heart monitors, pagers, telemetry devices, temperature alarms and blood analyzers

  Recycling/disposal options: recycle to reclaim mercury

- **Alkaline and Carbon-zinc** (nine volt, D, C, AA, AAA, alkaline button) Alkaline and carbon-zinc batteries contain chromium and zinc, and older ones (pre-1996) may contain mercury. All imported batteries (even new) are likely to contain mercury (except those manufactured in Western Europe and Japan, which may contain trace levels). These are classified as non-hazardous.

  Common uses: pumps, diagnostic equipment, defibrillators, otoscopes, opthalmoscopes, dictation machine, pen lights, glucometers, flash lights and telemetry devices

  Recycling/disposal options: recycle older alkalines to reclaim mercury; recycle newer alkalines to reclaim zinc, or dispose of in a landfill or treat as hazardous waste

Non-Mercury Containing Batteries

The following batteries are classified as hazardous waste. Businesses and institutions are required to manage these hazardous materials through recycling or hazardous waste treatment/disposal.

- **Lead-acid** (button, some cylindrical and rectangular) Lead-acid batteries contain lead. Some are rechargeable.

  Common uses: wheelchairs, portable generators

Pub 2-06 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.
This version: October 15, 2001

Recycling/disposal options: recycle to reclaim lead, or treat as hazardous waste

- **Nickel-cadmium** (9 volt, C, D, AA, AAA, battery packs) Nickel-cadmium batteries contain high levels of nickel and cadmium. They are labeled as rechargeable.

  Common uses: emergency lighting, portable communication devices and medical equipment backup

  Recycling/disposal options: recycle to reclaim nickel and cadmium, or treat as hazardous waste

- **Silver-cadmium** (9 volt, C, D, AA, AAA, battery packs) Silver-cadmium batteries contain silver and cadmium. These batteries are rechargeable.

  Common uses: medical electronics

  Recycling/disposal options: recycle to reclaim silver and cadmium, or treat as hazardous waste

- **Small sealed lead-acid flat plates** (gum packs, pack configurations) Small sealed lead-acid flat plates contain high levels of lead. They are labeled and are rechargeable.

  Common uses: emergency lighting, portable communication devices, medical equipment backup and laptop computers

  Recycling/disposal options: recycle to reclaim lead, or treat as hazardous waste

Planning

Such a program may seem like a big undertaking, but with proper planning a battery round-up provides for good public relations, employee morale, and potential savings from the elimination of battery disposal in red bag waste. Important stakeholders to involve in a planning team include: hospital department staff from Safety, Facilities, Community Relations, Communications, Purchasing and Laboratory. Other important stakeholders to include are: State Hazardous Waste or Pollution Control Agencies and your hospital recycling contractor(s). Anticipate six months to plan your battery round-up.

Important committees to include in the planning process are:

- **Fundraising** – to cover printing costs for posters, tent cards, advertising and the reception;
- **Event Planning** – a high visibility event and reception for employees and family members that will mark the beginning of a permanent hospital-wide ongoing battery collection and recycling program;
- **Publicity** – internal public information planning (posters, email alerts, tent cards for tables, newsletters, etc.) and external media communications; and
- **Education** – responsible for development of educational pieces for distribution to hospital workers and their families about battery recycling, including types of batteries used in health care, examples of their use, and mercury content.

Resources

Recycling America's Rechargeable Batteries. The Plan. Rechargeable Battery Recycling Corp

Reducing Mercury Use in Health Care

"Greening Hospitals" HCWH

Mercury Disposal Options for Region 1 US EPA June 1999 by Rebecca Herman, contractor

Mercury Pollution Prevention in Healthcare: A Prescription for Success by Guy Williams

Pollution Prevention for Health Care Facilities by Hollie Shaner.

11th International Seminar on Battery Waste Management, Conference Literature

Florida Educational Seminars, Inc. (Sponsored by the Battery Industry)

Implementation of the Mercury-Containing & Rechargeable Battery Management Act (EPA530-K-97-009)

Used Dry Cell Batteries: Is a Collection Program Right for Your Community US EPA EPA 530-K-92-006

Universal Waste Rule US EPA EPA530-F-95-025

Health Care Without Harm

1755 S Street, NW
Suite 6B
Washington, DC 20009
Phone: 202.234.0091
Fax: 202.234.9121
www.noharm.org
info@hcwh.org

This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.

Dioxin, PVC, and Health Care Institutions

What is dioxin?

Dioxin is the name given to a group of persistent, very toxic chemicals. The group includes chlorinated dibenzo-dioxins, the most toxic of which is 2,3,7,8 -tetrachlorodibenzo-p-dioxin (TCDD), and chlorinated dibenzo-furans. The group also includes related compounds which are structurally similar and are dioxin-like in their activity. The toxicity of these compounds is measured against TCDD using "toxic equivalents," which assign a fractional potency to each dioxin. Dioxins, defined here to include dioxins and furans, have equivalence factors assigned to them. The EPA has not assigned equivalence factors for brominated dioxins, brominated furans, brominated biphenyls and PCBs, although it is believed each group includes some dioxin-like compounds.

Dioxins and related compounds are highly persistent in the environment and in living organisms. They are bioaccumulative and fat-soluble. Their concentrations increase as they biomagnify up the food chain.

What are the hazards of dioxin?

Dioxins are extremely toxic and potent environmental contaminants. They modulate and disrupt growth factors, hormones, enzymes, and developmental processes. In animals, dioxin causes cancer in multiple organ systems, sometimes at exposure levels as low as nanograms per kilogram of body weight. Prenatal exposure to dioxin in rodents substantially increases the risk of breast cancer later in life.[1] Human epidemiological studies conclude that dioxin causes cancer in humans as well.[2] A draft report by the EPA estimates that as many as one in 1,000 of the most highly exposed people in the general population are at risk of developing cancer because of dioxin.

Dioxin also has widespread effects on reproduction and development, as shown in animal and human studies. Tiny doses in the range of nanograms (one thousandth of one millionth of a gram) to micrograms (one millionth of a gram) per kilogram of body weight of dioxin can cause harm. Exposure to these levels on a single day during pregnancy cause permanent disruption of male sexual development in rodents, including delayed testicular descent, lower sperm counts, and feminized sexual behavior.[1] In primates, small dietary exposures to dioxin are associated with an increased risk and severity of endometriosis.[4] A study in humans also shows higher levels of dioxin in women with endometriosis than in a control population.[5]

Dioxin is particularly toxic to the developing immune system. Animal tests show that nanograms per kilogram doses given 1-4 times during pregnancy cause permanent alterations in the immune system of offspring.[6] Human studies also show an increased susceptibility to infection and changes in immune system parameters as a result of in utero exposure to ambient environmental levels of dioxin and dioxin-like compounds.[7,8] Low levels of exposure during pregnancy also alter thyroid hormone levels in mothers and offspring, perhaps explaining neurological effects, including learning disabilities, that are seen in carefully conducted primate studies.[9]

How are we exposed?

The US EPA estimates that over 90% of our exposure is through food, with major sources including beef, dairy products, fish, pork, and breast milk.

Pub 3-01 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.
This version: October 15, 2001

What is the level of exposure in the general population?

The general population, through ordinary dietary exposures, carries a current body burden of dioxin that is near or above the levels that cause adverse effects in animal tests. Through food alone, Americans are getting 22 times the maximum daily dioxin exposure considered by the US EPA to be without adverse effects.

Breast milk contamination is such that the nursing infant, during vulnerable periods of development, is exposed to dietary levels of dioxin 35 to 65 times the amount considered safe. Nonetheless, breast feeding remains far superior to formula feeding for a variety of reasons, and reducing breast feeding is not an appropriate public health response.

What are the sources of dioxins?

Dioxins are unintentionally formed during a variety of industrial processes. Dioxin-like compounds can be generated and released to the environment from various combustion processes when chlorine donor compounds are present. Chlorine donor compounds can include polyvinyl chloride (PVC) plastic and other chlorinated compounds. Dioxin compounds can also be formed during the manufacture of chlorine and chlorine-containing compounds including the monomers which comprise PVC, chlorinated solvents and pesticides. Dioxins can also be formed during the bleaching of paper with chlorine, and in other industrial and combustion processes that include the presence of chlorine.

The primary source of dioxins from the health care sector is waste incineration. Chlorine-containing products burned in incinerators, including medical devices and products, provide the chlorine necessary for dioxin formation.

Prior to the implementation of new rules (which will reduce the health care sector's contribution to total dioxin loading) the EPA identified municipal and medical waste incinerators as two of the leading sources of dioxin emissions to air in the US.

Once dioxin is emitted into the air from incinerators and other sources, rain, snow and dust can carry it to the surface of the earth, where it can enter the food chain.

What is the evidence that the manufacture of PVC feedstocks is linked to dioxin formation?

The draft dioxin reassessment recently released by the US Environmental Protection Agency (EPA) reviews the contribution of PVC manufacturing to dioxin emissions.[10] According to calculations of the Vinyl Institute (an industry trade association), reviewed and given a medium confidence rating by the EPA,[11] the production of PVC and its feedstocks result in air releases of 11.2-31.0 grams toxic equivalency (TEQ)[12] dioxins and furans per year. These levels may understate the contribution of dioxin from the manufacture of PVC throughout its lifecycle.

Under what conditions can the combustion of PVC result in dioxin formation?

The draft EPA dioxin reassessment also reviews the contribution of waste incineration to dioxin emissions. The report summarizes a large body of literature that finds carbon and catalysts must be present in an incinerator in order for dioxins to form.[13] PVC is usually the largest chlorine source in municipal and medical waste incinerators. The relationship between chlorine inputs into an incinerator and dioxin formation, however, depends upon combustion conditions.

For uncontrolled combustion, such as open burning of household waste, landfill fires, or building fires, a direct association between chlorine content of the combusted material and dioxin formation has been established. For example, a study of the open burning of household waste showed that waste containing larger amounts of PVC (4.5% vs. 0.2%) produced substantially larger amounts of dioxins in air emissions (269 vs. 44.3 microgram/kg waste burned) and ash (7,356 vs. 489 microgram/kg waste burned).[14]

In modern commercial waste incinerators, the rate at which dioxins are formed and released depends upon chlorine inputs, incinerator design, operating conditions, the presence of catalysts, and pollution control equipment. While the EPA concludes, based on studies of modern waste incinerators, that the largest determinants of dioxin formation are operating conditions (including overall combustion efficiency, post-combustion flue gas temperatures, and residence times — and the presence of iron or copper catalysts) rather than chlorine content alone, there is little doubt that chlorine content of the waste feed is critical.

Several laboratory and incinerator pilot studies have found a direct relationship between chlorine loading and dioxin emissions.[15] In addition, the EPA's conclusion appears to rest largely on an analysis of incinerator emissions data by Rigo, et al. (1995), which has serious methodological flaws.[16] It is also important to note that the EPA conclusion refers only to stack gas emissions, which are a relatively small fraction of total dioxins released from incinerators, and does not consider releases in fly ash, bottom ash, and water discharges.

For any given waste incinerator, according to the EPA, conditions may exist in which changes in chlorine content of waste feed will correlate highly with dioxin and furan emissions. These conditions may prevail during start-up or shut-down, changes in waste feed rate, or operational upsets. Although modern commercial waste incinerators are designed and intended to be operated to minimize release of dioxins and other hazardous air pollutants, they are, nevertheless, a significant source of dioxin releases.

What is Health Care Without Harm's position on dioxin, PVC, and medical waste incineration?

Available data reveal a complex relationship among chlorine feed, design and operating conditions, and dioxin emissions. It is certain that chlorine sources are necessary for dioxin emissions, PVC products are the largest chlorine source, and incinerators with pollution control equipment are significant sources of dioxin releases in stack gases, fly ash, bottom ash, and water discharges. Moreover, even modern, well-designed incinerators do not consistently operate at optimal combustion conditions.

For these reasons, along with concern about other hazardous pollutants emitted from waste incinerators — including mercury, particulates, sulfur and nitrous oxides, and hydrochloric acid — Health Care Without Harm has taken the pollution prevention position that PVC use should be minimized and ultimately eliminated, alternatives used when available without compromising patient safety or care, and all unnecessary waste incineration should be avoided.

Notes

1. Brown NM, Manzolillo PA, Zhang JX, et al. Prenatal TCDD and predisposition to mammary cancer in the rat. Carcinogenesis 19(9):1623-1629, 1998.
2. Steenland K, Piacitelli L, Deddens J, et al. Cancer, heart disease, and diabetes in workers exposed to 2,3,7,8-tetrachlorodibenzo-p-dioxin. J Natl Cancer Inst 91(9):779-786, 1999.
3. Mably TA, Moore RW, Peterson RE. In utero and lactational exposure of male rats to 2,3,7,8-tetrachlorodibenzo-p-dioxin. 1. Effects on androgenic status. Toxicol Appl Pharmacol 114:97-107, 1992; and Schantz SL, Bowman RE. Learning in monkeys exposed perinatally to 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). Neurotoxicol Teratol 11(1):13-19, 1989.
4. Rier SE, Martin DC, Bowman RE, et al. Endometriosis in Rhesus monkeys (Macaca mulatta) following chronic exposure to 2,3,7,8 –tetrachlorodibenzo-p-dioxin. Fund Appl Toxicol 21:433-441, 1993.
5. Mayani A, Barel S, Soback S, Almagor M. Dioxin concentrations in women with endometriosis. Human Reprod 12(2):373-375, 1997.
6. Birnbaum LS. Workshop on perinatal exposure to dioxin-like compounds. V. Immunologic effects. Environ Health Perspect 103(suppl 2):157-160, 1995.
7. Weisglas-Kuperus N, Koopman-Esseboom C, et al. Immunologic effects of background prenatal and postnatal exposure to dioxins and polychlorinated biphenyls in Dutch infants. Pediatr Res 38:404-410, 1995.
8. Weisglas-Kuperus N, Patandin S, Berbers G, et al. Immunologic effects of background exposure to polychlorinated biphenyls and dioxins in Dutch preschool children. Environ Health Perspect 108(12):1203-1207, 2000.
9. Koopman-Esseboom C, Morse DC, Weisglas-Kuperus N, et al. Effects of dioxins and polychlorinated biphenyls on thyroid status of pregnant women and their infants. Pediatr Res 36(4):468-473, 1994.
10. See US EPA, Report #: EPA/600/P-00/001Ab, March 2000
11. The EPA developed a three-part confidence rating scheme: "high" means the estimate is derived from a comprehensive survey; "medium" is based on estimates of average activity and number of facilities or a limited survey; and "low" is based on data judged possibly non-representative
12. Since the toxicity of the various congeners of dioxins and furans varies, the toxicity of a given mixture of congeners is usually expressed as TEQs, where the most toxic form is assigned a value of one and the relative contribution of others is calculated accordingly.
13. Dioxins/furans form most readily in commercial incinerators as the combustion gases reach cooler temperatures, primarily in the range 200-450°C.
14. Lemieux PM. Evaluation of emissions from the open burning of household waste in barrels. US EPA. EPA/600/SR-97/134, 1998.
15. For example, see: Bruce, et al, The role of gas phase Cl2 in the formation of PCDD/PCDF during waste combustion, Waste Management, 11: 97-102, 1991; Kanters, et al, Chlorine input and chlorophenol emission in the lab-scale combustion of municipal solid waste, Environmental Science and Technology, 30: 2121-2126, 1996; and Wagner and Green, Correlation of chlorinated organic compound emissions from incineration with chlorinated organic input, Chemosphere, 26: 2039-2054, 1993.
16. In 1995, the Vinyl Institute commissioned a report, prepared for the American Society of Mechanical Engineers, that purported to examine the relationship between PVC in incinerator waste feed and dioxin emissions (Rigo HG, Chandler JA, Lanier WS, The relationship between chlorine in waste streams and dioxin emissions from combustors, The American Society of Mechanical Engineers, 1995). After examining data from dozens of burns in a number of municipal and medical waste incinerators, the report concludes that there is no statistically significant relationship between fuel chlorine content and dioxin emissions. The analysis, however, is flawed in a number of significant ways. First, there was no attempt to control for differences in incinerator design or operating conditions so that the question of interest could be addressed independent of other variables. Second, the authors used data collected for regulatory compliance purposes and not intended to examine the relationship between chlorine input and dioxin output. Without actually knowing the PVC content of the waste feed, they were forced to use hydrochloric acid emissions as a surrogate for chlorine loading. Hydrochloric acid emissions can be used to approximate chlorine loading but do not provide precise estimates. Moreover, in the tested incinerators, dioxin concentrations were sampled at various points in the exhaust stream – from boiler outlet to further downstream – predictably a source of variability, since dioxin can be formed at various points in the exhaust, depending on temperature and fly ash composition. This sampling strategy provides a poor estimate of total dioxin emissions to the air and ash. In summary, this analysis relies on data that are poorly suited to answer the question of interest. A more complete referenced discussion of the connection between PVC incineration and dioxin formation may be found in: Thornton J., Pandora's Poison: Chlorine, Health, and a New Environmental Strategy (Chapter 7), MIT Press: Cambridge MA, 2000.

What's Wrong With Incineration?

Health Care Without Harm has several concerns regarding the burning of waste generated by health care (both solid waste and regulated medical waste). Incineration produces both toxic air emissions and toxic ash residue.[1] The air emissions affect the local environment, and in many cases, may affect communities hundreds or thousands of miles away. The ash residue is sent to landfills for disposal, where the pollutants have the potential to leach into groundwater. (It must be noted that waste treated by other methods and then landfilled will also produce leachate.)

In addition to releasing the pollutants contained in the waste stream to the air and into the ash, burning medical waste actually creates new toxic compounds, such as dioxins. Medical waste incineration has been identified by the U.S. Environmental Protection Agency as the third largest known source of dioxin air emissions,[2] and as the contributor of about 10 percent of the mercury emissions to the environment from human activities.[3]

Many, if not most, on-site medical waste incinerators burn not only infectious waste, but also readily recyclable items such as office paper and cardboard. This destroys resources and prevents cost savings that could be recouped through recycling. Medical waste incineration's identification as a primary source of some very toxic pollutants stands in direct contradiction to physicians' oaths to "do no harm."

Dioxin

Dioxin belongs to a family of 419 chemicals with related properties and toxicity, but the term "dioxin" is often used to refer to the 29 that have similar toxicity. Dioxin is one of the most toxic chemicals known to humankind. While exposure of the general population occurs through the ingestion of many common foods, children exposed *in utero* during critical periods of development appear to be the most sensitive and vulnerable to the effects of dioxin.[4] Dioxin exposure has been linked to disrupted sexual development, birth defects and damage to the immune system. Dioxin has been associated with IQ deficits, hyperactive behavior and developmental delays.[5, 6]

The International Agency for Research on Cancer (IARC), an arm of the World Health Organization, acknowledged dioxin's cancer-causing potential when they classified it as a known human carcinogen.[7] The U.S. Environmental Protection Agency (EPA) has determined that most Americans are exposed to dioxin through ingestion of common foods, mostly meat and dairy products. Dairy cows and beef cattle absorb dioxin by eating contaminated feed crops. The crops become contaminated by airborne dioxins that settle onto soil and plants. Dioxins enter the air from thousands of sources including incinerators that burn medical, municipal and hazardous waste.[8]

Mercury

Mercury is a potent neurotoxin, which means it attacks the body's central nervous system; it can also harm the brain, kidneys and lungs. It can cross the blood-brain barrier as well as the placenta. Mercury poisoning can cause slurred speech, impaired hearing, peripheral vision and walking, muscle weakness, mood swings, memory loss and mental disturbances. The risks of damage to the nervous systems of developing fetuses and young children are primary reasons for fish-consumption advisories, aimed at discouraging pregnant women, women of child-bearing age, and young children from eating too much fish. Studies done on women who ate methylmercury-contaminated fish or grain showed that even when the mothers showed few effects of exposure, their infants demonstrated nervous-system damage. If mercury-containing items are put into a "red bag" for infectious waste and sent to an incinerator, mercury will

Pub 3-02 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.
This version: October 15, 2001

contaminate the air. (This can happen with non-incineration technologies as well. If mercury goes into treatment equipment, it will come out.) Airborne mercury then enters a global distribution cycle in the environment, contaminating fish and wildlife.

Other Hazardous Pollutants

Many other hazardous pollutants have been identified in the emissions from medical waste incinerators: arsenic, ammonia, benzene, bromodichloromethane, cadmium, carbon tetrachloride, chromium, chlorodibromomethane, chloroform, cumene, 1,2-dibromoethane, dichloromethane, dichloroethane, ethyl benzene, lead, mesitylene, nickel, particulate matter, naphthalene, tetrachloroethane, toluene, trichloroethane, 1,1,1-trichloroethane, trichloroethylene, trichloromethane, vinyl chloride, and xylenes.[1] Analysis of emissions of other treatment methods is necessary to determine if these emissions occur in the absence of combustion.

References

1. "Issues in Medical Waste Management Background Paper," Office of Technology Assessment, Congress of the United States, OTA-BP-O-49, October, 1988.
2. *Inventory of Sources of Dioxin in the United States* (EPA/600/ P-98/002Aa), National Center for Environmental Assessment, USEPA, April 1998, p. 2-13.
3. *Mercury Study Report to Congress, Volume I:* Executive Summary, USEPA Office of Air, December 1997, pp 3-6.
4. Pluim, HJ, Koope, JG, Olie, K., et al. 1994. "Clinical laboratory manifestations of exposure to background levels of dioxins in the perinatal period." *Act Paediatr* 83:583-587, Koopman-Esseboom C, Morse DC, Weisglas-Kuperus N, et al. 1994. "Effects of dioxins and polychlorinated biphenyls on thyroid hormone status of pregnant women and their infants." *Pediatr Res* 36: 468-473; Pluim HJ, de Vijlder JJM, Olie, K, et al. 1993. "Effects of pre- and postnatal exposure to chlorinated dioxins and furans on human neonatal thyroid hormone concentrations." Environmental Health Perspectives 101: 504- 508; Weisglas-Kuperus N, Sas TCJ, Koopman-Esseboom C, et al. 1995. "Immunologic effects of background prenatal and postnatal exposure to dioxins and polychlorinated biphenyls in Dutch infants." *Pediatr Res* 38: 404-410; Huisman M, Koopman-Esseboom C, Fidler V, et al. 1995. "Perinatal exposure to polychlorinated biphenyls and dioxins and its effect on neonatal neurological development." *Early Human Development* 41: 111-127.
5. "Workshop[s] on Perinatal Exposure to Dioxin-like Compounds. I-VI. Summar[ies]," *Environmental Health Perspectives Supplements*, Vol. 103, Supplement 2, March 1995.
6. *Health Assessment Document For 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD) And Related Compounds*, Vol. 1 of III, and Vol. II of III, USEPA, Office of Research and Development, EPA/600/ BP-92/001b and EPA/600/BP-92/001c, external review draft, and Devito, M J and Birnbaum, L S. (1994) "Toxicology of dioxins and related chemicals." In *Dioxins And Health*, Arnold Schecter, ed., NY: Plenum Press, 139-62, as cited in *Dying From Dioxin: A Citizen's Guide To Reclaiming Our Health And Rebuilding Democracy*, Gibbs, L M and the Citizens Clearinghouse for Hazardous Waste, Boston: South End Press, 1994, pp. 138-139.
7. "IARC Evaluates Carcinogenic Risk Associated with Dioxins," International Agency for Research on Cancer press release, February 14, 1997.
8. *Estimating Exposure To Dioxin-Like Compounds*, Volume I: Executive Summary, USEPA, Office of Research and Development, EPA/600/6-88/005Ca. June 1994 review draft, p. 36.
9. *Draft Technical Support Document To Proposed Dioxins And Cadmium Control Measure For Medical Waste Incinerators*, California Air Resources Board, 1990, pg.51, as cited in "Medical Incinerators Emit Dangerous Metals And Dioxin, New Study Says," Rachel's Environment & Health Weekly #179, May 2, 1990.

Health Care Without Harm

1755 S Street, NW
Suite 6B
Washington, DC 20009
Phone: 202.234.0091
Fax: 202.234.9121
www.noharm.org
info@hcwh.org

This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.

Order form for

Alternative Medical Waste Treatment Technologies

A Resource for Hospital Administrators, Facility Managers, Health Care Professionals, Environmental Advocates, and Community Stakeholders

Published August 2001

Table of Contents

This publication was printed in August 2001 and can be ordered by completing the form below and sending it by postal mail or via fax to:

Jolie Patterson, Health Care Without Harm
1755 S Street, NW, Suite 6B, Washington, DC 20009
Phone: 202.234.0091 Fax: 202.234.9121

You may also email your request to info@hcwh.org. Please supply the following information.

Donations to cover the cost of printing and postage are suggested. Please send your check or money order for $15 made payable to "Health Care Without Harm."

Name: _____

Organization: _____

Address: _____

City, State/Province, Zip Code: _____

Phone: (_____)_____ Fax:(_____)_____

E-mail: _____

Pub 3-03 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health*
For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.
This version: October 15, 2001

Reducing Polyvinyl Chloride (PVC) Use in Hospitals

There are many ways in which hospitals can take immediate action to reduce PVC use. The process will involve:

- gathering data through audits and letters to vendors;
- identifying alternatives;
- developing and implementing a PVC reduction plan; and
- establishing a PVC reduction policy.

Begin by identifying products that contain PVC and determining appropriate alternatives

Reducing PVC requires knowing which products contain PVC and the availability of alternatives. PVC products range from critical health care devices, such as disposable intravenous (IV) bags and tubing, to bedpans and notebook binders, as well as basic construction materials and furnishings, such as water pipes and wall coverings. If you take the time to identify products your hospital purchases and the materials that they are made of, it will facilitate the process of reducing PVC use over time. For example, Catholic Healthcare West, a large nonprofit hospital system, requires its group purchasing organization (GPO) to identify products that contain PVC.

To start a list of PVC products in your hospital see Table 1 and the Sustainable Hospitals Project website, www.sustainablehospitals.org.

What should be included in a PVC reduction plan?

Reduction priorities should be based on the potential for patient exposure to DEHP, potential for the PVC product to be incinerated upon disposal, volume of PVC use, and availability of substitute products.

Taking into consideration these concerns, it is wise to establish an organization-wide PVC reduction plan that includes the following priorities:

a. First, target disposable PVC health care products, especially within neonatal intensive care units (NICUs), maternity departments, and pediatrics.
b. Second, phase out the purchase of PVC office supplies.
c. Third, purchase PVC-free furnishings, furniture products, and construction products when purchasing new furniture, renovating existing departments, or constructing new wings or buildings; and
d. Fourth, when buying new durable medical products, specify those that are PVC-free.

Disposable PVC health care products should be the first priority because of the potential for significant patient exposure to DEHP and because they may be incinerated at the end of their useful life. DEHP exposure is critical to consider, especially for fetuses, newborns, and toddlers who may be exposed to levels of DEHP near or at those that cause harm in relevant animal models. Since DEHP is a reproductive and developmental toxicant, DEHP use in NICUs, maternity departments and pediatrics is of particular concern. For maternity departments, NICUs, and pediatrics, healthcare providers may decide that eliminating DEHP exposures in their particularly vulnerable patients justifies the higher cost for some of the alternatives.

Pub 3-04 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health* [illegible]
For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.
This version: October 15, 2001

Office supplies are another priority for elimination because they may be incinerated upon disposal, cost-competitive alternatives are widely available, and hospitals usually can replace them easily under existing contracts.

PVC-containing furnishings, furniture products, and construction products should be eliminated from new purchases, building renovations, and new building construction. For most of these products, cost-competitive, PVC-free alternatives are widely available.[4]

Durable medical products pose the greatest challenge to reduction due to the lack of knowledge of their PVC content and availability of PVC-free devices. The primary use for PVC in durable medical products is as the housing — the rigid, outer plastic covering — for testing and diagnostic equipment. Since durable medical products have a longer use life than disposable medical products (such as IV bags) and result in little DEHP exposure, they are a secondary target for reduction. A first step in reducing PVC use in these applications would be to require vendors to disclose the PVC content in their equipment.

How do PVC-free and DEHP-free alternatives differ?

DEHP-containing PVC: Because PVC is a rigid plastic by nature, manufacturers add DEHP to make PVC flexible. DEHP does not chemically bind to PVC. DEHP may therefore leach from plasticized PVC when a medical device comes into contact with fluids, lipids, and/or heat. DEHP is a reproductive and developmental toxicant in laboratory animal testing. Other toxicity concerns are unresolved. [See, Health Care Without Harm's Fact Sheet, "DEHP Exposure During the Medical Care of Infants: A Cause for Concern."]

PVC-free: Non-PVC plastics used in medical devices include silicone, polyethylene, and polypropylene. Most flexible, PVC-free medical devices do not contribute chlorine to waste incinerators and are, therefore, less likely to contribute to dioxin formation when waste is burned. In addition, PVC-free products do not contain plasticizers, and potential risks from plasticizer leaching are avoided.[1]

DEHP-free: DEHP-free PVC medical devices contain alternative softening agents (plasticizers), such as citrates and trimellitates, which have been substituted for DEHP. Both may leach from PVC, although at different rates, depending on the nature of the solution in the bag. Citrates are less hazardous than DEHP, as indicated by their use as a food additive. Much less is known about the safety/hazards of the trimellitates, though some research indicates that trimellitates leach less than DEHP.[2, 3] While purchasing DEHP-free PVC products is an option for reducing DEHP exposure, it should only be considered an interim solution because it does not address the lifecycle impacts of PVC.

Which disposable PVC health products contain PVC and what are the alternatives?

Disposable PVC health care products fall into five broad categories: bags, tubes, gloves, trays,[5] and catheters. Bags (42.5%), tubes (43.0%), and gloves (12.5%) account for 98% of disposable PVC healthcare products.[6]

PVC bags package IV products, enteral feeding formulas, and blood products (including packed red blood cells, fresh frozen plasma, and platelet rich plasma). PVC bags are also used to collect bodily fluids. DEHP-containing PVC medical bags first became a matter of concern in the 1970s because of DEHP exposures from the use of blood and total parenteral nutrition (TPN) bags.

Alternatives to PVC bags: PVC-free bags are on the U.S. market for packaging IV products, platelet rich plasma, fresh frozen plasma, enteral formula, and TPN. The PVC-free bags are both cost- and technically-competitive with the PVC bags.

For packed red blood cell bags, however, there is only a DEHP-free alternative. An unintended consequence of DEHP leaching from PVC bags is that it acts as a preservative of red blood cells by extending the shelf-life of stored red blood cells. The Food and Drug Administration does not regulate DEHP as an additive to red blood cells. The alternative plasticizer used in red blood cell bags is a citrate. Citrates, in fact, have a long history of use as a blood preservative. The shelf life of blood in citrate-plasticized bags is similar to that of DEHP-plasticized bags. A DEHP-free bag is on the market at a slightly higher cost than the DEHP-containing PVC bag.

PVC tubing conveys liquids — such as IV solutions and nutritional formulas — and respiratory gases to patients. PVC tubing and catheters are actually poor technical performers in medical treatments that involve contact with human tissue longer than approximately three to seven days. The leaching of DEHP not only exposes patients to the plasticizer, but also causes the product to become brittle and subject to cracking. For these reasons, products like umbilical vessel catheters and gastrostomy tubes are no longer manufactured from PVC. Recent research suggests that significant levels of DEHP may leach out of nasogastric tubes within 24 hours. A Swedish study of PVC nasogastric tubes used for 24 hours "showed that the section of the tube which had been inside the infant's stomach contained only half as much plasticiser as the rest of the tube. ...Since this discovery, the [Swedish County] council's medical board decided to substitute polyurethane tubes for the PVC ones."[7]

Alternatives to PVC tubing: PVC-free or DEHP-free tubing is on the US market for most medical applications. Silicone, polyethylene, and polyurethane are three alternative polymers frequently used in tubing applications. In most applications, at least one of these polymers can compete with PVC in terms of technical performance. In terms of economic performance, PVC-free tubing generally costs more than PVC tubing. In the next few years, however, plastics industry analysts expect metallocene polyolefins (polyethylene and polypropylene are polyolefins) to become cost-competitive with flexible PVC medical products.[8]

PVC gloves: PVC is used primarily in the manufacture of examination gloves and has little market share in the surgical glove market.

Alternatives to PVC gloves: Latex is the dominant material used in the manufacture of examination gloves. However, concerns with latex allergies have led hospitals and manufacturers to consider gloves made of different materials. For example, when Kaiser Permanente decided to phase-out the use of latex gloves it searched for PVC-free gloves, ultimately settling on gloves made of nitrile. While these are more expensive than latex and PVC gloves, Kaiser received a cost-competitive bid due to the size of its contract. Reflecting growing demand, a diversity of latex-free and PVC-free gloves is on the market today, although costs are slightly higher.[9]

Are PVC-free construction and furnishing products available?

PVC-free construction and furnishing products are widely available and are often cost-competitive. For example, PVC-free mattress covers and shower curtains can be purchased and are cost-competitive with the PVC products. During renovations and new building construction, hospitals should

Table 1. Polyvinyl Chloride (PVC) Products in Hospitals

Disposable Health Care Products

Blood Products and Transfusions
- apheresis circuits
- blood bags and tubing
- extracorporeal membrane oxygenation circuits

Collection of Bodily Fluids
- dialysis, peritoneal: drainage bags
- urinary collection bags, urological catheters, and irrigation sets
- wound drainage systems: bags and tubes

Enteral Feeding Products
- enteral feeding sets (bags and tubing)
- nasogastric tubes
- tubing for breast pumps

Gloves, Examination

Intravenous (IV) Therapy Products
- catheters
- solution bags
- tubing

Kidney (Renal Disease) Therapy Products
- hemodialysis: blood lines (tubing) and catheters
- peritoneal dialysis: dialysate containers (bags) and fill and drain lines (tubing)

Packaging, Medical Products
- film wrap
- thermoformed trays for admission and diagnostic kits, and medical devices

Patient Products
- bedpans
- cold and heat packs and heating pads
- inflatable splints and injury support packs
- patient ID cards and bracelets
- sequential compression devices

Disposable Health Care Products (continued)

Respiratory Therapy Products
- aerosol and oxygen masks, tents, and tubing
- endotracheal and tracheostomy tubes
- humidifiers, sterile water bags and tubing
- nasal cannulas and catheters
- resuscitator bags
- suction catheters

Office Supplies
- notebook binders
- plastic dividers in patient charts

Durable Medical Products
- testing and diagnostic equipment, including instrument housings

Furniture Products and Furnishings
- bed casters, rails, and wheels
- floor coverings
- furniture upholstery
- inflatable mattresses and pads
- mattress covers
- pillowcase covers
- shower curtains
- thermal blankets
- wallpaper
- window blinds and shades

Construction Products
- doors
- electrical wire sheathing
- pipes: water and vent
- roofing membranes
- windows

specify PVC-free products. Including home and commercial buildings, construction products, furnishings, and furniture products account for approximately 75% of all PVC end uses.

Why establish an organization-wide PVC reduction policy?

An organization-wide PVC reduction policy is an important step toward eliminating PVC products from hospitals because it reflects senior management's support for action, signals staff to take the issue seriously, and illustrates to vendors the need to market PVC-free products. Educational programs - workshops, grand rounds, and conferences - can raise staff and management's awareness of the lifecycle hazards of PVC and the toxicity of DEHP. The time investment in planning and education internally can result in broader PVC reduction policies. For example, Tenet Healthcare and Universal Health Services entered into memoranda of understanding between management and shareholders on reducing PVC use throughout their hospital systems after learning about the hazards of PVC.

Tenet Healthcare agreed to: "investigate the availability and utility of PVC-free and phthalate-free disposable medical products available in the marketplace;" "seek information on a regular basis from its suppliers of disposable medical products concerning whether their products are PVC-free and phthalate-free;" and "request its suppliers of disposable medical products to aid in the development of and further advancements in PVC-free and phthalate-free disposable medical products."

Notes

1. A few PVC-free products do contain chlorine, including neoprene gloves, which are manufactured from polychloroprene.
2. Christensson A, Ljunggren L, Nilsson-Thorell C, Arge B, Diehl U, Hagstam KE, Lundberg M. In vivo comparative evaluation of hemodialysis tubing plasticized with DEHP and TEHTM. Int J Artif Organs 14(7):407-10, 1991.
3. Quinn MA, Clyne JH, Wolf MM, Cruickshank D, Cooper IA, McGrath KM, Morris J. Storage of platelet concentrates—an in vitro study of four types of plastic packs. Pathology 18(3):331-5, 1986.
4. Currently wire and cable coated with PVC is the most difficult of these products to replace.
5. Trays are used to package surgical instruments, kits for surgical procedures, medical diagnostic kits, and admission kits.
6. Schlechter, M. Plastics for Medical Devices: What's Ahead? Norwalk, CT: Business Communications Company, Inc., 1996.
7. The Federation of Swedish County Councils, PVC in the Swedish Healthcare System, Stockholm, 2000.
8. "The PVC markets that are specifically targeted for replacement [by metallocene polyolefins] include flexible medical uses, packaging film, wire and cable insulation, transportation, flooring and geomembranes" (Aida M. Jebens, 1997, Chemical Economics Handbook: Polyvinyl Chloride (PVC) Resins, Palo Alto: SRI International, p. 580.1882B).
9. For a list of products see. www.sustainablehospitals.org.

Health Care Without Harm
1755 S Street, NW
Suite 6B
Washington, DC 20009
Phone: 202.234.0091
Fax: 202.234.9121
www.noharm.org
info@hcwh.org

This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.

Alternatives* to Polyvinyl Chloride (PVC) and Di-2-Ethylhexyl Phthalate (DEHP) Medical Devices

Products detailed in this publication include:

Ambulatory Products

Bedding Products

Blood bags:
- fresh frozen plasma
- packed red blood cells
- platelets
- platelet rich plasma

Body Bags

Central line catheters and PICC lines
- introcan safety catheters
- midline catheters
- percutaneous catheter introducers
- peripherally-inserted central catheters (PICC)

Dialysis, peritoneal
- rigid dialysate containers
- peritoneal catheters

Enteral feeding sets
- bags and tubing
- extension sets

Enteral feeding nasogastric tubes
- PEG tubes
- gastrostomy tubes
- nasoenteric tubes
- nasogastic tubes
- nasojejunal tubes
- pediatric clear straight catheters

Epidural vessel catheters

Gloves, Examination

Intravenous (IV) products:
- administration sets
- bags
- infusion tubes

Patient ID Bracelets

Respiratory Therapy Products
- endotracheal tubes
- masks, aerosol and oxygen
- oxygen hood
- tracheostomy tubes

Sequential Compression Devices

Total parental nutrition
- bags
- catheters
- tubing

Umbilical vessel catheters

Urinary drainage catheters
- Foley catheters
- urethral catheters for pediatrics
- urinary catheters

Wound Drains and Drainage Systems
- drains
- nephrostomy catheters
- surgical and wound drains
- thoracic catheters

Office Supplies

Shower Curtains

---

* Health Care Without Harm does not endorse any of these products, has not tested them for safety or efficacy, and does not take responsibility for the accuracy of the information or product performance. Listing here is based solely on information provided by the manufacturer. Non-PVC products may contain much smaller amounts of DEHP. Flexible PVC-free products still must be tested to ascertain whether they are in fact DEHP-free. Products that contain latex and chlorine are excluded from this table: latex products because of concerns over latex allergies and chlorine containing products because of concerns over lifecycle hazards. Exceptions are made for the few PVC products for which few or no non-PVC products are available. In those cases non-DEHP products are identified. This table is a work-in-progress.

Sources: Sustainable Hospitals Project, 2000, "Alternative Products," see http://sustainablehospitals.org (Lowell: Sustainable Hospitals Project, UMass Lowell); and Tickner, Joel, et al, 1999, The Use of Di-2-Ethylhexyl Phthalate in PVC Medical Devices: Exposure, Toxicity, and Alternatives (Lowell: Lowell Center for Sustainable Production, UMass Lowell); and all information was verified through telephone contacts with manufacturer representatives or review of manufacturer website information.

Pub 3-05 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care.*
For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.
This version: October 15, 2001

Alternatives to Polyvinyl Chloride (PVC) and Di-2-Ethylhexyl Phthalate (DEHP) Medical Devices (Part 1 of 4)

Products	Manufacturer	Telephone	Webpage	Material	Comments
Ambulatory Products	Many manufacturers including Merry Walker Corp.	815-678-3388	www.merrywalker.com	Steel	Product: Merry Walker
Bedding Products	Precision Dynamics Corp.	800-847-0670	www.pdcorp.com	Polyethylene	Disposable mattress and pillow covers, draw sheets
Blood Bags	Baxter Healthcare, Fenwal Division	800-766-1077	www.baxter.com	Polyolefin Non-DEHP PVC	Bags for platelets, platelet rich plasma and fresh frozen plasma Bags for packed red blood cells
Body Bags	LASAN Plastics, Inc.	207-693-4817	www.lasan.com	Polyethylene/polypropylene blend	
Central Line Catheters and PICC Lines	B. Braun	800-227-2862	www.bbraunusa.com	Polyurethane or Teflon Teflon or polyurethane	Percutaneous catheter introducers Central venous catheter, introcan safety catheter
	Becton Dickinson	201-847-6800	www.bd.com	Silicone or polyurethane	Peripherally-inserted central catheter, midline catheter
	Klein-Baker Medical	210-696-4061	www.neocare.com	Silicone	Peripherally-inserted central catheter (neonates)
	Utah Medical Products, Inc.	800-533-4984	www.utahmed.com	Silicone	Peripherally-inserted central catheter (neonates)
	Vygon	800-544-4907	www.vygonusa.com	Polyurethane or Silicone Polyurethane	Peripherally-inserted catheter (adults and neonates) Midline catheters (pediatrics or adults)
Dialysis, Peritoneal	B. Braun	800-621-0445	www.bbraunusa.com	Polypropylene/polyethylene comonomer	Rigid peritoneal dialysate container
	Degania Silicone	401-658-0130	www.deganiasilicone.com	Silicone	Peritoneal catheter
Enteral Feeding Sets	Children's Medical Ventures	800-377-3449	www.childmed.com	Non-DEHP PVC	Enteral set
	CORPAK MedSystems	800-323-6305	www.corpakmedsystems.com	Multi-layer bag: nylon, ethylene vinyl acetate, polypropylene Non-DEHP PVC	Non-PVC bag Non-DEHP tube
	Kendall Healthcare	800-962-9888	www.kendallhq.com	Non-DEHP PVC	Non-DEHP bag & tube
	Vygon	800-544-4907	www.vygonusa.com	Polyethylene	Extension set tubes

Alternatives to Polyvinyl Chloride (PVC) and Di-2-Ethylhexyl Phthalate (DEHP) Medical Devices (Part 2 of 4)

Products	Manufacturer	Telephone	Webpage	Material	Comments
Enteral Feeding--Nasogastric (NG) Tubes	CORPAK MedSystems	800-323-6305	www.corpakmedsystems.com	Silicone Polyurethane	Gastotrostomy tube for neonates PEG tube for neonates, nasoenteric feeding tube
	C. R. Bard, Inc.	800-545-0890	www.bardmedical.com	Silicone Polyurethane	Nasogastric tube for neonates Pediatric clear staright catheter
	Kendall Healthcare	800-962-9888	www.kendallhq.com	Polyurethane	Nasogastric tube, PEG feeding tube
	Kimberly-Clark (Ballard Medical Devices)	800-524-3557	www.kchealthcare.com	Silicone	PEG feeding tube, gastrotomy feeding tube, jejunal feeding tube
	Klein-Baker Medical	210-696-4061	www.neocare.com	Silicone	Feeding tube for neonates
	Ross	800-231-3330	www.ross.com	Polyurethane Silicone	Nasoenteric feeding tube, nasojejunal feeding tube Gastrostomy tube (some peds), PEG tube
	Utah Medical Products, Inc.	800-533-4984	www.utahmed.com	Silicone	Nasogastric and nasojejunal tubes (neonates/peds)
	Vygon	800-544-4907	www.vygonusa.com	Polyurethane Silicone	Gastric feeding tubes for infants, sump tube (Salem or Replogal) Nasojejunal tubes
	Zevex	800-970-2337	www.zevex.com	Polyurethane	Nasoenteric feeding tube
Epidural Vessel Catheters	B. Braun	800-227-2862	www.bbraunusa.com	Polyamide (Nylon)	Epidural vessel catheter
	Vygon	800-544-4907	www.vygonusa.com	Polyethylene, polyurethane or polyamide (nylon)	Epidural vessel catheter
Gloves, Examination	Allegiance Healthcare Corp.	800-964-5227	www.allegiance.net	Nitrile	
	Ansell-Perry	800-321-9752	www.ansellhealthcare.com	Nitrile	
	Best Manufacturing Co.	800-241-0323	www.bestglove.com	Nitrile	
	ECI Medical Technologies	902-543-6655	www.ecimedical.com	Styrene butadiene	
	Maxxim Medical	800-727-7951	www.maxximmedical.com	Polyurethane	

Alternatives to Polyvinyl Chloride (PVC) and Di-2-Ethylhexyl Phthalate (DEHP) Medical Devices (Part 3 of 3)

Products	Manufacturer	Telephone	Webpage	Material	Comments
Gloves, Examination (continued)	Safeskin Corporation	800-462-9993	www.safeskin.com	Nitrile	
	SmartCare Inc.	800-822-8956	www.smartcare.com	Nitrile	
	Tillotson Healthcare Corp.	800-445-6830	www.thcnet.com	Nitrile	
Intravenous (IV) Bags and Tubing	B. Braun	800-227-2862	www.bbraunusa.com	Multi-layer bag: Polypropylene/polyethylene copolymer, polyester, elastomer laminate	IV bag (Excel)
				Polypropylene/polyethylene copolymer	IV bag (PAB)
				Polyethylene	IV set with PVC-free tube (no longer manufacturing, but still available from some vendors)
	Budget Medical Products	800-569-1620	www.icumed.com	Non-DEHP PVC	IV tube
	Children's Medical Ventures	800-377-3449	www.childmed.com	Non-DEHP PVC	IV administration sets
	Curlin Medical	714-893-2200	www.curlinmedical.com	Non-DEHP PVC	Infusion tube
Office Supplies: 3-ring binders	Available from standard office supply companies	800-847-0670		Polyethylene, cardboard	
Patient ID Bracelets	Precision Dynamics Corp.	800-521-5123	www.pdcorp.com	Tyvek®	Appropriate for short stays
	TabBand	800-940-3993	www.tabband.com	Tyvek®, polypropylene and polyethylene	
	Wristband & Medical Specialty Products	800-348-6064	www.wristbandsupply.com	Tyvek®	Appropriate for short stays
Respiratory Therapy Products	Bivona Medical Technologies	800-847-8000	www.bivona.com	Silicone	Endotracheal tube, tracheostomy tube
	DHD Healthcare	800-553-5214	www.dhd.com	Silicone	Aerosol mask
	Rusch	800-533-4984	www.ruschinc.com	Red rubber or silicone	Reusable endotracheal tube
	Utah Medical Products, Inc.	800-932-0760	www.utahmed.com	Co-polyester--polyethylene foam and polypropylene	Disposable infant oxygen hood
	Vital Signs	800-962-9888	www.vital-signs.com	Polyester	Oxygen or aerosol applications-Aero2Mask

Alternatives to Polyvinyl Chloride (PVC) and Di-2-Ethylhexyl Phthalate (DEHP) Medical Devices (Part 4 of 4)

Products	Manufacturer	Telephone	Webpage	Material	Comments
Sequential Compression Device	Kendall Healthcare	800-846-3000	www.kendallhq.com	Polyolefins	
Shower Curtains	Brookstone	800-222-6883	www.brookstone.com	Tyvek®	
	Many manufacturers			Nylon	
Total Parenteral Nutrition	Abbott	800-766-1077	www.abbott.com	Non-DEHP PVC	Empty IV bag and tube
	Baxter Healthcare, Fenwal Division	800-544-4907	www.baxter.com	Ethylene vinyl acetate	TPN bag
	Vygon	800-962-9888	www.vygonusa.com	Polyurethane	Catheter for parenteral nutrition and mid/long-term IV therapy (See PICC lines above)
Umbilical Vessel Catheters	Kendall Healthcare	210-696-4061	www.kendallhq.com	Polyurethane	Umbilical vessel catheter
	Klein-Baker Medical	800-533-4984	www.neocare.com	Silicone	Umbilical vessel catheter (neonates)
	Utah Medical Products, Inc.	800-544-4907	www.utahmed.com	Silicone or polyurethane	Umbilical vessel catheter
	Vygon	800-545-0890	www.vygonusa.com	Polyurethane	Umbilical vessel catheter
Urinary Catheters	C.R. Bard	800-658-0130	www.bardmedical.com	Polyurethane	Urethral catheter for pediatrics
	Degania Silicone	401-658-0130	www.deganiasilicone.com	Silicone	Foley catheter
	Klein-Baker Medical	800-533-4984	www.neocare.com	Silicone	Urinary drainage catheter (neonates)
	Utah Medical Products, Inc.	800-545-0890	www.utahmed.com	Silicone	Urinary catheters
Wound Drains/Drainage Systems	C.R. Bard	401-658-0130	www.bardmedical.com	Silicone	Drains
	Degania Silicone	800-533-4984	www.deganiasilicone.com	Silicone	Surgical and wound drains, thoracic catheter, nephrostomy catheter (may fit neonates)
	Utah Medical Products, Inc.		www.utahmed.com	Silicone	Thoracic catheter

Health Care Without Harm does not endorse any of these products, has not tested them for safety or efficacy, and does not take responsibility for the accuracy of the information or product performance. Listing here is based solely on information provided by the manufacturer. Non-PVC products may contain much smaller amounts of DEHP. Flexible PVC-free products still must be tested to ascertain whether they are in fact DEHP-free. Products that contain latex and chlorine are excluded from this table: latex products because of concerns over latex allergies and chlorine containing products because of concerns over lifecycle hazards. Exceptions are made for the few PVC products for which few or no non-PVC products are available. In those cases non-DEHP products are identified. This table is a work-in-progress.

Sources: Sustainable Hospitals Project, 2000, "Alternative Products," see http://sustainablehospitals.org (Lowell: Sustainable Hospitals Project, UMass Lowell); and Tickner, Joel, et al, 1999, The Use of Di-2-Ethylhexyl Phthalate in PVC Medical Devices: Exposure, Toxicity, and Alternatives (Lowell: Lowell Center for Sustainable Production, UMass Lowell); and all information was verified through telephone contacts with manufacturer representatives or review of manufacturer website information.

Health Care Without Harm
1755 S Street, NW
Suite 6B
Washington, DC 20009
Phone: 202.234.0091
Fax: 202.234.9121
www.noharm.org
info@hcwh.org

This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.

DEHP Exposures During the Medical Care of Infants

A Cause for Concern

Prepared by
Ted Schettler MD, MPH
Science and Environmental Health Network

What is DEHP (di-ethylhexyl phthalate)?

DEHP is one member of a family of chemicals called phthalates and is used as a plasticizer of polyvinyl chloride (PVC) medical devices. Plasticizers provide PVC with flexibility, strength, and bondability. Most PVC medical devices contain 20-40% DEHP by weight, but PVC tubing may contain up to 80% DEHP.[1,2] DEHP-plasticized PVC products are common in neonatal intensive care units (NICUs). Manufacturers use DEHP in bags that contain IV solutions, enteral formula, and blood products, and in tubing that delivers these fluids as well as TPN and oxygen.

DEHP-containing PVC medical products have been used for approximately 40 years. When the Food and Drug Administration (FDA) was authorized to regulate medical devices beginning in the mid-1970's, products made of material formulations that had been used previously were not tested to the same degree as new products that came to market after May, 1976. Any change in the status of older products or new products made of the same material must be based on a FDA conclusion that their use poses a significant risk of harm, rather than the manufacturer being required to demonstrate product safety.

How are patients exposed?

DEHP does not chemically bind to PVC. DEHP may therefore leach from plasticized PVC when a medical device comes into contact with fluids, lipids, and/or heat. DEHP is lipophilic and leaches preferentially into lipid-containing solutions. The rate of DEHP leaching also depends on storage conditions (e.g. temperature, contact time, agitation).

In general, medical procedures that require hours or days, like hemodialysis, blood transfusion, extracorporeal membrane oxygenation (ECMO), total parenteral nutrition (TPN), or enteral feeding, result in higher DEHP exposures than brief procedures. On a weight basis, neonates in the neonatal intensive care unit (NICU) are likely to be among the most highly DEHP-exposed patients because of the regular use of many different DEHP-containing PVC products in that setting.

What are the health effects of DEHP?

DEHP is a reproductive and developmental toxicant in laboratory animal testing. MEHP, the monoester metabolite of DEHP, is toxic to the Sertoli cells of the testes, causing cellular abnormalities and impairing proliferation. In rodents, developmental DEHP exposure causes more general adverse effects on the structure and function of the male reproductive tract.[3] Effects on the developing male reproductive tract occur at far lower doses than are toxic to adult animals.[4,5,6] The testicular toxicity of DEHP has not been evaluated in immature, prepubertal primates, including humans. Based on developmental studies in animals, the Food and Drug Administration (FDA) and the National Toxicology Program's Center for Evaluation of Risks to Human Reproduction conclude that some medical procedures result in DEHP exposures that exceed the threshold NOAEL (no observable adverse effects level) in the developing male reproductive tract (NOAEL by oral route of exposure ~3.7-14 mg/kg/day) and exceed the FDA's estimated tolerable intake (TI), below which no adverse effects are expected.[7,8]

In addition to effects on the developing male reproductive tract, questions have been raised about the effects of DEHP exposure on the liver and lungs. One prospective study found cholestasis in infants supported by ECMO.[9] The authors hypothesize that hemolysis during ECMO produces a large bilirubin load, the excretion of which is inhibited by inspissated bile and/or

Pub 3-06 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.
This version: October 15, 2001

DEHP. Another study, however, did not find cholestasis after ECMO,[10] but DEHP plasma concentrations in the second study were substantially lower than in the first (estimated aggregate exposure levels 4.7-35 mg/kg vs. 42-140 mg/kg). Recently, renewed concerns have surfaced about a contributory role of DEHP in the genesis of hepatotoxicity frequently observed in infants receiving TPN.[11] Although this potential hazard has not been studied, larger quantities of DEHP leach from PVC tubing through which TPN solution is passed than were previously estimated. The authors of this study estimate that infant exposures from TPN may reach 10 mg/kg/day, which is more than one order of magnitude higher per kg than adult exposures from hemodialysis, and are experienced daily.

DEHP also leaches from PVC endotracheal tubes during use. One study documents a direct relationship between time of endotracheal tube use and DEHP leaching.[12] The authors hypothesize a link between DEHP exposure and the risk of bronchopulmonary dysplasia in premature newborns. This potential hazard has never been studied in infants. DEHP deposition in the infant lung, however, has been documented after ventilation with PVC tubing.[13]

The FDA also notes that DEHP leaching from PVC materials promotes platelet aggregation and complement activation, with the potential for adverse clinical consequences, including microemboli.[14]

Toxicokinetics of DEHP

Much of the DEHP administered via the gastrointestinal tract is converted to its monoester, mono-ethylhexyl phthalate (MEHP), by intestinal lipases before absorption into the systemic circulation. In adult primates, including humans and marmosets, a smaller proportion of DEHP is hydrolyzed and absorbed as the monoester [than in rats], apparently because of less lipase activity in primate intestine.[15] The degree of biotransformation of DEHP to MEHP is important since MEHP is generally agreed to be the testicular toxicant.

When DEHP is administered intravenously, less DEHP is converted to MEHP than if the exposure is via the intestinal tract.[16] In studies of patients, including infants, undergoing hemodialysis or exchange transfusions, however, significant levels of MEHP have been measured in blood after these parenteral exposures.[17] In a study of 11 patients undergoing maintenance hemodialysis for treatment of renal failure, concentrations of the metabolite, MEHP, ranged from about 1/3 to 6 times the DEHP concentrations.[18]

These data demonstrate that a significant amount of DEHP is converted to MEHP even after intravenous exposure to the parent compound. Humans and primates largely excrete the monoester via glucuronide conjugation, whereas rodents further hydrolyze MEHP into other intermediates.[19] The glucuronidation pathways of human children, however, do not mature until they are 3 months old.[20] Thus, this important clearance mechanism is not fully available to neonates and young infants.

What are the levels of DEHP exposure in the NICU?

Published reports of DEHP exposures from various sources in the neonatal intensive care unit are summarized in the table. For critically ill neonates, examining single sources of exposure may substantially underestimate total exposures. Babies who require ECMO, for example, also require multiple blood transfusions, parenteral feeding, medications, and IV fluids. Breast milk and enteral feeding formula may be administered through DEHP-containing PVC tubing. Loff, et al. note that, in infants receiving TPN, when infusions of other medications are also administered, the load can easily reach 10 mg DEHP/kg/day.[21] No studies have quantified exposure to DEHP from enteral feeding bags and tubing, nasogastric tubes, breast milk pumps and tubing, respiratory tubing, endotracheal tubes, oxygen masks, or all sources combined.

Summary

Neonates and infants who receive medical care that includes the use of plasticized PVC products may easily be exposed to DEHP at levels that are in excess of the no observed adverse effect level (NOAEL) in animal tests. For some medical therapies, these exposures also exceed the FDA-derived "tolerable intake" (TI). (see table) The FDA has concluded that total parenteral nutrition, enteral feeding, exchange transfusions, and ECMO can individually result in DEHP exposures that exceed the TI by 3-50 fold. Of course, multiple simultaneous medical procedures using DEHP-containing PVC products will more readily result in exposures in excess of the TI. DEHP toxicity in the developing male reproductive system is the greatest known risk, with additional concerns about thrombus formation, microemboli, and impacts on the liver and lungs. An expert panel convened by the National Toxicology Program's (NTP) Center for Evaluation of Risks to Human Reproduction concluded that:

> "[for DEHP] the available reproductive and developmental toxicity data and limited but suggestive human exposure data indicate that exposures of intensively-treated infants and children can approach toxic doses in rodents, which causes the panel serious concern that exposure may adversely affect male reproductive tract development."

The panel also expressed "concern that ambient oral DEHP exposures [primarily from general dietary contamination] to pregnant or lactating women may adversely affect the development of their offspring." DEHP exposures from medical therapy would, of course, add to ambient, dietary exposures. The FDA characterizes their safety assessment of DEHP as entirely consistent with the NTP panel's concerns.

Potential exposures to DEHP from medical procedures and nutrition in a neonatal intensive care unit

Source of DEHP Exposure	Exposure (mg DEHP/kg body weight)	Unit	Total Exposure or Concentration in Product	Source	TI/dose*
Artificial ventilation in preterm infants (PVC respiratory tubing; not polyethylene)	NR	Hour (inhalation)	0.001-4.2 mg(est. total exposure)	1	
Neonatal blood replacement transfusion; short-term, acute	0.3 (0.14-0.72)	treatment period	NR	2	2
Neonatal blood replacement transfusion; double volume; short term, acute	1.8 (0.84-3.3)	treatment period	NR	3	0.3
Platelet concentrates in newborns	1.9	treatment	NR	4	0.3
Extracorporeal oxygenation in infants	14-140	treatment	NR	5	0.04-0.004
Extracorporeal oxygenation in infants	4.7-34.9	Treatment	NR	6	0.12-0.02
Congenital heart repair (neonates)		1-4 hours	0.3-4.7 mg/mL/hr(change in level in whole blood during procedure)	7	
IV crystalloid solution	0.03	From tubing	NR	8	20
Total parenteral nutritional formula (TPN), with lipid	2.5	NR	3.1 ug/mL (concentration in TPN formula); more from tubing	9	0.2
TPN/IV Tubing	5	day	10 mg/2-kg baby/day	10	0.12
Multiple IV Sources: packed red blood cells, platelet rich plasma, fresh frozen plasma, and medications	5	day	10 mg/2-kg baby/day	11	0.12
Breast milk	0.0015-0.0165	Day	0.01-0.11 mg/kg (concentration in breast milk)	12	27-2.4
Infant formula	0.015	Day	0.004-0.06 mg/kg wet weight	13	2.6
Infant formula	0.0087-0.035	NR	0.33-0.98 mg/kg dry weight	14	4.5-1.1

NR = Not Reported *TI/dose: based on FDA's TI of 0.6 mg/kg/day for parenteral exposures and 0.04 mg/kg/day for intestinal exposures; TI/dose ratios < 1 imply that the TI has been exceeded for the given source of exposure

Notes

1. NTP-CERHR expert panel report on di(2-ethylhexyl)phthalate. National Toxicology Program. US Dept of Health and Human Services; Oct, 2000.
2. DiGangi J. Phthalates in vinyl medical products. Washington DC: Greenpeace USA, 1999.
3. Gray E, Wolf C, Lambright C, et al. Administration of potentially antiandrogenic pesticides (procymidone, linuron, iprodione, chlozolinate, p,p'-DDE, and ketoconazole) and toxic substances (dibutyl- and diethylhexyl phthalate, PCB 169, and ethane dimethane suphonate) during sexual differentiation produces diverse profiles of reproductive malformations in the rat. Toxicol Ind Health 14: 94-118, 1999.
4. Lamb J, et al. 1987. Reproductive effects of four phthalic acid esters in the mouse. Toxicol Appl Pharmacol 88: 255-269.
5. Arcadi R, Costa C, Imperatore C, et al. Oral toxicity of DEHP during pregnancy and suckling in the Long-Evans rat. Food Chem Toxicol 36:963-970, 1998.
6. Poon R, Lecavalier P, Mueller R, et al. Subchronic oral toxicity of di-n-octyl phthalate and DEHP in the rat. Food Chem Toxicol 35:225-239, 1997.
7. NTP-CERHR expert panel report on di(2-ethylhexyl)phthalate. National Toxicology Program. US Dept of Health and Human Services; Oct, 2000.
8. US FDA. Safety assessment of di(2-ethylhexyl)phthalate (DEHP) released from PVC medical devices. Sept, 2001.
9. Schneider B, Schena J, Truog R, et al. A prospective analysis of cholestasis in infants supported with extracorporeal membrane oxygenation. J Pediatr Gastroenterol Nutr 13: 285-89, 1991.
10. Karle V, Short B, Martin G, et al. Extracorporeal membrane oxygenation exposes infants to the plasticizer, di(2-ethylhexyl)phthalate. Crit Care Med 25:696-703, 1997.
11. Loff S, Kabs F, Witt K, et al. Polyvinylchloride infusion lines expose infants to large amounts of toxic plasticizers. J Pediatr Surgery 35(12): 1775-1781, 2000.
12. Latini G, Avery G. Materials degradation in endotrachael tubes: a potential contributor to bronchopulmonary dysplasia. Acta Pediatr 88(10):1174-5, 1999.
13. Roth B, Herkenrath P, Lehmann H, et al. Di-(2-ethylhexyl)-phthalate as a plasticizer in PVC respiratory tubing systems: indications of hazardous effects on pulmonary function in mechanically ventilated, preterm infants. Eur J Pediatr 147: 41-46, 1988.
14. US FDA. Safety assessment of di(2-ethylhexyl)phthalate (DEHP) released from PVC medical devices. Sept, 2001.
15. Pollack G, Li R, Ermer J, et al. Effects of route of administration and repetitive dosing on the disposition kinetics of di(2-ethylhexyl)phthalate and its mono-de-esterified metabolite in rats. Toxicol Appl Pharmacol 79:246-256, 1985.
16. Rubin R, Schiffer C. Fate in humans of the plasticizer, di-2-ethylhexyl phthalate, arising from transfusion of platelets stored in vinyl plastic bags. Transfusion 16:330-335, 1976.
17. Sjoberg P, Bondesson U, Sedin E, et al. Exposure of newborn infants to plasticizers. Plasma levels of di-(2-ethylhexyl) phthalate and mono-(2-ethylhexyl) phthalate during exchange transfusion. Transfusion 25(5):424-428, 1985.
18. Pollack G, Buchanan J, Slaughter R, et al. Circulating concentrations of di(2-ethylhexyl)phthalate and its de-esterified phthalic acid products following plasticizer exposure in patients receiving hemodialysis. Toxicol Appl Pharmacol 79:257-267, 1985.
19. Albro P, Corbett J, Schroeder J, et al. Pharmacokinetics, interactions with macromolecules and species differences in metabolism of DEHP. Environ Health Perspect 45:19-25, 1982.
20. Creistel T. Onset of xenobiotic metabolism in children: toxicological implications. Food Addit Contam 15:45-51, 1998.
21. Loff S, Kabs F, Witt K, et al. Polyvinylchloride infusion lines expose infants to large amounts of toxic plasticizers. J Pediatr Surgery 35(12): 1775-1781, 2000.

Table Sources

1. Roth B, Herkenrath P, Lehman H, et al. Di-(2-ethylhexyl)-phthalate as plasticizer in PVC respiratory tubing system: indications of hazardous effects on pulmonary function in mechanically ventilated, preterm infants. J Pediatr 147:41-46, 1988.
2. Sjoberg P, Bondesson U, Sedin E, et al. Exposure of newborn infants to plasticizers: Plasma levels of di-(2-ethylhexyl) phthalate and mono-(2-ethylhexyl) phthalate during exchange transfusion. Transfusion 25(5):424-428, 1985.
3. Sjoberg, 1985.
4. Huber WW, Grasl-Kraupp B, and Schulte-Hermann R. Hepatocarcinogenic potential of DEHP in rodents and its implications on human risk, Critical Reviews in Toxicology, 26: 365-481, 1996.
5. Schneider B, Schena J, Troug R, et al. Exposure to di(2-ethylhexyl)phthalate in infants receiving extracorporeal membrane oxygenation. New Engl J Med 320:1563, 1989.
6. Karle VA, Short BI, Martin GR et al. Extracorporeal membrane oxygenation exposes infants to the plasticizer, DEHP, Critical Care Medicine, 25: 696-703, 1997.
7. Barry YA, Labow RS, Keon, WJ, et al. Perioperative exposure to plasticizers in patients undergoing cardiopulmonary bypass. J Thorac Cardiovas Surg, 97: 900-905, 1989.
8. Loff, S, Kabs F, Witt K, Sartoris J, et al. Polyvinylchloride infusion lines expose infants to large amounts of toxic plasticizers, J Ped Surg, 35: 1775-1781, 2000.
9. Mazur HI, Stennett DJ, and Egging PK. Extraction of diethylhexylphthalate from total nutrient solution-containing polyvinyl chloride babs. J Parenter Enter Nutr, 13:59-62, 1989.; Loff, S, Kabs F, Witt K, Sartoris J, et al. Polyvinylchloride infusion lines expose infants to large amounts of toxic plasticizers, J Ped Surg, 35: 1775-1781, 2000.
10. Loff, S, Kabs F, Witt K, Sartoris J, et al. Polyvinylchloride infusion lines expose infants to large amounts of toxic plasticizers, J Ped Surg, 35: 1775-1781, 2000.
11. Loff, S, Kabs F, Witt K, Sartoris J, et al. Polyvinylchloride infusion lines expose infants to large amounts of toxic plasticizers, J Ped Surg, 35: 1775-1781, 2000.
12. Pfordt J and Bruns-Weller E. 1999. Die Phthalsäureester als eine Gruppe von Umweltchemikalien mit endokrinen Potential. Niedarsächsisches Ministerium fhr Ernährung, Landwirschaft und Forsten.
13. Petersen J and Breindahl T. Plasticizers in total diet samples, baby food, and infant formulae, Food Additives and Contaminants, 17: 133-141, 2000.
14. MAFF. Food surveillance information sheet - Phthalates in infant formulae. Joint Food Safety and Standards Group: MAFF - UK, 1996.

Health Care Without Harm

1755 S Street, NW
Suite 6B
Washington, DC 20009
Phone: 202.234.0091
Fax: 202.234.9121
www.noharm.org
info@hcwh.org

This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.

PRINTED WITH SOY INK

The PCF certification mark and term are the sole property of the Chlorine Free Products Association and are only used by authorized and certified users.

A Summary of the Expert Panel Report of the National Toxicology Program on DEHP and its Risks to Human Reproduction[1]

In October 2000, the National Toxicology Program of the U.S. Department of Health and Human Services' Center for the Evaluation of Risks to Human Reproduction (NTP-CERHR) released an Expert Panel report on Di(2-ethylhexyl)phthalate (DEHP) and its risks to human development and reproduction. Below is a summary of the Expert Panel's findings. The Panel did not consider risks other than those to reproduction and development. The NTP has not yet released its official findings.

Overall Findings

The National Toxicology Program's Expert Panel report focuses concern on three distinct populations at risk of DEHP exposure: critically ill infants, healthy infants and toddlers, and the offspring of pregnant or lactating women.

Critically ill infants: "The available reproductive and developmental toxicity data and the limited but suggestive human exposure data indicate that exposures of intensively-treated infants/children can approach toxic doses in rodents, which causes the Panel serious concern that exposure may adversely affect male reproductive tract development."[2]

Healthy infants and toddlers: "If healthy human infant/toddler exposure is several-fold higher than adults, the Panel has concern that exposure may adversely affect male reproductive tract development."[3]

Pregnancy and lactation: "[T]he panel has concern that ambient oral DEHP exposures to pregnant or lactating women may adversely affect the development of their offspring."[4]

DEHP: Preferred Plasticizer for Medical Devices

Di(2-ethylhexyl)phthalate, commonly referred to as "DEHP," is used as a plasticizer of polyvinyl chloride (PVC) in the manufacture of a wide variety of consumer products. Plasticizers provide PVCs with characteristics such as flexibility, strength, and bondability. Plasticizers allow PVC to be softened and shaped into many designs without cracking or leaking, "an important performance characteristic for medical devices."[5]

DEHP is currently the only phthalate plasticizer used in PVC medical devices. DEHP is used as a plasticizer for medical devices because it can provide the "desired mechanical properties" to the PVC.[6] By weight, PVC-based medical devices contain, on average, 20%-40% DEHP.[7]

Medical Procedures Where PVCs are Most Commonly Used

A variety of medical procedures use PVC-containing devices including: administration of intravenous (IV) fluids; cardiopulmonary bypass; ECMO (extracorporeal membrane oxygenation); enteral and total parenteral nutrition feedings; hemodialysis; respiratory therapy; and transfusion of whole blood, platelets, or plasma.[8] PVC tubing is used in medical applications such as extracorporeal membrane oxygenation (ECMO), feeding tubes, hemodialysis, IV fluid tubing, and mechanical ventilation.[9]

Absorption and Metabolism of DEHP

DEHP administered via the gastrointestinal tract is substantially converted to the monoester, MEHP, by intestinal lipases before absorption into the sys-

Pub 3-07 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.
This version: October 15, 2001

temic circulation. "In primates, including humans and marmosets, a smaller proportion of DEHP is hydrolyzed and absorbed as the monoester [than in rats], apparently because of less lipase activity in primate intestines."[10] When DEHP is administered intravenously, "the ratio of DEHP to its monoester in blood is much higher than if the DEHP is received orally."[11] The degree of biotransformation of DEHP to MEHP is important since MEHP is generally agreed to be the testicular toxicant that has led NTP-CERHR to raise a "serious concern" for neonates. (See "Development and Reproductive Effects of DEHP" section below.)

According to NTP-CERHR's Expert Panel, "[i]n a study of 11 patients undergoing maintenance hemodialysis for treatment of renal failure……concentrations of the metabolite, MEHP, ranged from about 1/3 to 6 times the DEHP concentrations."[12] These data demonstrate that a significant amount of DEHP is converted to MEHP even after intravenous exposure to the parent compound. Humans and primates largely excrete the monoester as a glucuronide, whereas rodents further metabolize this intermediate.[13] The glucuronidation pathways of human children, however, do not mature until they are 3 months old. Thus, the important clearance mechanism is not fully available to neonates and young infants."[14]

Developmental and Reproductive Effects of DEHP

The Expert Panel only looked at the risks of DEHP exposure to human reproduction and development.[15] Numerous animal studies indicate that the liver and testes are target organs of DEHP. "[I]t is clear from the existing data that testicular pathology and reduced sperm numbers are consistent effects [of DEHP]."[16] Testes, and specifically the Sertoli cell, have been identified as a target.[17] "The data are sufficient to conclude that DEHP is a reproductive toxicant in male rats, mice, ferrets, and guinea pigs when administered orally."[18]

> [T]here are sufficient data in rodents to conclude confidently that oral exposure to DEHP can cause reproductive and developmental toxicity in rats and mice. Further, an effect observed in rats involves adverse effects on the development, structure, and function of the male reproductive tract. Thus, for DEHP, the effects on reproduction and development are intertwined.[19]

Because reproductive effects occur at lower doses than are toxic to adult animals, "current concern focuses on prenatal exposure leading to postnatal toxicity."[20] As the NTP-CERHR Expert Panel report indicates,

> [R]ecent mechanistic studies have documented that phthalates are more potent reproductive toxicants at lower doses when exposure occurs during gestation. The most sensitive endpoints are those that monitor the development and formation of the reproductive system: testes descent, prepuce separation (also known as balanopreputial separation) in males, and vaginal opening and onset of estrous cycling in females.[21]

"Based on these studies, it would appear from the current data set that the LOAEL (lowest observed adverse effect level) is ~38 mg/kg bw/day and the NOAEL (no observed adverse effect level) is ~3.7-14 mg/kg bw/day for reproductive effects in rodents by the oral route."[22]

The NTP-CERHR Expert Panel report describes apparent species differences in the reproductive toxicity of DEHP and its metabolites. Two studies of juvenile or pubertal non-human primates (marmosets and cynomolgus monkeys) showed no effect on testicular weight after 2-13 week oral exposures to DEHP at 500-2500 mg/kg/day. The Panel concluded that for the cynomolgus monkeys,

> If the cynomolgus monkey were as sensitive as a juvenile rat to the effect of DEHP, testicular histopathology would have been observed. If the monkeys were only as sensitive as an adult rat, this dose would have been ineffective in producing testicular toxicity. Thus, while this study is useful in confirming that monkeys are not as sensitive as the most vulnerable of other model species, it is not useful in confidently placing the monkey along the spectrum of susceptibility to DEHP-induced testicular damage. As such, it is of limited use to the Panel in determining the likely risk of DEHP to human reproduction.[23]

Furthermore, there is "moderate-to-low" confidence that the authors found the real NOAEL or LOAEL for marmosets, because the most susceptible age of animal was not exposed and the most sensitive endpoints were not examined.[24]

Exposure to DEHP Can Be Increased Under Certain Conditions

The NTP-CERHR Expert Panel reports that DEHP does not bind to PVC, but instead leaches out when the medical device comes in contact with fluids or is heated.

> Since the DEHP plasticizer is not chemically bound to PVC, it can leach out when the medical device contacts fluids such as blood, plasma, and drug solutions, or it can be released and migrate when the device is heated. The rate at which DEHP migrates from the medical device into the stored material depends on the storage conditions (temperature of the fluid contacting the device, the amount of fluid, the contact time, the extent of shaking or flow rate of the fluid) and the lipophilicity of the fluid.[25]

DEHP leaches into many IV and enteral formulas/solutions, including whole blood, plasma, total parenteral and enteral nutrition solution, and solutions containing Polysorbate 80 and other formulation aids used to solubize some IV medications.[26] DEHP leaching also may occur during sterilization and irradiation.[27] The conditions under which medical devices are stored or treated can increase the migration of DEHP. Hence, "[l]ong

storage or use time, increased temperature, and agitation all increase leaching out of DEHP from medical devices. Leaching is also enhanced by increased lipid content or by the lipophilic nature of liquids that contact DEHP in medical devices."[25]

> In general, medical procedures that require hours or days, like hemodialysis or ECMO, result in higher DEHP exposures than brief medical procedures like infusion of packed red blood cells or administration of IV medications. Chronic or recurrent treatments like hemodialysis in chronic renal failure patients or multiple, long-term transfusions in cancer victims can result in cumulatively high exposures. Intensive procedures like exchange transfusions in neonates can result in acutely high exposures.[29]

Neonate exposures to DEHP from exchange transfusions range from 1,700-4,200 ug/kg bw per treatment.[30] Two studies estimated neonate exposures from ECMO at 42,000 to 140,000 ug/kg bw (or 4,200 to 14,000 ug/kg bw/day); and non-detect (using heparin-coated tubes) to 34,900 ug/kg bw per treatment (or non-detect to 3.49 ug/kg bw/day).[31] Evidence indicates that coated tubes may not leach as readily as non-coated.

IV Administration of Solutions and Drugs

IV administration of solutions and drugs may result in exposure to DEHP. "[S]everal studies have found that if normal saline and glucose solutions in PVC bags are agitated, DEHP may form an emulsion, increasing the amount of DEHP extracted into the solutions."[32] A variety of drugs are administered intravenously by adding them to PVC IV bags. Although pharmaceutical solvents such as ethanol and polyethylene glycol do not affect the extraction of DEHP from PVC storage bags, formulation aids such as Polysorbate 80 and castor oil dramatically increase the rate of DEHP extraction.[33] In addition, some drug formulations significantly increase the extraction of DEHP from the PVC container into the solution.[34]

Total Parental Nutrition

The NTP-CERHR Expert Panel report recognizes that one of the greatest risks of DEHP exposure exists in total parental nutrition (TPN) formulations.

> [TPN] formulations contain amino acids, dextrose, electrolytes, and lipids. The presence of lipids have been shown to increase extraction of DEHP from PVC bags. In TPN formulations without added lipids, there was no measurable amount of DEHP. In TPN formulations with added lipids, the concentration of DEHP in the TPN solutions increased with time and storage temperature.[35]

Single v. Multiple Exposures to DEHP

According to the NTP-CERHR Expert Panel,

> For many patients, particularly critically ill neonates, examining single sources of exposure (e.g., ECMO or ventilation) may substantially underestimate DEHP exposure. Babies who require ECMO, for example, also require multiple replacement blood transfusions, parenteral feeding, medications, and IV fluids. Many of these other inputs could substantially increase DEHP exposure. DEHP also passes through breast milk which, when available, is used in some critically ill, hospitalized babies, as part of enteral nutrition.[36]

Hence, multiple sources of DEHP exposure must be considered when evaluating the aggregate risk to an individual patient in a medical care setting.

Pediatric DEHP Exposure, Particularly in Neonates, Raises "Serious Concern"

While the NTP Expert Panel recognized that the benefits of medical procedures can outweigh any risks, the Expert Panel had "serious concern" that DEHP exposure may adversely affect male reproductive tract development of critically ill infants.[37] The available reproductive and developmental toxicity data and the limited but suggestive human exposure data indicate that exposures of intensively-treated infants/children can approach toxic doses in rodents.[38] Thus, the Panel concluded that pediatric exposure represents a special case.[39] Once again, NTP only reviewed the reproductive and developmental toxicity data of DEHP.

> Exchange transfusions, ECMO, and cardiopulmonary by-pass for correction of congenital anomalies all represent high exposure scenarios.... ECMO, used for refractory respiratory failure in both premature infants and term infants, gives one of the highest single-course exposures to DEHP.[40]

The scientific evidence available to the NTP-CERHR Expert Panel lead it to raise serious concerns about neonatal DEHP exposure and its potential link to reproductive problems. The report finds that:

- "[I]nfants undergoing routine replacement blood transfusions may be exposed to doses of DEHP 1-2 orders of magnitude above general population exposures and have concomitant MEHP exposure."[41] (MEHP is the monoester metabolite of DEHP.);
- "DEHP levels in necropsy tissues (heart and gastrointestinal) from premature neonates who received varying quantities of blood products were found to be significantly higher in comparison to those of infants who had not received blood transfusions;"[42]
- "Infants undergoing intensive therapies may be exposed to levels up to 3 orders of magnitude above general exposures. Chronic exposures in adults undergoing hemodialysis can be 1-2 orders of magnitude above average exposure to DEHP;"[43]
- "Documented parenteral medical exposure to DEHP of critically ill infants can exceed general population exposures by several orders of magnitude;"[44]

- "[M]edical exposures from simultaneous interventions in the same patient (e.g., ventilation, nasogastric tubes, transfusion, and parenteral feeding) have not been quantified. Such exposures may result in dose levels considerably above those documented for single medical procedures;"[45] and
- "The 3-30 ug/kg/d range of exposure for the general population may be increased by 2-3 orders of magnitude for infants undergoing intensive therapeutic interventions."[46]

Notes

1. Source document: NTP-CERHR Expert Panel Report on Di(2-ethylhexyl)phthalate, National Toxicology Program, U.S. Department of Health and Human Services, Center for the Evaluation of Risks to Human Reproduction, October 2000. Note: the downloadable NTP-CERHR report that is available from CERHR by mail or the internet site has double pages 9-12. Hence, all cites to the four repeated pages will be identified as "second page __."
2. Page 101.
3. Page 101.
4. Page 102.
5. Page 9.
6. Page 9. "These mechanical properties include flexibility, strength, suitability for use at a wide range of temperatures, suitability for various sterilization processes, resistance to kinking, optical clarity, weldability, barrier capability, centrifugability, and bondability."
7. Page 10.
8. Pages 9-10.
9. Page 12.
10. Page 85.
11. Page 34.
12. Page 34.
13. Page 85.
14. Page 85.
15. In addition to effects on the developing male reproductive tract, questions have been raised about the effects of DEHP exposure on the liver and lungs.
16. Page 94.
17. Page 98.
18. Page 94. "The oral repeat-dose studies in rats and mice consistently show that the primary targets for effect are liver, kidney, and testes. Effects were also observed in some studies on the pituitary, thyroid, thymus, ovaries, and blood. While the liver shows a biological response at the lowest doses of DEHP that cause effects, the testes' response at somewhat higher doses is a greater health hazard concern." Page 80.
19. Page 99.
20. Page 72.
21. Page 60.
22. Page 101.
23. Page 67.
24. Page 66.
25. Page 10.
26. Page 10.
27. Page 10.
28. Second page 9.
29. Page 13.
30. Second page 12.
31. Second page 12.
32. Page 11. "As expected, very little PVC leaches into normal saline solutions form PVC storage bags even after long periods of storage."
33. Page 12.
34. Page 12. Other drug formulations that significantly increase the leaching of DEHP include, cefoperazone (Cefobid Bulk), chlordiazepoxide HCL (Librium), ciproflocaxin (Cipro IV), cimetidine (Tagamet), cyclosporine (Sandimmune), etoposide (VePesid), fluconazole (Diflucan), metronidazole HCl (Flagyl IV), micronazole (Monistat IV), paclitaxel (Taxol), tracrolimus (Prograf), taxotere (Docetaxel), teniposide (Vumon), total parenteral nutrition formulas, and vitamin A. "The highest DEHP concentrations are reached when the drugs are pre-mixed in IV bags and the premixed solution is agitated for 24 hours. However, it should be noted that clinicians and nurses are familiar with the increased leaching of DEHP from PVC containers into lipophilic drug formulations. Pearson and Trissel have recommended that these drug formulations be prepared in non-PVC containers and administered through non-PVC tubing. The labeling of such formulations includes a warning to that effect."
35. Page 12.
36. Page 13.
37. Page 101.
38. Page 101.
39. Second page 12. "Several important exposures in the fetus and neonates have not been explored, including placental transfer of maternally-derived DEHP/MEHP from medical and/or dietary sources, and contributions from parenteral and enteral feeding, ventilators, IV fluids, or combinations of simultaneous exposures. It is likely that such investigation would yield higher exposures to small babies during a developmentally vulnerable time." Page 79.
40. Second page 12.
41. Page 98.
42. Page 34.
43. Page 102.
44. Page 101.
45. Page 102.
46. Page 101.

Health Care Without Harm
1755 S Street, NW
Suite 6B
Washington, DC 20009
Phone: 202.234.0091
Fax: 202.234.9121
www.noharm.org
info@hcwh.org

This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.

Resources on PVC and DEHP in Health Care

US Government Publications

U.S. Food and Drug Administration (FDA), Center for Devices and Radiological Health. 2001. *Safety Assessment of Di(2-ethylhexyl) Phthalate (DEHP) Released from PVC Medical Devices*. Rockville, MD: U.S. FDA.

National Toxicology Program, Center for the Evaluation of Risks to Human Reproduction (CERHR). 2000. *NTP CERHR Expert Panel Report on Di (2-ethylhexyl) Phthalate*. Webpage: http://cerhr.niehs.nih.gov/news/index.html

United State Environmental Protection Agency (US EPA). 2000. *Draft Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) and Related Compounds*. Washington, DC: US EPA. Webpage: http://www.epa.gov/ncea/pdfs/dioxin/part1and2.htm.

European Government Publications

Swedish National Chemicals Inspectorate. 2000. *Risk Assessment: bis(2-ethylhexyl) phthalate* (Final Draft). Solna, Sweden.

Danish Ministry of Environment and Energy. 1999. *Action Plan for Reducing and Phasing Out Phthalates in Soft Plastics*. Copenhagen, Denmark.

European Commission. 2000. *Green Paper on Environmental Issues of PVC*. Webpage: www.europa.eu.int/comm/environment/pvc/index.htm

European Commission. 2000. Five PVC studies:

1. *The Influence of PVC on the Quantity and Hazardousness of Flue Gas Residues from Incineration*
2. *Economic Evaluation of PVC Waste Management*
3. *The Behaviour of PVC in Landfill*
4. *Chemical Recycling of Plastics Waste (PVC and Other Resins)*
5. *Mechanical Recycling of PVC Wastes*

Webpage: www.europa.eu.int/comm/environment/waste/facts_en.htm

Other Materials on PVC or DEHP in Healthcare

Health Care Without Harm. 2001. *Dioxin, PVC and Health Care*. Washington, DC: Health Care Without Harm. Webpage: www.noharm.org.

Health Care Without Harm. 2001. *Reducing PVC Use in Hospitals*. Washington, DC: Health Care Without Harm. Webpage: www.noharm.org.

Health Care Without Harm. 2001. *A Summary of the FDA Safety Assessment of DEHP Released from PVC Medical Devices*. Washington, DC: Health Care Without Harm. Webpage: www.noharm.org.

Rossi M. 2000. *Neonatal Exposure to DEHP and Opportunities for Prevention*. Falls Church, VA: Health Care Without Harm. Webpage: www.noharm.org.

Rossi M, Schettler T. 2000. "PVC White Paper." In *Proceedings from Setting Healthcare's Environmental Agenda* (San Francisco, CA). Falls Church, VA: Health Care Without Harm.

Schettler T. 1999. *Do We Have a Right to Higher Standards? C. Everett Koop, MD and an ACSH Panel Review the Toxicity and Metabolism of DEHP*. Falls Church, VA: Health Care Without Harm. Webpage: www.noharm.org.

Schettler T. 2001. *DEHP Exposures During the Medical Care of Infants: A Cause for Concern*. Washington, DC: Health Care Without Harm. Webpage: www.noharm.org.

Silas J. 2001. *A Summary of the Expert Panel Report of the National Toxicology Program on DEHP and its Risks to Human Reproduction*. Washington, DC: Health Care Without Harm. Webpage: www.noharm.org.

Tickner J, Schettler T, Guidotti T, McCally M, Rossi M. 2001. "Health Risks Posed by Use of Di-2-Ethylhexyl Phthalate (DEHP) in PVC Medical Devices: A Critical Review." *American Journal of Industrial Medicine*, 39:100-111.

Pub 3-08 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org. This version: October 15, 2001

Tickner J, Hunt P, Rossi M, Haiama N, Lappe M. 1999. *The Use of Di-2-Ethylhexyl Phthalate in PVC Medical Devices: Exposure, Toxicity, and Alternatives*. Lowell: Lowell Center for Sustainable Production, University of Massachusetts Lowell. Webpage: www.noharm.org.

University of Massachusetts Lowell, Sustainable Hospitals Project. 2000. "Alternative Products." Webpage: www.sustainablehospitals.org.

Video: "First Do No Harm: PVC and Medicine's Responsibility." Western Lake Superior Sanitary District, MN. (2000). (For copies contact Health Care Without Harm at hcwh@chej.org or 202-234-0091).

Health Care Without Harm

1755 S Street, NW
Suite 6B
Washington, DC 20009
Phone: 202.234.0091
Fax: 202.234.9121
www.noharm.org
info@hcwh.org

This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.

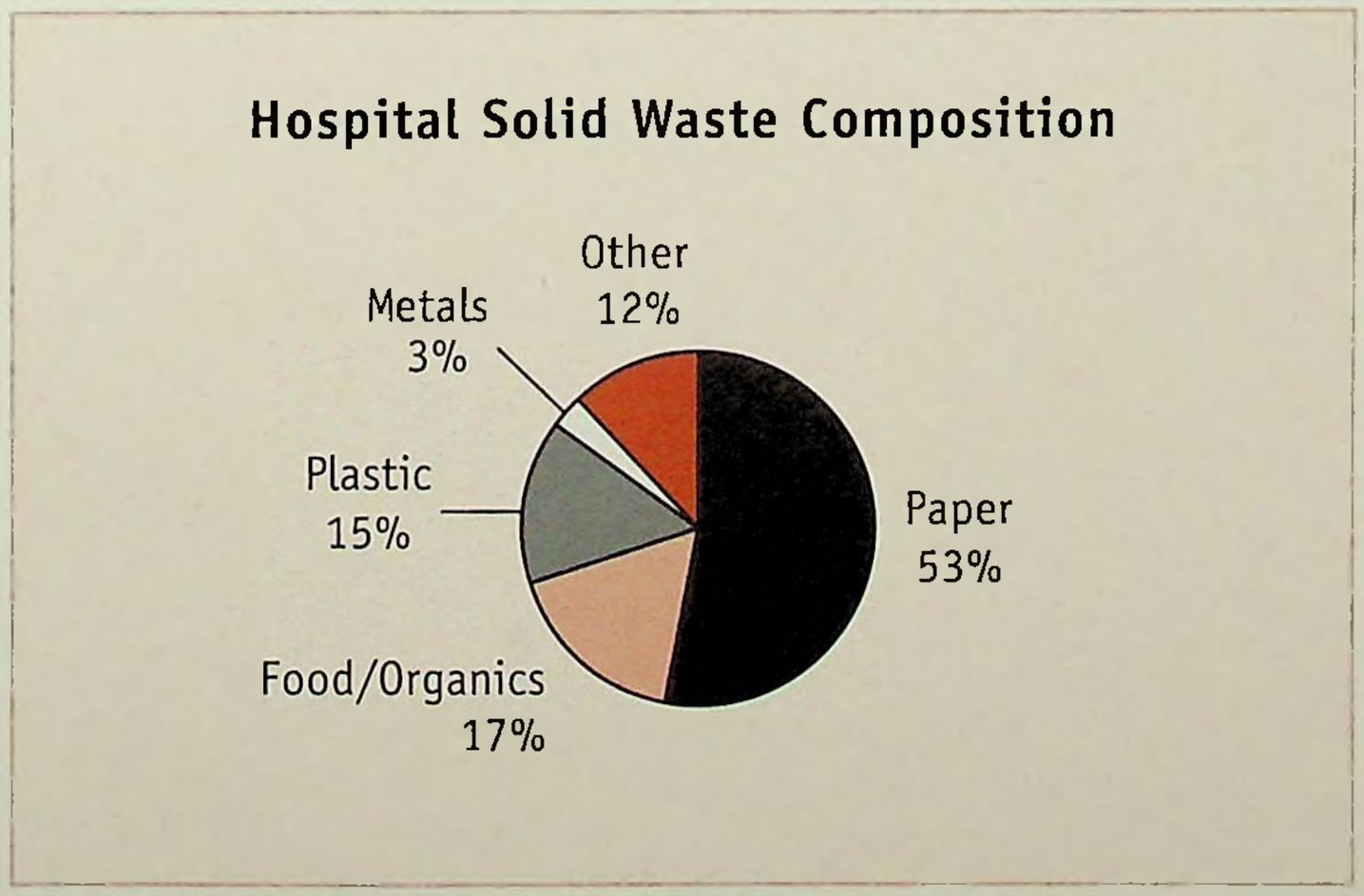
Waste Minimization, Segregation and Recycling in Hospitals

There isn't a healthcare organization anywhere that does not strive to improve patient satisfaction; delivery of care; performance as a corporate citizen; and the bottom line. Even the best endowed among nationally prominent health care providers have sought to soften the blow of decreasing Federal dollars.

Everyone is asked to look for a way to cut potential costs within the hospital environment. Here are several strategies that can not only save facilities thousands of dollars, they also significantly lessen hospitals' impact on the environment and community around them.

In 1996, Beth Israel Medical Center in New York City implemented an aggressive waste minimization plan that sought to minimize both the volume and the toxicity of the waste their facility generated. As a result, they continue to save over $600,000 a year. Here are some beginning steps any health care organization can take to minimize waste.

1. **Establish a "Green Team."** Convene a task force of administrators, housekeepers, nurses and others who are responsible for waste handling. You can add your directors of purchasing and environmental services, someone from the product selection/safety team, risk managers, safety managers, director of nursing, and interested employees and staff. This group can then strategize about courses of action for the facility with input from all responsible sectors.
2. **Conduct a waste audit.** It doesn't have to be done by a consultant, it can be handled by a nurse or an employee from environmental services. Take a good look at everything that is coming into your hospital (through the Purchasing /Materials Management Department) to everything that exits the hospital—in the form of recyclables, red bag waste, solid waste, food waste, laboratory chemicals, chemotherapeutic and pathological waste. You may be surprised to find that about 85% of the waste that exits the hospital is non-infectious waste similar to that you'd find in a large hotel or office building. The chart bellows illustrates the composition of hospital waste.
3. **Waste segregation** is an important step in reducing the volume of waste, because it offers the ability to make more accurate assessments about the composition of the hospital's waste, and positions the facility for different management



Pub 4-01 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Ca*
For additional copies of this or other publications included in the kit, or to find out how to get a
complete kit, visit Health Care Without Harm on the Web at www.noharm.org.
This version: October 15, 2001

strategies.[1] Use the results from the waste audit to identify wasteful practices and design a waste management strategy that incorporates waste reduction, reuse, and recycling measures.

4. **Education is a top priority.** Teach nursing and housekeeping staff the proper way to segregate waste. Train staff about the environmental consequences of medical waste incineration. Post signs where waste is sorted.
5. **Recycling.** Don't throw out what you can recycle. Make recycling a priority. There are more than 25 materials in a hospital that can be safely and easily recycled. Cardboard, glass, office paper, drink cans, newspapers, magazines, and PETE #1 and HPDE #2 plastic have nationwide recycling markets. Set aside space for bins and work with your waste hauler to expand the scope of your recycling contracts.
6. **Purchasing practices** are key in pursuing aggressive waste minimization. Work with your purchasing team to select reusable rather than disposable products. Have your product selection team examine the environmental impacts/safety of materials coming into the hospital. Work with your risk manager to choose products that don't have a negative impact on worker or patient health and safety. Implement a purchasing program that favors products made of recycled paper that has not been bleached with chlorine. Communicate with suppliers about the need for totally recyclable or reusable packaging materials.

With a careful examination of the current system, implementation of an education and recycling-based program, hospitals can indeed reduce their waste and save money at the same time. Participating in waste reduction programs will help your facility lead the way in providing the best patient care with concern for the safety and well-being of your employees, patients, visitors and the communities you work in and serve.

Notes

1. Shaner, H. et al. (1993) *An Ounce of Prevention: Waste Reduction Strategies for Health Care Facilities*. American Society for Healthcare Environmental Services. Chicago, IL.

Health Care Without Harm
1755 S Street, NW
Suite 6B
Washington, DC 20009
Phone: 202.234.0091
Fax: 202.234.9121
www.noharm.org
info@hcwh.org

This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.

Implementing A Red Bag Reduction Program

Adapted with permission from
Waste Reduction Remedies
by Stephanie C. Davis

1. Check Out Your Wastes

Has there been an analysis of disposal costs by weight and volume to determine a baseline?

Does someone routinely walk the floors and review the trash scene by department?

What is in the containers - and what should be?

Are Regular Solid Waste containers available wherever there are RMW receptacles?

Are the Regular Solid and Red Bag Waste containers easily accessible for the staff that use them?

Is waste removal charged by department?

What changes can be made in the disposal contract?

2. Containers and Liners Do Matter

What size containers are available, and what sizes are really needed?

Are the current RMW containers step-ons or open/lidless?

Can any newly purchased containers be made out of the highest percentage possible of recycled materials?

Are clear bags used for the Regular Solid Wastes?

Are Red Bags cadmium and lead-free?

Is the ink used on Red Bags non-toxic?

3. Location, Location, Location

Where can one larger RMW container be centrally located to replace numerous patient room containers? Utility rooms? Drug dispensing rooms? Specially constructed non-public area?

Has a spreadsheet inventory been made of the type, number and department location of waste containers in the facility?

Will reconfiguring the location of step-on and open containers meet facility needs?

Involve employees in container placement — they use the containers.

Remember, there may be some resistance to change, but patience, perseverance and education go a long way.

4. Sharps Management

Are sharps disposed with the RMW?

Does a current contract or regulation specify that Sharps and Red Bag Waste be disposed of together, or is this convention?

Can a Sharps Container Reuse Program be implemented with the incumbent contractor or can it be required on the next contract?

Who currently changes out the sharps containers — facility staff or a contracted company?

Can sharps containers be made out of the highest percentage possible of recycled materials?

5. Where are the Suction Canisters Going?

Can the suction canisters be treated to render them non-infectious and disposed of with the Regular Solid Waste?

Does a current contract or regulation specify that Fluid Canisters and Red Bag Waste be disposed together or is this convention?

Can a Fluid Canister treatment program be introduced to the facility that renders the contents non-infectious, is cost-effective, is non-toxic, does not impact the sewer system, and can be implemented with relatively little effort on the part of staff?

Pub 4-02 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.
This version: October 15, 2001

6. Efficient Pick-up Schedules

Do the internal disposal routes and disposal schedules need adjustment or a complete change?

Facility waste reduction practices and changes impact staff and jobs. If a contracted housekeeping company is used, are the employees on board with new procedures?

Are there any related union issues that warrant discussion?

7. Communication is Key

Are all regulated compliances in place?

Are signs and labels available in non-English translations in addition to universal symbols?

Do signs and labels match the color of the type of wastes in the container to which it refers?

8. Educate All Employees

Knowledge helps with employee cooperation. Cooperation helps reduce waste and increase safety. Reduced waste and increased safety reduces costs.

Education and re-education is an ongoing process in health care facilities impacted by constant change: staff, per diems, students, patients and the transient public.

Get employees engaged and thinking about their waste habits by having someone routinely walk the floors and review the trash scene by department.

9. The P & 3Rs: Prevent, Reduce, Reuse, Recycle

Continue to monitor, educate and reduce wastes.

Talk to procurement administrators, contractors and vendors about reduced packaging requirements and "take back" policies.

Learn from other hospital, industry and government waste reduction programs.

Whenever possible phase-in re-usables and "buy recycled" programs.

Start in-house material and chemical exchange programs.

Start recycling programs for corrugated paper, computer and mixed paper, metal cans and glass bottles, and compost food waste.

Tie waste contracts to market prices for recyclable commodities.

10. How Do You Define Success?

The less red bag waste, the more solid waste, the less solid waste, the more recyclables, the less initially purchased, the less total waste produced.

Health Care Without Harm
1755 S Street, NW
Suite 6B
Washington, DC 20009
Phone: 202.234.0091
Fax: 202.234.9121
www.noharm.org
info@hcwh.org

This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.

Guidelines for Optimizing Waste Segregation

By Hollie Shaner, RN, MSA

1. Hand washing sinks should have waste containers lined with clear bags beside them to capture paper towel waste as solid waste rather than red bags. Red bag waste is automatically put into the biohazard stream.
2. Every copier and printer should have an appropriately sized recycling bin beside it, not a trash can. Tremendous savings can occur once this is implemented since paper waste will be diverted from the landfill, and directed to a recycling facility where such wastes can actually become revenue generators.
3. Every soiled utility area and every department should have a "battery waste" collection container. This should be plainly labeled and readily accessible so batteries can be properly disposed of either as recyclable or hazardous waste (depending on the type of battery) and, most importantly, kept out of the 'incinerator-bound' waste stream.
4. Clear bags should be used for solid waste so staff can see through them to know what they are handling. 80% of the waste cans should be lined with clear bags, since MOST of the waste will either be solid waste or recyclable waste if properly segregated.
5. Cadmium-free red bags should be used to capture biohazard waste. Red bags should be placed with careful discretion and under the control of the Waste Manager. Red bags should not be randomly issued for wastes. Housekeepers must know specifically which containers are supposed to be lined with red bags. Other containers (the majority of them) should be lined with clear bags.
6. Cadmium-free sharps boxes and containers should be used to capture sharps waste. These containers should be changed out by housekeeping staff on a designated schedule, and as needed to ensure worker safety. All sharps containers should be ordered under the auspices of the Waste Manager to avoid inadvertent procurement of sharps boxes with cadmium for colorant.
7. Wherever there is a vending machine, there should be recycling bins nearby to capture vending machine-generated wastes. This would include such wastes as aluminum cans, #1 plastic soda bottles, newspapers, steel cans, etc.
8. Require vendors to take back pallets.
9. Flatten cardboard at the point of generation. Transporting flattened boxes enhances the efficiency of transporting waste materials. Flattened boxes reduce volume and limit the amount of wasted airspace in collection carts. This measure can reduce the number of trips necessary to move materials to the baler. Use a knife/blade to flatten boxes quickly.
10. Rinse cans whenever possible. This reduces odors and reduces the likelihood of having insects swarming around can collection containers. This is especially necessary in food service operations where the can waste is not removed from the area daily.
11. Pay attention to collection container sizes and frequency of pick up. A bag of segregated materials can weigh much more than a bag of mixed trash. Adjust container size and collection frequency to achieve the optimal situation of just enough pick ups that are not too heavy to retrieve. (A 40 pound waste handling weight limit for the housekeeping department is suggested to prevent injury).
12. Institute mandatory facility-wide waste education annually; post waste program guidelines in every department, on-line, and in employee handbook; print recycling guidelines on mugs, napkins, table tents, in paycheck stuffers, newsletters, etc.

Pub 4-03 This publication is part of *Going Green: A Resource Guide for Pollution Prevention in Healthcare* Kit. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.

Reach for Unbleached

Choosing Chlorine-Free Paper and Paper Products

Of a hospital's solid waste stream, about 45% is paper and paperboard.[1] Most hospitals have not made a conscious choice to move away from chlorinated paper products, resulting in the continued purchase of office paper, paper towels, bathroom tissue paper and napkins that use chlorine in the bleaching process.

When chlorine is utilized in the process of bleaching paper, high levels of halogenated organic pollutants and chlorinated compounds are released into the environment, notably dioxins and furans. Many of these chlorinated pollutants are shown to cause numerous health problems including many different kinds of cancer, reproductive disorders, genetic damage and immune system suppression. An average North American pulp mill using chlorine chemistry will use around 35-45,000 gallons of water per ton of pulp. A chlorine free pulp mill will use 2,500 - 3,000 gallons of water per ton of pulp. The math is simple — less water, less pollutants, less energy, better for the environment, better for human health, better for industry.[2]

Hospitals should work with their Purchasing/Materials Management Department to choose paper that is both recycled and chlorine-free, if possible. Another area in which hospitals can address this issue is in the purchase of paper products such as bathroom tissue paper, napkins, and perforated, fold and roll towels. An effort should be made to purchase recycled, non-chlorinated versions of these products. The Chlorine-Free Products Association continuously updates a list of chlorine-free paper suppliers and producers of chlorine-free paper products available on their website at **www.chlorinefreeproducts.org.**

Purchasing/Materials Management staff should ask their paper suppliers if their paper is:

Processed Chlorine Free (PCF)
The Processed Chlorine Free label[3] is reserved for recycled content paper. This includes all recycled fibers used as a feedstock that meet EPA guidelines for recycled or post-consumer content. PCF papers have not been rebleached with chlorine containing compounds. Minimum of 30% post-consumer content is required.

Totally Chlorine Free (TCF)-
The Totally Chlorine Free label[3] is reserved for virgin fiber papers. TCF papers do not use pulp produced with chlorine or chlorine containing compounds as bleaching agents.

Elemental Chlorine Free (ECF)-
Elemental Chlorine Free paper DOES NOT eliminate chlorine from the bleaching process, it just uses another form of the element, chlorine dioxide. ECF pulp production continues to result in the release of high levels of halogenated organic pollutants and chlorinated compounds into the environment.

Notes

1. First, Do No Harm. Environmental Working Group, 1997.
2. www.chlorinefreeproducts.org, Chlorine Free Products Association, 2000.
3. The PCF certification mark and term are the sole property of the Chlorine Free Products Association and are only used by authorized and certified users.

Pub 4-05 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.
This version: October 15, 2001

Disposables and Their Alternatives

Item	Alternative
Underpads/chux	Reusable underpads; if adequate-sized reusable underpads are used there is the additional benefit of being able to eliminate the drawsheet
Eggcrate mattresses	Purchase mattresses with built-in eggcrates; minimize use of disposable eggcrates
Single-use disposable Ambu bags	Reusable Ambu bags; can be used for up to 8 years; cost more up front, have reprocessing cost, but don't become waste for a long time
Single-use disposable ventilator circuits	Reusable ventilator circuits
Single-use disposable gowns	Reusable cloth gowns
Single-use dishware	Reusable dishware, both crockery and cutlery
Single-sided copy machines for paper copies	Double-sided copiers, saves on paper used, saves on waste generated
Single-use disposable pulse oximetry probes	Reusable pulse oximetry probes
Disposable diapers (for young and old)	Reusable diapers
Sharps containers	Reusable sharps containers
Single-use cardboard packaging	Reusable tubs for packaging regulated medical waste
Single-use envelopes	Reusable inter-office mailers
Single-use disposable pillows	Reusable pillows
Single-use disposable bedpans	Reusable plastic or steel bedpans, or dissolvable paper bedpans
Single-use urinals	Reusable plastic, steel or dissolvable urinals
Single-use emesis basins	Reusable plastic or steel emesis basins
Single-use wash basins	Reusable plastic or steel wash basins
Single-use bowls	Reusable plastic or steel bowls
Single-use anti-embolytic products	Reusable anti-embolytic products
Single-use alkaline batteries	Rechargeable batteries
Disposable wash cloths	Reusable wash cloths
Disposable pitchers and cups	Reusable pitchers and cups

Pub 4-04 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*.
For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.
This version: October 15, 2001

Recycling
Fact Sheet

Hospitals generate a tremendous amount of trash and end up throwing away valuable resources. Comprehensive recycling and waste minimization programs can save a health care organzation both environmental and financial resources. Facilities all across the country have discovered that recycling programs can simultaneously reduce disposal costs and raise staff morale. Waste reduction strategies go beyond recycling and should emphasize waste minimization, but recycling and reuse programs are a critical aspect of any waste management and minimization program. As community health providers, hospitals should be pioneers in these important environmental programs.

In addition to recycling and reuse programs, hospitals need to focus on creating less toxic waste in the first place. For example, hospitals need to adjust their purchasing practices to favor recycled content. Not only does this help reduce the amount of pollution generated to create these products, but buying recycled also helps to stimulate the market for the hospital's recycled materials.

Only 15% of the hospital waste stream is classified 'regulated' or 'potentially infectious', and must be handled as such. The majority of hospital waste is similar to that found in an office building or hotel—mostly paper, cardboard, metal and food waste. Much of this waste can be diverted from landfills and can reduce waste disposal costs through the implementation of an aggressive recycling program.

Below is a list of materials that should be recycled in your facility:

- Batteries
  - Ni-Cad
  - Lead Acid
  - Alkaline
  - Mercuric Oxide
  - Lithium
  - Zinc Air
  - Dry Cell
  - Others
- White Office Paper
- Mixed Office Paper
- Corrugated Cardboard
- Aluminum
- Glass
- Newspaper
- Magazines
- Boxboard
- Junk Mail
- Books
- Steel Cans
- Silver
- Toner Cartridges
- Xylene
- Fluorescent Lights
- Formalin
- Overhead Transparency Film
- #1 PETE
- #2 HDPE
- #3 PVC
- #4 LPDE
- #5 PP
- #6 PS
- #7 Mixed

Implementing a hospital-wide mandatory paper recycling policy is a necessity. Hospitals can see substantial savings by diverting paper waste from the landfill, and can actually generate money from recyclers. Virtually all waste haulers have some capacity to collect recycled paper, while the few that don't can likely refer you to a recycler in the area.

Pub 4.06 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.
This version: October 15, 2001

Easy steps to begin a recycling program include:

- Every copier and printer should have a recycling bin placed beside it, labeled RECYCLED PAPER in large letters. There should not be trash cans nearby, but rather, kept where other types of waste are usually generated.
- Purchasing departments should order paper with a high percentage of recycled content.
- Departments should make double-sided copies where possible.
- Paper can be reused in a plain paper fax machine.
- Substitute reusable inter-office mailers in place of single-use envelopes.

It is important to remember that each area in a hospital has special needs and should be treated as an independent system. *An Ounce of Prevention: Waste Reduction Strategies for Health Care Facilities* (available through the American Hospital Association) is an excellent resource on how to implement a recycling program in your hospital, and comprehensively addresses the departmental concerns that need to be taken into consideration.

A Case Study

Albany Medical Center (AMC), a 500-bed research hospital in upstate New York has a model recycling program. The program recycled 16 million pounds of waste and saved the hospital $4 million in its first six years. The facility is now recycling 43 percent of its total waste stream. In addition to the host of typical items it recycles, such as paper, cardboard and steel cans, AMC is able to recycle five different types of waste chemicals into usable products through the use of a $75,000 chemical distillery it built in 1995. The distillation center can convert waste alcohol, formalin, xylene, mineral spirits and paint into pure products that AMC can use in its labs. The distillery is expected to reduce AMC's hazardous chemical waste production from 29 tons to 6 tons and save $250,000 per year in disposal and chemical purchasing costs.

Recycling Facts

- In a lifetime, the average American will throw away 600 times his or her adult weight in garbage. This means that each adult will leave a legacy of 90,000 lbs. of trash for his or her children.
- The five primary material industries—paper, steel, aluminum, plastics, and container glass—account for 31 percent of U.S. manufacturing energy use.
- You can make 20 cans out of recycled material with the same amount of energy it takes to make one new one.
- Enough energy is saved by recycling one aluminum can to run a TV set for three hours or to light one 100 watt bulb for 20 hours.
- In this decade, it is projected that Americans will throw away over 1 million tons of aluminum cans and foil, more than 11 million tons of glass bottles and jars, over 4 and a half million tons of office paper and nearly 10 million tons of newspaper. Almost all of this material could be recycled.
- Incinerating 10,000 tons of waste creates one job, landfilling the same amount creates 6 jobs, recycling the same 10,000 tons creates 36 jobs.
- Every Sunday, the United States wastes nearly 90% of the recyclable newspapers. This wastes about 500,000 trees.
- One tree can filter up to 60 pounds of pollutants from the air each year.

Health Care Without Harm
1755 S Street, NW
Suite 6B
Washington, DC 20009
Phone: 202.234.0091
Fax: 202.234.9121
www.noharm.org
info@hcwh.org

This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.

Waste Minimization Resources

Air Force Environmental Exchange. *PRO-ACT Fact Sheet: Management of Medical/Infectious Waste.* Environmental Quality Directorate HQ Air Force Center for Environmental Excellence, October, 1998.

Barlow, Rick."Medical Waste Becomes Monster in Cost-Cutting Fight." Hospital Material Management December, 1991:1-10.

Bisson, Connie, Glenn McRae and Hollie Shaner, RN. An Ounce of Prevention: Waste Reduction Strategies for Health Care Facilities. Chicago: American Society for Healthcare Environmental Services, 1993. Available from the American Hospital Association. AHA Publication # 057007. 1-800-AHA-2626

Brady, Lorraine. "Start-up Establishing Infectious Medical Waste Disposal System." Health Industry Today August, 1994:1-14.

Boston University Corporate Education Center. *A New Prescription: Pollution Prevention Strategies for the Health Care Industry.* Proc. of a Workshop of the Boston University Corporate Education Center, Oct. 1998, Tyngsborough, Massachusetts.

Brown, Janet. Guide to Waste Management. New York: Beth Israel Medical Center, 1997. 212-420-2442

Byrns, George and Thomas Burke. "Medical Waste Management Implications for Small Medical Facilities." Journal of Environmental Health Vol. 55, No. 3. Nov/Dec. 1992:12-15.

California Integrated Waste Management Board (CAL EPA). Online. Internet. October, 2001. Available FTP: www.ciwmb.ca.gov/BizWaste/Factsheets/Hospital.htm

Canadian Centre for Pollution Prevention and Broadhurst Environmental Management Inc. *Health Care Pollution Prevention and Environmental Management Resource Guide.* 1-800-667-9790

Citizens' Environmental Coalition (CEC). Environmentally Safe Hospitals, Reducing Waste and Saving Money. A Resource Guide for New York City Hospital Materials and Waste Managers. New York: CEC, 1999. 518-462-5527

City of Palo Alto Regional Water Quality Control Plant. *Best Management Practices for Hospitals and Medical Facilities.* Palo Alto Regional Water Quality Control Plant, 2501 Embarcadero Way, Palo Alto, CA 94303; (415) 329-2598

City of Palo Alto Regional Water Quality Control Plant. *Pollution Prevention for Hospitals and Medical Facilities.* Palo Alto Regional Water Quality Control Plant, 2501 Embarcadero Way, Palo Alto, CA 94303; (415) 329-2598

Davis, Stephanie. "Ten Steps To Consider Towards Implementing A Red Bag Reduction Program." Waste Reduction Remedies. 2000.

Department of Toxic Substances Control, Office of Pollution Prevention and Technology Development. Western Regional Pollution Prevention Network (P2 West). Online. Internet. (2000) Available FTP: www.westp2net.org/sector/healthcare.htm

Department of Veterans Affairs. *VHA Program Guide 1850.1 Recycling Program.* Washington, DC: Environmental Management Programs Office, Veterans Health Administration, 1998.

Environmental Working Group and Health Care Without Harm. First, Do No Harm. Washington, DC: 1997. Available FTP: www.ewg.org/pub/home/HCWC/hcwh.html

Garvin, Michael L. "Reducing Waste Volumes: 3 Obstacles to Overcome." Health Facilities Management June, 1990:32-42.

Goldberg, Michael E. et al. "Medical Waste in the Environment: Do Anesthesia Personnel Have A Role to Play?" Journal of Clinical Anesthesia Vol. 8:1996.

Pub 4-07 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care.* For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org. This version: October 15, 2001

Kentucky Pollution Prevention Center (KPPC). *Managing Your Medwaste for a Healthier Bottom Line.* (1996). Kentucky Pollution Prevention Center 420 Lutz Hall, Louisville, Kentucky 40292; (502) 852-0965 Available FTP: www.kppc.org/Publications/Videos/medwastevideo.cfm

Kerley, Frank R. and Brent E. Nissly. "Total Quality Management and Statistical Quality Control: Practical Applications to Waste Stream Management." Hospital Material Management Quarterly Vol. 14, No. 2. Nov. 1992:40-59.

Nelson, Julie A. and Larry A. Gibson. *Pollution Prevention Works for Iowa: Health Care Case Summaries.* (January, 1996). Iowa Waste Reduction Assistance Program, Waste Management Assistance Division, Iowa Department of Natural Resources, 900 East Grand Avenue, Des Moines, IA 50319-0034; (515) 281-8927

New York State Department of Environmental Conservation. Environmental Self-Assessment for Health Care Facilities: A Quick and Easy Checklist of Pollution Prevention Measures for Health Care Facilities. Online. Internet. February, 2000. Available FTP: www.dec.state.ny.us. 1-800-462-6553

Riggle, David "Solid Waste Surgery: Advance Hospital Recycling." BioCycle February, 1994:34-37.

Rau, Edward, et al. "Minimization and Management of Wastes from Biomedical Research." Environmental Health Perspectives Vol. 108, Suppl. 6. Dec. 2000:953-77.

Ridley, Keith. *Writing a Waste Reduction Plan for Healthcare Organizations.* Center for Industrial Services, University of TN, 1997. 615-532-4926

Shaner, Hollie. "Pollution Prevention for Nurses: Minimizing the Adverse Environmental Impacts of Health Care Delivery." Vermont Registered Nurse Vol.62, No. 4. 1996:1-2, 8-9.

Shaner, Hollie and Glenn McRae. The Guidebook for Hospital Waste Reduction Planning and Program Implementation. Chicago: American Society for Healthcare Environmental Services, 1996. Available from the American Hospital Association. AHA Publication # 057037 1-800-AHA-2626

Shaner, Hollie and Glenn McRae. "Invisible Costs, Visible Savings: Innovations in Waste Management for Hospitals." Surgical Services Management Vol. 2, No. 4. April 1996.

Shaner, Hollie and Glenn McRae. *No Time to Waste, Resource Conservation for Hospitals.* Professional Development Series of the American Society for Healthcare Environmental Services. Chicago: American Society for Healthcare Environmental Services, 1997.

Shaner, Hollie and Glenn McRae. *Eleven Recommendations for Improving Medical Waste Management.* Nightingale Institute for Health and the Environment. Online. Internet. December 1997. Available FTP: www.nihe.org

Wagner, Kathryn. Environmental Management in Healthcare Facilities. Philadelphia: W.B. Saunders Company, 1998.

Waste Reduction and Disposal Options for Specific Hospital Wastes. NC Division of Pollution Prevention and Environmental Assistance and NC Division of Waste Management. Online. Internet. August, 1996. Available FTP: www.p2pays.org/ref/01/00239.pdf

U.S. Environmental Protection Agency. *Project Summary:Hospital Pollution Prevention Case Study.* Washington: August, 1991. EPA/600/S2-91/024

U.S. Environmental Protection Agency. *Guides to Pollution Prevention: Selected Hospital Waste Streams.* Washington: June, 1990. EPA/625/7-90/009

Health Care Without Harm

1755 S Street, NW
Suite 6B
Washington, DC 20009
Phone: 202.234.0091
Fax: 202.234.9121
www.noharm.org
info@hcwh.org

This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care.* For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.

Environmentally Preferable Purchasing How-To Guide

What is environmentally preferable purchasing?

Environmentally preferable purchasing (EPP) is the act of purchasing products/services whose environmental impacts have been considered and found to be less damaging to the environment and human health when compared to competing products/services. EPP also includes the gradual and ongoing process in which a hospital continually refines and expands the scope of its efforts to select environmentally sound, healthy and safe products and services. A hospital's choice to implement EPP is an important part of a larger system of a hospital's practices that support the integrity of both business and environmental decisions. EPP may be as simple as buying recycled paper or as complex as considering the environmental impact of a product at each stage of its life, from when it is manufactured to when it is disposed of as waste.

What are the benefits of EPP?

By carefully selecting goods and services, hospitals can:

- reduce costs due to lower overhead, avoid waste disposal, liability or occupational health costs
- take advantage of positive publicity and promotion potential
- significantly improve their impact on the overall quality of the environment
- provide a healthier environment for patients, workers and employees through reduced exposure to cleaners, solvents, paints, and other hazardous materials.

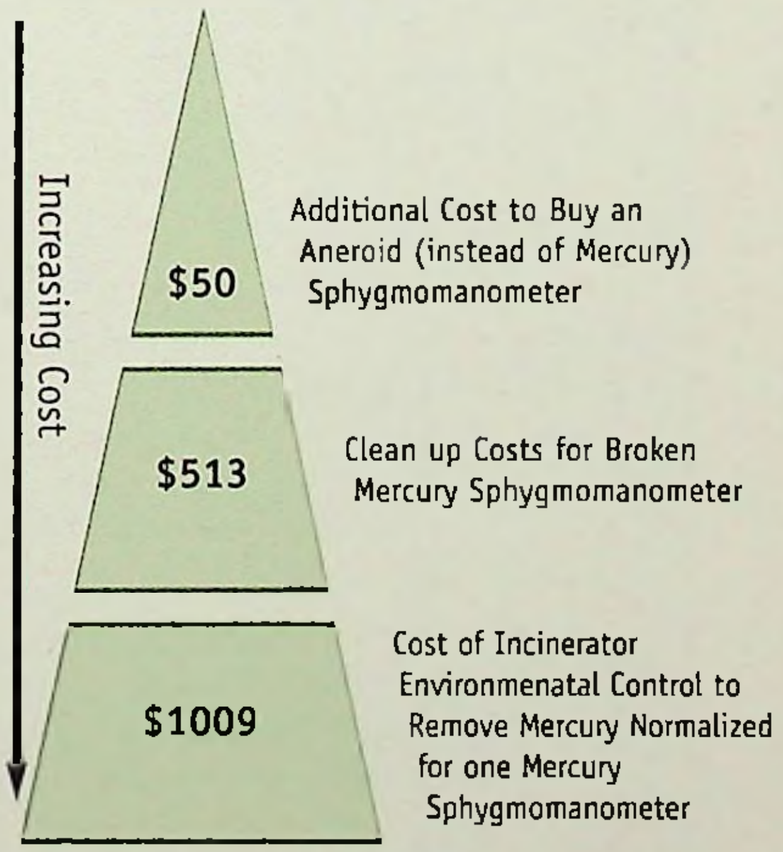
Why is the purchasing stage so important?

Purchasing departments are the central control point for nearly every product or service procured by the hospital. This is where the money is transferred from hospital to vendor and where contracts are developed. It is at this stage that leverage can best be applied to the vendors, making it an effective place to implement actions that reduce environmental impact.

Why is it less costly to make improvements at the point of purchase?

Correcting a problem close to its source is less costly than taking action downstream. Downstream corrections require a greater degree of technical complexity and labor to correct and often result in adverse publicity. A hospital that tries to save money by overlooking the environmental aspects of a product during the purchasing stage is likely to incur much greater expenses later on.

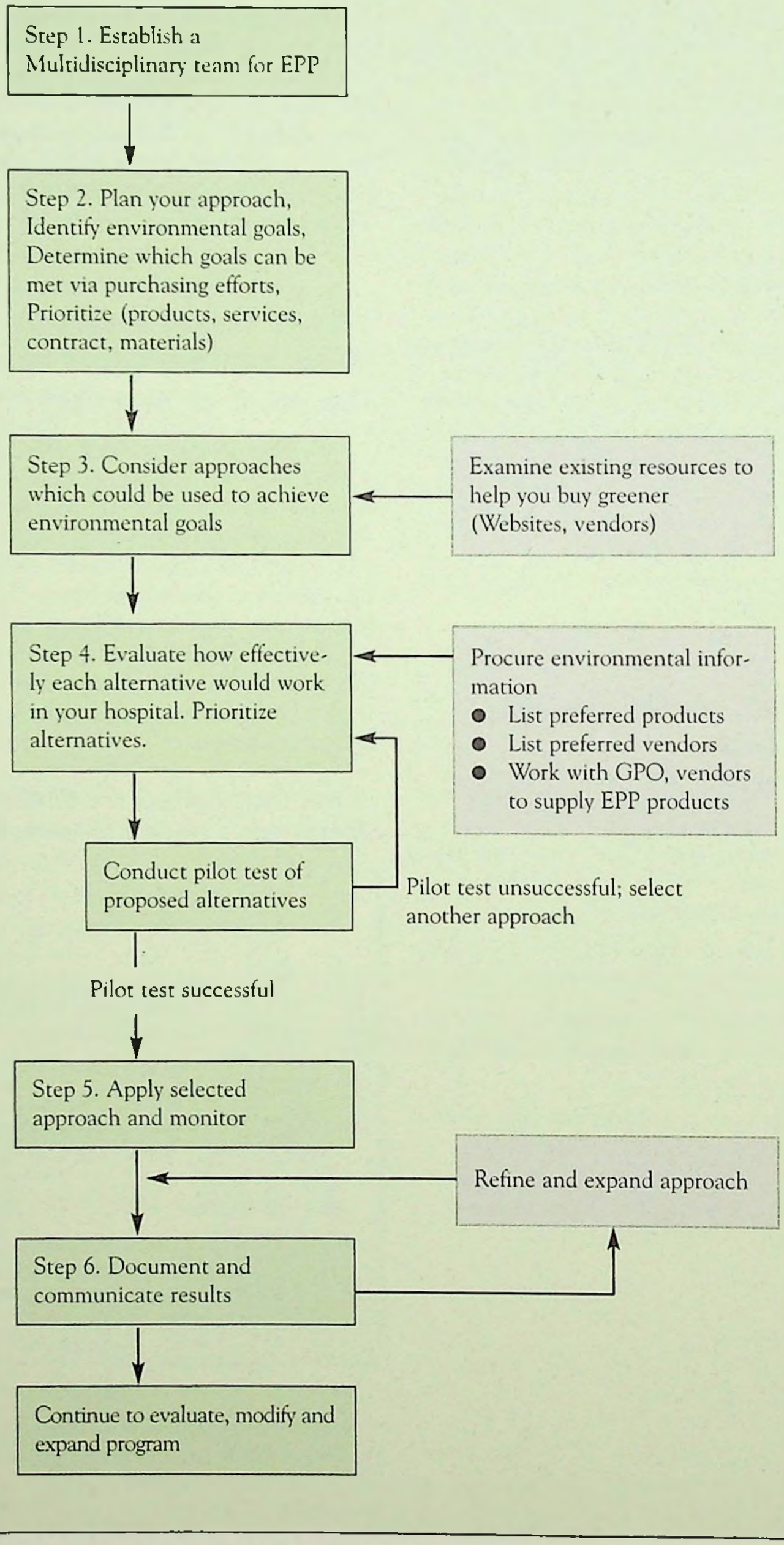
How Costs Increase the Further Downstream a Problem is Addressed



Reference: Mercury Elimination and Reduction Challenge (MERC), "Mercury in the Health Care Sector: The Cost of Alternative Products," November, 1996, pp 1424

Pub 5-01 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.
This version: October 15, 2001

Flowchart from the *Hospitals for a Healthy Environment Environmentally Preferable Purchasing "How To" Guide*



Setting up the Environmentally Preferable Purchasing (EPP) team

An EPP team is comprised of hospital professionals from different areas working together to foster a new purchasing culture. This team should coordinate its activities with the facility-wide environmental team and the product review committee(s). The leader of the team should be someone whose administrative responsibilities include ensuring that the EPP Project is fully implemented.

Why is an EPP team necessary?

The diverse perspectives of members from various departments can challenge current practices and promote innovative solutions. A team can work together to create pilot projects and provide effective solutions to obstacles. If each department is part of the process, there will be greater buy-in to changes in practices and products. A dedicated team can also motivate the purchasing and other departments to implement environmentally preferable purchasing. The facility-wide environmental team is looking at the whole picture, and may not have the resources to implement environmentally preferable purchasing without the assistance of a dedicated EPP team. Some hospitals may find that the product review committee or the facility-wide environmental team are sufficiently interested in EPP that a separate EPP team is not necessary.

The team should include:

- representation from all relevant departments
- someone with management responsibility
- people with a passion for and understanding of the ecological focus of the team

Membership can include representation from:

- Central Services
- Clinical Staff
- Communication/Public Relations
- Environmental (Ecology) Team
- Environmental Services
- Facilities Operations (physical plant, operations, logistics, and security)
- Financial Services (Accounting)
- Food Services
- Group Purchasing Organization (GPO)
- Infection Control
- Laboratory services
- Materials Management (purchasing, contracting and distribution services)
- Prime Distributor
- Risk/Safety Management
- Waste Management / Housekeeping

Determining goals and objectives of the EPP team

1. Consult with facility environmental team to determine which EPP goals might fulfill the main environmental goals of the institution.

2. Review pressing environmental concerns of the hospital and available resources so that the committee can be informed when deciding on goals.

3. Decide on environmentally preferable purchasing goals that are specific, measurable, and can be completed in a specific time period. For example:

- Increase purchase of recyclables or reusables by 30% by the next fiscal year.
- Reduce packaging waste or total solid waste by 20% in 12 months.
- Reduce energy or water use by 10% every six months for 5 years.
- Reduce purchase of products that become hazardous waste by 10% in the next contract.
- Reduce purchase of mercury-containing products by 80% by next year.

Actions to implement environmentally preferable purchasing

1. Request support for EPP goals from top management in the form of a policy statement, RFP language, job descriptions, or other support.

2. Develop policies and procedures to ensure the implementation of the environmentally preferable purchasing practices:

- Determine in writing who is responsible for ensuring that policies are followed and how they will be held responsible (for instance, through periodic reporting).
- Develop an audit process so that performance is periodically reviewed. The audit process should incorporate a system for the celebration and duplication of successes, and the recognition and rectification of projects or products that did not work.
- Determine in writing who is responsible for the audit process.

3. Using the measurable goals determined above, choose a small, manageable pilot project. For example:

- Replace mercury sphygmomanometers with aneroid equipment in one department.
- Work with histology lab to find mercury-free replacement for a specific reagent in a specific process.
- Include environmental criteria, such as battery recycling or energy efficiency, in next major equipment or service solicitation.

4. Develop an implementation timeline.

- The timeline should be realistic and allow time for research and evaluation of alternatives, education of affected parties, and continuous evaluation of pilot.
- Be creative when deciding on method to achieve goals. Reducing hazardous waste from the histology lab could involve changes in practice (not using more solvent than necessary), capital equipment expenditures (buying an autoanalyzer that uses microamounts), or procedure (switching to a less toxic fixative). Involve the workers from that department in soliciting ideas for how to meet the goal.
- Continuous evaluation should be part of any EPP program. Set in place mechanisms for obtaining continuous feedback from employees and product users, evaluating that feedback and using it to improve the program or a specific product.
- Create a tracking system.

5. Determine educational needs to implement EPP. Education is a critical part of implementation. The EPP team should consult with the inservice training department to discuss educational needs, such as education of:

- purchasers and users on the need for EPP;
- top management on what support is needed to implement EPP;
- how new products/practices will be evaluated and what feedback is desired;
- how employees are to use the new product;
- other affected parties;
- new employees at orientation; and
- vendors, manufacturers, distributors, and GPO.

Implementation of specific goal/pilot project:

1. Implementation:

- If goal involves replacement or focus on specific product, work with product selection committee or standardization committee in hospital and GPO to determine process (for instance, writing environmental specifications for RFP).
- Determine and publicize timeline for implementation of specific goal.
- Determine who is responsible for ensuring timeline and goals are met.
- Determine educational needs to implement EPP project. Create a written plan for education of affected parties regarding implementation of this particular project, including who is responsible for the education.
- Implement purchase.

2. Continual Improvement:

- Determine if measurable goal was met.
- Request feedback from affected parties.
- Review process.
- Incorporate feedback into action plan for next project or improvement of this one.
- Keep records and track progress.

3. If Goal Was Successfully Met:

- Publicize success to hospital and wider community.
- Assess possibility of expansion of pilot project or determine next specific goal.
- To determine next specific project, consider introducing additional environmental considerations, raising the measurable goal, or expanding the program.
- Track and report on progress.

4. If Goal Was Not Met:

- Do not be discouraged!
- Determine the causes of not meeting the goal.
- Brainstorm on how to correct the shortcoming, move forward and be creative!
- Choose an interim goal or pilot project to implement to get back on track.
- Move forward on the new goal or pilot project.

Additional resources

Lists of resources, a detailed EPP education matrix, flow chart of actions, links to specifications, discussion of related issues, suggestions for troubleshooting, and more details on EPP are available at http://h2e.ashes.org.

This is a product of the Environmentally Preferable Purchasing workgroup of Hospitals for Healthy Environment, a cooperative project between the US EPA and the American Hospital Association. Lara Sutherland (Massachusetts Office of Technical Assistance), Christopher Kent (US EPA), Catherine Galligan (University of Massachusetts-Lowell Sustainable Hospitals Project), Tim Washburn (Catholic Healthcare West), Kinley Deller (King County Solid Waste), Patrick Eagan (University of Wisconsin-Madison), Timonie Hood (US EPA Region 9), Glen Macri (Becton Dickinson), Layne Nelson (Minnesota Department of Administration), Russ Sylvester (Premier, Inc.), Joan Roberts (Novation), John Mateka (Memorial Regional Hospital), Sidney Pittman (Halifax Medical Center), Wayne Warren (Veterans Administration).

Health Care Without Harm
1755 S Street, NW
Suite 6B
Washington, DC 20009
Phone: 202.234.0091
Fax: 202.234.9121
www.noharm.org
info@hcwh.org

This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.

Sample letter to Group Purchasing Organizations

This is modeled on a letter sent to GPOs by the Michigan Hospital Association.

Fred Representative
Group Purchasing Organization
5 GPO Drive
Anywhere, PA

Dear Mr. Representative:

In 1998, the American Hospital Association and the United States Environmental Protection Agency signed a Memorandum of Understanding setting aggressive goals for the health care industry to minimize the volume and toxicity of medical waste. [Your organization] has established a Task Force on Hospitals for a Healthy Environment [or other efforts] to coordinate these efforts in [your area].

Many organizations dedicated to environmental protection are closely examining health care operations, and along with the communities we serve, are asking if health care as an industry is doing all that it can to protect and preserve the natural environment. In concert with the AHA and the USEPA, [your organization] calls on manufacturers, suppliers and group purchasing organizations to begin work toward implementation of the following initiatives:

- Eliminate Mercury: As an industry, we must identify and develop alternatives to mercury and mercuric compounds. Health care is identified as a major contributor to mercury in the environment and we must do all we can to remove this bio-accumulative toxin from our operations. Even trace amounts in common health care products should be identified and eliminated.
- Eliminate the use of PVC plastics: The manufacturing and incineration of PVC plastics used in the health care industry have been identified as a major source of dioxin in the natural environment. It is critical that the health care industry identify and implement competitively priced alternatives to PVC.
- Reduce Wasteful Packaging: Source reduction must be a major focus to enable the health care industry to achieve waste reduction goals. The elimination of unnecessary packaging, return programs, elimination of polystyrene foam as packaging material and other waste reduction efforts will prove critical to success.
- Recycled Content: Successful waste recovery and recycling programs will be essential to meeting waste reduction goals. Recycling programs depend upon strong markets for recovered materials. As an industry, recycled content should be included in as many products as possible to provide demand for recovered materials. Additionally, efforts should be made to replace hard-to-recycle plastics with commonly recycled materials.

[Your organization] is committed to fostering healthy communities and environmental safety and health. We recognize that the health and well-being of the people and communities we serve is fundamentally connected to the health and vitality of the environment and natural world we all share, and we look forward to working with all segments of our industry to position health care as a leader in building sustainable communities.

For more information, about these efforts, please contact [your organization].

Sincerely,

[Representative]
[Your Organzation]

Pub 5-02 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care.* For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.
This version: October 15, 2001

Latex* Allergy in Health Care Fact Sheet

*natural rubber latex

Latex Allergy– Symptoms and Causes

Since 1987, when the Centers for Disease Control and Prevention (CDC) recommended universal precautions, the increased use of natural rubber latex gloves in health care settings has been associated with an increase in reported natural rubber latex allergies among both patients and workers. Prevalence studies indicate that 6-17% of the exposed health care workforce has become allergic to latex.[1] Symptoms range from irritating to life-threatening.

Ten years later, in June 1997, the National Institute for Occupational Safety and Health (NIOSH) published an Alert – "Preventing Allergic Reactions to Natural Rubber Latex in the Workplace" — which, among other recommendations, called for education to inform workers of the symptoms of latex allergy. These symptoms include dermatitis, urticaria, rhinitis, nasal, eye or sinus symptoms, asthma, and anaphylaxis.[2] Deaths have been reported as well.[1] Latex is recognized by NIOSH as a hazard to the health of exposed workers.

Latex allergy has become an increasingly serious threat to health care workers (housekeepers, lab workers, dentists, nurses and physicians) who experience frequent or prolonged exposure to natural rubber latex through inhalation and exposure to mucous membrane or disrupted skin. Sensitization occurs through contact with latex proteins. Powder on gloves is a vehicle for sensitization. Powder increases the probability of sensitization as it allows direct contact of aerosolized latex proteins with mucous membranes of the eyes and respiratory tract.

For many allergic workers the common denominator is, "I have been using latex gloves for years, why is this a problem now?" The number of exposures necessary for sensitization varies depending on the individual. A health care worker can use latex gloves for many years before developing a latex allergy.

For most sensitized people, the symptoms of skin rashes, runny nose, and itchy eyes persist for a very long time. For others, the rashes and runny nose quickly become breathing problems such as asthma, airway obstruction, and extreme spasms in the throat (laryngospasm). For still others, the first symptom may be life-threatening shock (anaphylaxis). No immunotherapy or desensitization exists for latex allergy. Each systemic reaction comes with less provocation; each reaction is worse. For a summary of the reactions associated with latex gloves, see Table 1.

Patients with spina bifida, and patients with congenital genitourinary abnormalities who are heavily exposed to natural rubber latex through surgical procedures and contact with latex catheters show sensitization rates as high as 18-73%.[4,5] Patients who have undergone as few as three surgical procedures may be at a higher risk of developing latex allergy.

Not only direct contact with latex, but also exposure to the airborne latex proteins carried on powder can sensitize an individual and elicit an immune response (allergic reaction). Therefore, only avoidance of exposure to latex material and aeroallergens will prevent latex allergy from developing in workers and patients.[6]

Pub #-01 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care.* For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.
This version: October 15, 2001

Table 1. Types of reactions associated with latex gloves

Cause of Reaction	Terms Used or Description	Signs and Symptoms	Cause(s)
Irritant contact dermatitis	Irritation (non-allergic irritation)	Dry, crusty, hard bumps, sores, and horizontal cracks on skin may manifest as itchy dermatitis on the back of hands under the gloves	Direct skin irritation by gloves, powder, soap/detergent, scrubs, and/or incomplete hand rinsing and drying
Allergic contact dermatitis	Type IV delayed hypersensitivity Allergy contact sensitivity	Red, raised, palpable area with bumps, sores, and horizontal cracks may extend up the forearm. Occurs after a sensitization period. Appears several hours after glove contact and may persist many days.	Exposure to chemicals used in latex manufacturing, including accelerators, biocides, antioxidants (e.g., thiurams, carbamates, and benziothiazoles)
Allergy to latex proteins	Type I hypersensitivity IgE/histamine mediated reaction	Wheal and flare response or itchy redness on the skin under the glove. Occurs within minutes, fades away rapidly after removing the glove. In chronic form may mimic irritant and allergic contact dermatitis. Symptoms can include facial swelling, rhinitis, eye symptoms, generalized urticaria, respiratory distress, and asthma. In rare cases, anaphylactic shock may occur.	Exposure to proteins in latex on glove surface and/or bound to powder and suspended in the air, settled on objects, or transferred by touch.

Source: American Nurses Association. *Latex Allergy: Protect Yourself, Protect Your Patients* (brochure). Washington, D.C. ANA, 1996.

Worker Protection

According the Occupational Safety and Health Law of 1970, employers have a responsibility to provide a workplace free from recognized hazards that are causing or are likely to cause death or serious physical harm to employees.

Recommendations for a Latex Safe Work Environment[7]

1. Use non-latex — and non-chlorine (non-vinyl and non-neoprene) containing[3] — examination gloves in all health care settings.
2. Use latex-free equipment in resuscitation and invasive procedures.
3. Identify products that contain latex, including surgical gloves and other medical devices:
   - locate non-latex alternatives and
   - plan, evaluate and implement the use of non-latex alternatives.
4. Provide education for nurses and other health care workers to ensure an understanding of latex allergy, including:
   - routes of exposure, sensitization and reactions;
   - procedures for reporting acute and chronic occupational illness;
   - protocols for treatment and accommodation of sensitized workers;
   - submit written reports (retaining copies) of their symptoms to their supervisors and the occupational health department (when available); and
   - report adverse health effects resulting from the use of latex gloves and other latex medical devices to the FDA MedWatch Program: tel: 1-800-FDA-1088 or fax: 1-800-FDA-0178.
5. Provide education for nurses and physicians to:
   - recognize signs and symptoms of latex allergy in patients;
   - safely care for latex allergic patients; and
   - learn treatment protocols for patients with acute allergic reactions to latex.

6. Identify health care providers with expertise in treating latex allergy to provide care for latex allergic nurses, other health care workers, and patients.
7. In some states it is the law to report cases of latex-induced occupational asthma to the Department of Public Health, as in Massachusetts, where all cases must be reported to the Department of Public Health, Occupational Health Surveillance Program (tel: 617-624-5637).

Non-latex Gloves with Barrier Protection Equal to or Better Than Latex

A variety of non-latex gloves made of alternative materials, with barrier protection equal to or better than latex gloves, are available (see Table 2). The protective characteristics of each material must be taken into consideration in relationship to the purpose for which the glove will be used. Information on how to select medical gloves and a list of non-latex glove alternatives are available from the Sustainable Hospitals Project (SHP) at the University of Massachusetts Lowell. This information can be found online at www.sustainablehospitals.org or contact the SHP directly at 978-934-3386 or shp@uml.edu.

In summary, health care practitioners and their employers must protect themselves and others against latex sensitization and allergy. Important steps include:

- Use non-latex and non-vinyl gloves that offer barrier protection equal to or better than natural rubber latex.
- Learn to recognize the signs and symptoms of latex allergy in yourself, co-workers and patients.

Table 2. Non-latex and non-chlorine (non-vinyl and non-neoprene) containing gloves

Manufacturer	Glove
Ansell-Perry 800-321-9752 www.ansellhealthcare.com	Nitra-Tex™ nitrile exam glove Nitra-Touch® nitrile exam glove Elite™ polyurethane surgical glove
Best Manufacturing Co. 800-241-0323 www.bestglove.com	N-DEX® and Nitra-Care® gloves
ECI Medical Technologies,Canada 902-543-6665 www.ecimedical.com	Elastyren® family of synthetic copolymer medical gloves
Maxxim Medical 800-727-7951 www.maxximedical.com	SensiCare™ Nitrile exam glove SensiCare™ NXP exam glove SensiCare™ polyurethane exam glove SensiCare™ polyisoprene surgical glove
Safeskin Corporation 800-462-9993 www.safeskin.com	Safeskin Blue Nitrile Safeskin Purple Nitrile™
SmartCare Inc. 800-822-8956 www.smartcare.com	Nitra PF™
Tillotson Healthcare Corporation 800-445-6830 www.thcnet.com	Dual Advantage Pure Advantage

Source: Sustainable Hospitals Project Clearinghouse, www.sustainablehospitals.org

If you or anyone has the signs and symptoms of latex allergy:

- report the signs and symptoms to supervisors, managers, and occupational health providers immediately;
- inform all your healthcare providers — physicians, dentists, nurses — that you have latex allergy and that you must avoid exposure to all latex products including latex gloves; and
- wear a medical alert bracelet.

Only with increased awareness, education, reporting, and support will health care practitioners be enabled to protect themselves, their co-workers, and their patients from sensitization and potentially life-threatening reactions to latex.

Health care practitioners and employers will not be able to prevent themselves, their employees, and patients from sensitization and potentially life-threatening latex reactions unless latex is removed from the workplace. Increasing attention to latex allergy education and latex-safe protocols for patient care is essential for a safe environment for workers and patients alike.

References

1 & 2. US Department of Health and Human Services. Public Health Service. Centers for Disease Control and Prevention. NIOSH Alert. Preventing allergic reaction to natural rubber latex in the workplace. June, 1997; NIOSH publication, pp 97-135.

3. US Department of Labor. Occupational Safety and Health Administration. Technical Information Bulletin: Potential for Allergy to Natural Rubber Latex Gloves and Other Natural Rubber Products. Washington, DC: OSHA, April 12, 1999.

4. Meeropol, E., Kelleher R., Bell Sl, & Leger R., 1990. Allergic reactions to rubber in patients with myelodysplasia. New England Journal of Medicine. 1990: 323:2072.

5. Kelly, K., Pearson, M., & Kurup, V. A cluster of anaphylactic reactions in children with spina bifida during general anesthesia: Epidemiologic features, risk factors, and latex hypersensitivity.

6. Poley, GE. Slater JE. Latex Allergy. J Allergy Clin Immunol 2000:105(6):1054-1062.

7. Source of recommendations: Massachusetts Nurses Association, Latex Allergy Position Statement, (1997).

8. Polyvinyl chloride (also known as PVC or "vinyl") and polychloroprene ("neoprene") are the chlorine-containing materials used to manufacture examination gloves. Chlorinated materials are of concern because they can contribute to dioxin emissions from incinerators.

Health Care Without Harm

1755 S Street, NW
Suite 6B
Washington, DC 20009
Phone: 202.234.0091
Fax: 202.234.9121
www.noharm.org
info@hcwh.org

This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care.* For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.

10 Reasons To Eliminate Glutaraldehyde Fact Sheet

A FACT SHEET OF THE SUSTAINABLE HOSPITALS PROJECT

SHP is a project within the University of Massachusetts Lowell Center for Sustainable Production, providing technical support to health care.

www.sustainablehospitals.org

Hospital disinfection is serious business. When glutaraldehyde was first marketed in the early 1960's[1], it was good news. Effective alternatives were sought to the highly toxic, irritating and carcinogenic disinfectant formaldehyde. However, reports of serious health effects from glutaraldehyde exposure were published shortly thereafter[2] and ever since. Today, 40 years later, there are alternatives that offer high level disinfection while protecting health care workers and the environment.

Reasons for Elimination

1. Glutaraldehyde (GA) is a potent occupational skin irritant and sensitizer.[3, 4]
2. Glutaraldehyde exposure in hospitals is a recognized cause of occupational asthma[5-10] in many industrialized nations (England, Australia and others) although it is not regulated in the United States. Studies demonstrate that adverse respiratory health effects may occur at levels below 0.2 ppm, the current NIOSH Recommended Exposure Limit (REL).[11, 12]
3. Anecdotal reports suggest that GA exposure has been associated with the development of chemical sensitization disorders.[13] This condition results in an intolerance not only to glutaraldehyde, a sensitizer, but to many other classes of chemicals as well.
4. Patients, visitors, and hospital staff may be needlessly exposed to glutaraldehyde vapors in patient rooms and clinical areas where open bins or poorly ventilated reprocessing units are in use.
5. Alternatives to glutaraldehyde are available that maintain infection control standards[14-17] and do not cause undue wear and tear on sensitive medical devices.
6. Alternatives to glutaraldehyde are available. These alternatives are safer both for workers (the risk of skin and respiratory sensitization is avoided) and for the environment.
7. It's smart to stay ahead of the game. OSHA is currently developing a Permissible Exposure Limit (PEL) for glutaraldehyde. Observers suggest that a 0.05 ppm ceiling limit may result due to evidence that respiratory sensitization can still occur at the NIOSH REL of 2 ppm. Other countries have lowered or are in the process of lowering their "ceiling" limits to 0.1 ppm or 0.05 ppm. In the US, the American Congress of Government Industrial Hygienists (ACGIH) recently lowered their Threshhold Limit Value (TLV – 15 min STEL) to 0.05 ppm.[18]
8. The alternatives will be cheaper in the long run:

   Direct costs of using glutaraldehyde include: special ventilation hoods, improved general ventilation, construction or purchase of enclosed disinfection stations, personal protective equipment, education and training programs, ongoing monitoring programs, chemical neutralization solutions, maintenance of a glutaraldehyde emergency spill team, and work practice aids such as absorbent mats, pouring nozzles, etc.

   Indirect costs — largely overlooked — include: employees with occupational dermatitis, employees with occupational asthma, lost work time, workers' compensation, costs of replacement labor, costs of managing staff, patient and community relations. Future costs may include: compliance with a new OSHA PEL and action from local POTWs (publicly operated treatment works) regarding the dumping of aldehydes, such as glutaraldehyde, down the drain.[19, 20]

Pub 6-03 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care.* For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.
This version: October 15, 2001

9. A plan to eliminate or phase-out glutaraldehyde is consistent with a public health approach: PREVENTION. It makes sense to eliminate highly toxic and sensitizing substances from the hospital environment when alternatives exist that are feasible, effective and sustainable.
10. Glutaraldehyde has successfully been eliminated — or dramatically reduced — in dozens of hospitals. The success of these hospitals is the best testimony for the benefits of change.

For more information

Contact the Sustainable Hospitals Project (SHP) by:
Phone (978) 934-3386
Email: shp@uml.edu
Mail: Sustainable Hospitals Project, Kitson 200, One University Avenue, Lowell, MA 01854.
Visit the SHP website for information on alternative products and practices: www.sustainablehospitals.org

Notes

1. Stonehill AA, Drop S Borick PM (1963). Buffered glutaraldehyde — a new chemical sterilizing solution. Am J Hosp Pharm 20:459-65.
2. Jordan WP Jr, Dahl MV, Albert HL (1972). Contact Dermatitis from Glutaraldehyde. Arch Dermatol 105: 94-95.
3. Jordan WP Jr, Dahl MV, Albert HL (1972). Contact Dermatitis from Glutaraldehyde. Arch Dermatol 105: 94-95.
4. Nethercott JR et al (1988). Occupational contact dermatitis due to glutaraldehyde in health care workers. 18:193-6.
5. Werley MS, Burleigh-Flayer HD, Ballantyne B (1995). Respiratory Peripheral Sensory Irritation and Hypersensitivity Studies with Glutaraldehyde Vapor. Toxicology and Industrial Health 11(5): 489-501.
6. Di Stefano F et. al (1998) Occupational asthma due to glutaraldehyde, Monaldi Archives of Chest Diseases 53:50-5.
7. Corrado OJ, Osman J, Davies RJ (1986). Asthma and Rhinitis after exposure to Glutaraldehyde in Endoscopy Units. Human Toxicology 5 (5): 328-8.
8. Chan-Yeung M, McMurren T, Catonio-Begley F, Lam S (1993). Occupational asthma in a technologist exposed to glutaraldehyde. J Allergy Clin Immunol 91(5): 974-8.
9. Gannon PFG et al (1994) Occupational asthma due to glutaraldehyde and formaldehyde in endoscopy and x ray departments. Thorax 50: 156-159.
10. Di Stefano F, Sitthruttanapruk S, McCoach J, Sherwood Burge P. (1999) Glutaraldehyde: an occupational hazard in the hospital setting. Allergy 54:1105-1109.
11. ACGIH (1998). Glutaraldehyde. Draft chemical summary and recommendations. American Congress of Government Industrial Hygienists. November 16, 1998.
12. MMWR. Epidemiologic notes and reports: Symptoms of irritation associated with exposure to glutaraldehyde. Colorado. April 3, 1987/36(12): 190-1.
13. Ziem G, McTamney J (1997). Profile of Patients with Chemical Injury and Sensitivity. Environmental Health Perspectives 105 (supplement 2): 417-36.
14. Rutala WA (1996) APIC Guideline for Selection and Use of Disinfectants. American Journal of Infection Control 24:313-42.
15. CDRH (2000). Sterilants and High Level Disinfectants Cleared by FDA in a 510(k) as of January 28, 2000 with General Claims for Processing Reusable Medical and Dental Devices. Center for Devices and Radiological Health Office of Device Evaluation, Division of Dental, Infection Control and General Hospital Devices. Internet Download on 7/11/00. www.fda.gov/cdrh/ode/germlab.html
16. Royal College of Nursing (2000). Is There an Alternative to Glutaraldehyde? A Review of Agents used in Cold Sterilisation. Royal College of Nursing, Working Well Initiative. November, 2000.
17. Crow S (1993). Peracetic Acid – Asking the Right Questions. Today's O.R. Nurse, May/June 1993: 47 – 49.
18. ACGIH (1999). Documentation of the Threshold Limit Values and Biological Exposure Indices, 6th Ed. American Conference of Governmental Industrial Hygienists; Publication 0206, Cincinnati, OH.
19. Rutala WA (1996) APIC Guideline for Selection and Use of Disinfectants. American Journal of Infection Control 24:313-42.
20. Dartmouth Hitchcock Medical Center (DHMC). Glutaraldehyde Waste Minimization Report. Unpublished report, 1997. Lebanon, New Hampshire.

Health Care Without Harm
1755 S Street, NW
Unit 6B
Washington, DC 20009
Phone: 202.234.0091
Fax: 202.234.9121
www.noharm.org
info@hcwh.org

This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care.* For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.

Needlestick Injuries Fact Sheet

Prepared cooperatively by the American Nurses Association and the Intravenous Nurses Society March 2001

The Problem

An estimated 600,000 – 800,000 needlestick injuries (nsi) occur annually in the United States.[1] About half of these injuries go unreported. An average hospital incurs approximately 30 worker nsi per 100 beds per year according to the Exposure Prevention Information Network (EPINet) exposure surveillance data from the International Health Care Worker Safety Center at the University of Virginia-Charlottesville.[2] Most reported nsi involve nursing staff, but lab staff, physicians, housekeepers, and other health care workers are also injured.[3] Some of these injuries expose workers to bloodborne pathogens, including hepatitis B, hepatitis C and HIV. Infection with any of these pathogens is potentially life-threatening.

The risk of infection from hepatitis is much greater than the risk of HIV, and while there is an immunization to prevent transmission of hepatitis B, and post-exposure prophylaxis and expensive treatment for HIV, there is currently no recommended prophylaxis or effective treatment for hepatitis C. Seventy-five percent of individuals infected with hepatitis C will become chronically infected. The eventual outcome of hepatitis C is liver failure. The only treatment for liver failure is a liver transplant.

The Solution = Prevention

The only real solution is prevention. Preventing exposure to blood by preventing needlestick injuries will prevent disease.

According to the Centers for Disease Control and Prevention (CDC), up to 86% of needlestick injuries can be prevented by using safer needlestick devices.[1] A combination of work practice controls, safety education, sharps disposal containers and safety devices can reduce the risk of bloodborne exposures by 94%.[5]

Safer needle devices are cost-effective. A safety needle costs about 28 cents more per needle, but the extra expense is minimal compared to the approximately $1 million facilities will spend for a needlestick inury that results in a serious infection.[6]

In 1992, the US Food and Drug Administration (FDA) recommended that health care institutions eliminate the use of sharps for supplemental (piggyback) administration of fluids into existing intravenous (IV) lines[7] as an unnecessary hazard. Despite this recommendation, only 2/3 of the hospitals in the US implemented IV needleless systems, and by 1999, only 15% of hospitals had implemented safer needle devices for injection, phlebotomy and intravenous access.[8]

In 1999, the FDA, the National Institute for Occupational Safety and Health (NIOSH) and the Occupational Safety and Health Administration (OSHA) recommended the elimination of glass capillary tubes used for blood collection and replacement with plastic capillary tubes to prevent injury and exposure to blood.[9]

Pub # 02 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care.* For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.
This version: October 15, 2001

In 2000, following the passage of similar laws in 17 states, Congress passed the Needlestick Safety and Prevention Act which amended the 1991 OSHA Bloodborne Pathogens Standard (BPS) to require the use of sharps with engineered sharps injury protections also known as safer needle devices.[10] This law requires the involvement of front-line health care workers in the evaluation, selection and implementation of safety devices. This is essential for clinically appropriate purchasing decisions and eases the process of implementation. Training is necessary to involve workers in the exposure control program and is required annually by the OSHA BPS. In addition, the law requires device-specific data collection regarding the cause of the needlestick injury (29 CFR 1910).

Desirable Characteristics of Safety Devices[11]

- The device is needleless.
- The safety feature is an integral part of the device.
- The device preferably works passively (i.e., it requires no activation by the user). If user activation is necessary, the safety feature can be engaged with a single-handed technique and allows the workers' hands to remain behind the exposed sharp.
- The user can easily tell whether the safety feature is activated.
- The safety feature cannot be deactivated and remains protective through disposal.
- The device performs reliably.
- The device is easy to use and practical.
- The device is safe and effective for patient care.

Criteria for device selection is available from the Training for the Development of Innovative Control Technologies (TDICT) Project at www.tdict.org/criteria.html

Safety Sharps Available on the Market

All institutions should utilize the safer medical devices that are appropriate, commercially available, and effective. The following categories of sharps have commercially available safety devices.[12]

Blood collection (phlebotomy) devices

- Shielded, self-blunting, or retracting needles for vacuum tub phlebotomy sets
- Plastic vacuum/specimen tubes resistant to breakage
- Shielded, self-blunting, or retracting winged-steel needles
- Blood gas syringes with a hinged needle recapping device
- Retracting finger/heelstick lancets
- Unbreakable plastic capillary tubes
- Hemoglobin readers that do not use capillary tubes or require centrifuge of the sample
- Adapters for needleless IV systems

IV Catheter insertion devices

- Shielded or retracting stylets

Injection devices

- Shielded and retracting needles
- Recapping with sliding sheath/sleeve (OSHA BPS prohibits recapping)

IV delivery systems

- Blunt needle/cannula to access the injection port
- Valve or stopcock to be used with a syringe (without a needle)
- Protected or recessed needles
- Pre-filled medication cartridge with safety needles

Suture needles and scalpel blades

- Rounded tip scalpel blades
- Retracting scalpel blades
- Shielded scalpel blades
- Disposable scalpels (blade removal not necessary)
- Quick release blade handles

Two web databases provide information regarding the safety devices currently on the market. The University of Virginia –Charlottesville International Center for Healthcare Worker Safety maintains a list of products commercially available in the above categories on the Web at www.med.virginia.edu/~epinet. The California Department of Health Services Sharps Injury Control Program maintains a web site at www.dhs.ca.gov/sharps

Checklist for Compliance with Amended Bloodborne Pathogens Standard

(as amended by the Needlestick Safety and Prevention Act of 2000)

The following questions will assist in determining compliance with the law (adapted from the ANA Checklist for Compliance at www.needlestick.org)

- Does a written Exposure Control Program (ECP) exist?
- Has a hard copy of the ECP been made available to employees or their representatives within 15 working days of a request for one?
- Is the ECP reviewed and updated annually or more frequently whenever new or modified procedures are adopted or whenever employee positions are revised in such a way that creates new potential exposures?
- Does the annual review of the ECP include a review of the most recent technological advances?

- Does the review of safety devices include the involvement of front-line health care workers (non-managerial employees responsible for direct patient care), which is required in device evaluation and selection, with evidence of this participation documented in the ECP?
- Are needleless or shielded needle IV line access products provided?
- Are safer needles and other sharps with integrated safety features being used when medically appropriate?
- Are purchasing decisions based on the safest and most effective option as opposed to the least expensive?
- Have frontline health care workers received interactive training on the use of safer devices from a knowledgeable person; been informed of the location of the ECP and the procedures to follow if an exposure occurs?
- Does post-exposure follow-up that conforms to the CDC guidelines for testing and prophylaxis occur within two hours of the exposure?
- Is there a sharps injury log updated regularly with the details of all needlestick injuries, including device brand and type?

Quality care can be assured only when health care workers are safe from the risk of disease and death caused by unnecessary needlesticks. Front-line healthcare workers should not have to risk their lives while saving the lives of their patients.

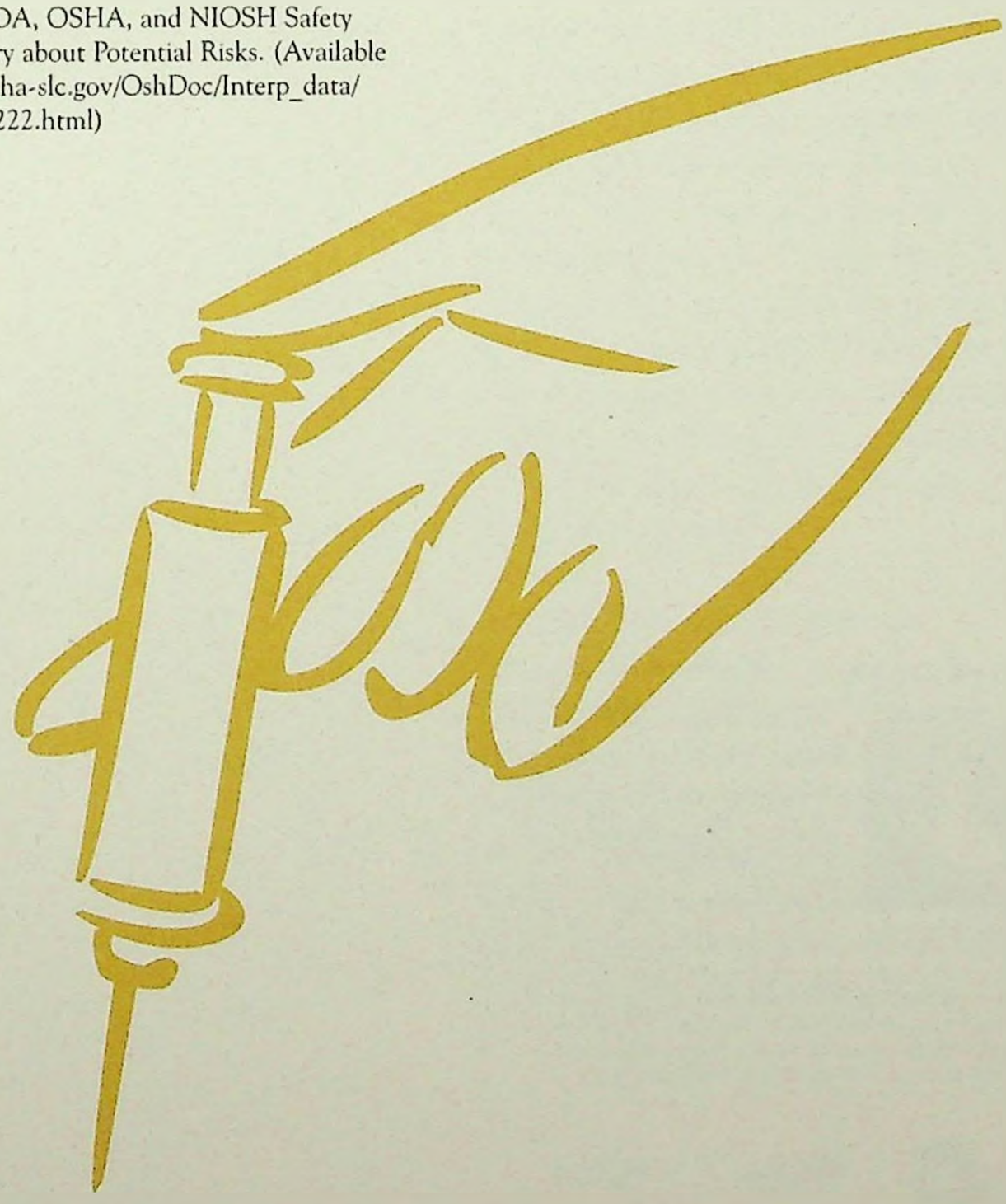
Notes

1. US Department of Health and Human Services. National Institute for Occupational Safety and Health (NIOSH). NIOSH ALERT Preventing Needlestick Injuries in Health Care Settings. Publication No. 2000-108. 2000.
2. EPINet. Exposure prevention information network data reports. University of Virginia: International Health Care Worker Safety Center, 1999.
3. US Department of Health and Human Services. National Institute for Occupational Safety and Health (NIOSH). NIOSH ALERT Preventing Needlestick Injuries in Health Care Settings. Publication No. 2000-108. 2000.
4. Centers for Disease Control and Prevention. Evaluation of safety devices for preventing percutaneous injuries among health care workers during phlebotomy procedures — Minneapolis-St. Paul, New York City, and San Francisco, 1993-1995. MMWR 46(2):21-25.
5. Jagger J. Reducing occupational exposure to bloodborne pathogens: where do we stand a decade later? Infect Control Hosp Epidemiol 17(9):5733-575,1996.
6. Pugliese G and Salahuddin M. eds. Sharps Injury Prevention Program A Step-By-Step Guide. Chicago, Illinois: American Hospital Association, 1999.
7. US Department of Health and Human Services. Food and Drug Administration (FDA). FDA Safety Alert. Needlestick and Other Risks from Hypodermic Needles on Secondary I.V. Administration Sets-Piggyback and Intermittent I.V., April 16, 1992. Available: www.osha-slc.gov/SLTC/needlestick/fdaletter.html
8. Pugliese G and Salahuddin M. eds. Sharps Injury Prevention Program A Step-By-Step Guide. Chicago, Illinois: American Hospital Association, 1999.
9. US Department of Health and Human Services. FDA. Glass Capillary Tubes: Joint FDA, OSHA, and NIOSH Safety Advisory about Potential Risks. (Available www.osha-slc.gov/OshDoc/Interp_data/I19990222.html)
10. Federal Register, vol. 66, January 18, 2001, pp5318-5325
11. US Department of Health and Human Services. National Institute for Occupational Safety and Health (NIOSH). NIOSH ALERT Preventing Needlestick Injuries in Health Care Settings. Publication No. 2000-108. 2000.
12. McCormick R. "Selecting Safety Products for Evaluation" in Pugliese G and Salahuddin M eds. Sharps Injury Prevention Program A Step By Step Guide. Chicago, Illinois: American Hospital Association, 1999.

Resources

OSHA. OSHA Directives 2-2.44D. Enforcement Procedures for the occupational exposure to bloodborne pathogens. Washington, DC: U.S. Department of Labor, Occupational Safety and Health Administration. 1999 (www.osha-slc.gov/OshDoc/Directive_data/CPL_2-2_44D.html).

Wilburn S. Know Your Rights: Ensuring your employer's compliance with federal needlestick law. American Journal of Nursing. Vol 101,3: 90. March 2001.



Cleaning Chemical Use in Hospitals Fact Sheet

Chemical use in hospitals contributes to poor air quality and has been implicated in the increase of worker respiratory ailments such as asthma and Reactive Airway Dysfunction Syndrome (RADS). Exposure to and contact with cleaning chemicals can also cause eye, nose and throat irritation, skin rashes, headaches, dizziness, nausea and sensitization. According to the Massachusetts Department of Public Health (DPH), the most commonly reported occupational asthma-causing agent is poor indoor air quality.

Good air quality results in an environment where workers feel healthy and comfortable and as a result, are more productive. This decreases both costs and liabilities. Adequate ventilation in relation to environmental cleaning products and processes is a major factor in good air quality.[1] By carefully choosing environmentally sound cleaning chemicals, cleaning methods and cleaning equipment, U.S. businesses could realize a productivity gain of $30 to $150 billion annually and a 0.5% to 5% increase in worker performance.

According to the American Lung Association (ALA), asthma is the most prevalent occupational lung disease in developed countries.[2] Cleaning and disinfecting chemicals such as ammonia, chlorine, cleaning detergents, ethylene oxide, pesticides, and sodium hydroxide, are listed by the DPH as causing RADS.[3] Nursing, teaching and office work are the occupations most likely to report problems with indoor air quality. DPH statistics from 1993-1998 note that nurses have the highest number of reported cases of work-related asthma, and indicate that health care is the industry with the most cases of work-related asthma. The most frequently reported exposures in health care were to latex, poor indoor air quality, and toxic cleaning products.[4]

Toxic cleaning chemicals contribute to poor indoor air quality and worker illnesses through a combination of the *product* selected and the *processes* utilized to apply the chemicals.

Product

Disinfectant chemicals

Disinfectants used in hospitals such as quaternary ammonium compounds, phenols, and bleach are registered with the EPA as pesticides. These toxic chemicals are used for routine cleaning on every surface in the hospital environment. Health effects from long-term exposure to quaternary ammonium compounds include occupational asthma and hypersensitivity syndrome.[5,6]

Floor stripping and polishing chemicals

Floor strippers contain chemicals that can seriously harm the user and may also affect the building occupants. Chemicals in these products include diethylene glycol ethyl ether, aliphatic petroleum distillates and nonyl-phenol ethoxylate, ethanolamine (a known sensitizer), butoxyethanol, and sodium hydroxide (lye).

Health care workers and others exposed to floor stripping and floor polishing chemicals experience headaches, eye irritation, dizziness, nausea, difficulty concentrating, fatigue, wheezing, coughing, asthma attacks, respiratory infections, hypersensitivity pneumonitis, and nose, throat and skin irritation. If exposure continues, irreversible lung damage and the formation of fibrous tissue (fibrosis) may occur making breathing more difficult.

Scented cleaning chemicals

The use of unscented cleaning chemicals is recommended to improve indoor air quality. The Archives of Environmental Health note that some humans exposed to fragrance products might experience some combination of

Pub 6-04. This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.
This version: October 15, 2001

eye, nose and/or throat irritation; respiratory difficulty; possibly broncho-constriction, or asthma-like reactions; and central nervous system reactions (eg. dizziness, incoordination, confusion, fatigue).[7]

Process

Inadequate ventilation

Inadequate ventilation, reducing the frequency and volume of air exchanges, or climate controls designed to save energy, increases the concentration of chemicals in indoor air. Extensive and complex cleaning projects (floor stripping, burnishing, rug cleaning) are often carried out on the overnight shift in hospitals, when fewer people are around, but also when ventilation is reduced to save energy. Additions, newer hospitals or remodeled areas are often very tight buildings with little or no natural ventilation and may have windows that do not open to allow fresh air intake to dilute these chemicals. Ventilation and fresh air exchanges should be increased when these projects are carried out.

Mixing of Chemicals

Cleaning chemicals are often purchased in concentrated solutions that require mixing and/or dilution by the employee who is responsible for application. It has been noted that when adverse health effects are suffered by workers, the concentration (or mixtures) of these products is often incorrect. This may indicate a problem with training, language skills or worker supervision.

When certain cleaning chemicals are mixed together synergistic effects may occur. This means that the interaction of two or more of these chemicals produces a health effect greater than that of the individual chemical alone. For example, if a quaternary ammonium compound is use in combination with a bleach cleaner, a toxic gas called chloramine forms and is released into the air.

Application methods of cleaning chemicals

The use of spray bottles, aerosol cans, and mechanized equipment, such as floor burnishers, buffers, and carpet washers, increase the airborne concentration of cleaning chemicals as particulate matter becomes aerosolized and suspends in the breathing zone of operators and building occupants. Spray bottles should be replaced with a pour and wipe application process. Floor burnishers and buffers should have an enclosed system with a filter (scrubber) to capture chemical vapors and particulate matter that is generated during the burnishing process. These changes will contribute to the reduction of the aerosol concentration of these cleaning chemicals and their by-products. These changes decrease air contamination and contribute to improved indoor air quality and the health and comfort of all the building inhabitants.

Resources

The following articles and guidelines will assist you in modifying the use and selection of cleaning chemicals for improved indoor air quality and a safer healthier work environment.

- A detailed report from INFORM, Inc. can be obtained by contacting Lara Sutherland via email at sutherland@informinc.org. This report is an in-depth look at the problems with cleaning chemicals and possible solutions.
- A list of environmentally preferable products, also noted as the best in class, The OSD Update, 99-31, can be obtained from the Massachusetts Operational Services Division, at One Ashburton Place, Room 1017, Boston, MA 02108. These products have been evaluated and accepted using a variety of environmental and health concerns as criteria.
- The Janitorial Pollution Prevention Project provides quick reference and worksheets on a variety of cleaning processes and materials focusing on safe and healthy work practices. www.westp2net.org/ Janitorial/jp4.htm

References

1. Fisk, William and Arthur Rosenfield. "Improved Productivity and Health from Better Indoor Environments," Center for Building Science Newsletter (Now Environmental Energy Technologies Newsletter). Lawrence Berkley Labs. Summer 1997. p.5. Available at http://eetd.lbl.gov/Bookstore.htm
2. American Lung Association, "Occupational Hazards," 2000, p.3. www.lungusa.org/air/air00_occupation.html
3. MA DPH SENSOR Occupational Lung Disease Bulletin. November, 2000.
4. MA DPH SENSOR Occupational Lung Disease Bulletin. January, 2000.
5. Bernstein, J A Combined Respiratory and Cutaneous Hypersensitivity Syndrome to Quat Amines. Jnl Allergy Clin Immunol 1994; Vol 94, No.2, pp 257-259.
6. Personal Communication: Amy Smoker, MS. Benzlkonium Chloride Fact Sheet. National Antimicrobial Information Network, Oregon State University. http://nain.orst.edu 1-800 447-6349,
7. Drs. Rosalind C. Anderson and Julius H Anderson, "Acute Toxic Effects of Fragranced Products". Archives of Environmental Health 53(2): 138-146 (1998).
8. California Office of Environmental Health Hazard Assessment Fact Sheet. Health Effects of Diesel Exhaust. August, 2000. www.oehha.ca.gov/air/diesel_exhaust/factsheet.html

Health Care Without Harm

1755 S Street, NW
Suite 6B
Washington, DC 20009
Phone: 202.234.0091
Fax: 202.234.9121
www.noharm.org
info@hcwh.org

This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.

Going Green: A Resource Kit for Pollution Prevention in Health Care

Table of Contents

Table of Contents This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.
This version: October 15, 2001

Health Care Without Harm

An unfortunate irony of the current health care system is that certain practices pose threats to public health and the environment.

Fortunately, many of these risks can be eliminated through fairly simple changes in the way a hospital operates and in the materials it purchases. For example, public and occupational health risks from mercury use can be eliminated by making sure that mercury-containing medical devices and products are phased out, and that existing ones, when retired, are not incinerated. By replacing existing mercury devices with non-mercury alternative devices for the future, this avoidable risk is eliminated.

Awareness of health care industry pollution and the need to engage in improved material purchasing and waste management policies has led to the creation of a number of pollution prevention partnerships. In 1998 the American Hospital Association and the U.S. Environmental Protection Agency signed a Memorandum of Understanding to prevent the release of persistent, bio-accumulative toxic chemicals released by the health care industry. The MOU established a series of goals and timetables to eliminate mercury releases, reduce waste, and minimize the production of persistent, bio-accumulative toxins.

Many hospitals and health care systems across the U.S. are already making great strides toward reducing the environmental impact of the health care industry, but more work needs to be done. Health Care Without Harm (HCWH) – an international collaboration of hospitals and health care systems, medical professionals, labor unions, environmental groups and community organizations – has put together this resource kit to assist health care providers/administrators in their efforts to reduce health care industry pollution from their facilities. A "work in progress," this Resource Kit contains steps that range from the simple to the complex, but all will have a measurable impact on your facility's environmental performance.

The information available to help health care facilities improve their environmental performance is constantly evolving. HCWH works to update its resources in a timely fashion. Look for the latest version of these resources as well as new materials on our web site at www.noharm.org.

This Resource Kit – and the steps contained in it – draw upon the collective wisdom and experience of health care professionals and others who have been successful at a number of facilities around the country. Many of the suggestions have the additional benefit of being economically sound as well, which is particularly welcome in an era of cost containment.

HCWH strongly encourages you to use the information here to help reduce the health care industry's environmental impact. Together we can make a profound difference in reducing environmental harm from health care practices, and demonstrate that our professions, industry, and our partners can work together for a healthier future.

Pub 1-01 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. Visit Health Care Without Harm on the Web at www.noharm.org for more information.
October 15, 2001

Health Care

Without Harm

The Campaign for Environmentally Responsible Health Care

Who We Are

The Health Care Without Harm coalition is a broad-based international campaign to address the environmental impacts of health care, without compromising worker safety or patient care. Our efforts include:

- advocating for policies to eliminate the indiscriminate incineration of medical waste,
- changing purchasing and materials management practices of hospitals and purchasing groups,
- promoting policies and procedures that work toward the minimization of waste volume and toxicity,
- supporting local campaigns to oppose medical waste incinerators,
- researching and advocating safer waste disposal alternatives, and
- educating the broader public about dioxin, mercury, and endocrine-disrupting chemicals and the health care industry's contribution to these problems.

Since its inception in 1996, the membership of the Health Care Without Harm (HCWH) campaign has grown from an initial 28 founding organizations, to more than 340 organizations in 37 countries. The coalition has attracted the attention of major health care systems, regulatory bodies and health manufacturers of medical products. Membership includes more than 100 health care facilities, and numerous organizations of health professionals: the American Nurses Association; the American Public Health Association; the Ambulatory Pediatrics Association; the Oncology Nursing Society; and many more.

The Campaign is a coalition of traditional health care organizations, as well as religious constituencies, labor unions, health-affected constituencies (cancer groups, endometriosis groups, children's health groups, etc.) and environmental groups, who agree that as providers and consumers of health care, we all have a place in a campaign that makes explicit links between environmental contamination and public health. Health Care Without Harm is an attempt to bring these important constituencies together in a broad effort on an issue that affects the health of every man, woman and child.

The Campaign understands that health professionals are not intentionally employing products or practices; they are simply not aware of the links between these products/practices in terms of environmental contamination and illnesses in the general population. In fact, as physicians, nurses and other health professionals have learned about the health risks of mercury, dioxin and other pollutants emitted by the use and/or disposal of products used in health care, they have generally supported actions that will reduce or eliminate that pollution while providing safe, effective patient care.

Groups that join the campaign do not contribute dues. Membership in Health Care Without Harm is based upon an organizational commitment to the mission and goals of the campaign, and a desire to participate fully in helping to achieve them. Health Care Without Harm is funded entirely by foundations and individuals. The campaign does not accept financial support from manufacturers of medical supplies and does not endorse specific products.

Pub 1-02 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.
This version: October 15, 2001

Memorandum of Understanding between the American Hospital Association & the U.S. Environmental Protection Agency

On June 24, 1998, a landmark agreement was put together by the American Hospital Association (AHA) and the United States Environmental Protection Agency (EPA). The Memorandum of Understanding (MOU) set new goals for hospital pollution prevention over the next five years, and brought together a stakeholders' council to enforce the provisions of the MOU. Health Care Without Harm (HCWH) was an active participant in the preparation of the agreement, and sat on the AHA Leadership Council.

The MOU set 10 action steps for the council to focus on over a five-year period. Two of the top priorities are the virtual elimination of mercury-containing waste from the hospital waste stream by the year 2005, and the goal of achieving a thirty-three percent (33%) reduction in total waste volume in all hospitals by 2005 and an overall goal of achieving a fifty percent (50%) reduction by 2010.

The ten points of the plan are as follows:

1. Virtual Elimination of Mercury Waste.
2. Total Waste Volume Reduction.
3. Seminars.
4. Software Distribution.
5. Industry P2 Information.
6. Review of Industry P2 Information.
7. Chemical Waste Minimization.
8. Ethylene Oxide and PBT Pollutant Information.
9. Industry Input on U.S. EPA Guidance.
10. AHA Environmental Leadership Council.
11. Awards/Recognition.

Hospitals for a Healthy Environment (H2E) was adopted as the title for this effort. In September 2001, H2E became a partnership of the AHA, EPA, HCWH and the American Nurses Association (ANA). An H2E listserve has been developed. Join the H2E listserv to share and learn technical information, find educational tools and identify practical strategies for mercury elimination and discuss other pollution prevention and waste minimization issues. For information on how to become an active participant in the H2E process, see their website at www.h2e-online.org.

The Memorandum

1.0 INTRODUCTION.
This Memorandum of Understanding ("MOU") is made between the United States Environmental Protection Agency ("U.S. EPA") Office of Prevention, Pesticides and Toxic substances ("OPPT"), U.S. EPA Region 5 and the American Hospital Association ("AHA"). Throughout this MOU, any reference to "U.S. EPA" shall include both OPPT and Region 5 and any reference to "AHA" shall refer to AHA and its Personal Membership Groups ("PMGs"). U.S. EPA and AHA are referred to herein as "the Parties" to this MOU.

1.1 The Parties intend by this MOU to establish a mutually beneficial public/private partnership.

1.2 This MOU will address the basic relationship, roles and responsibilities of the Parties but leaves for later agreement the more precise terms that will constitute the substance of the partnership.

2.0 PURPOSE.
The AHA consists primarily of health care provider organizations across the United States. The Parties enter into this MOU for the primary purpose of transferring to AHA institutional members, PMG personal members and other health care professionals technical information on Pollution Prevention ("P2") opportunities that exist with respect to waste generated

Pub 1-03 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.
This version: October 15, 2001

by the health care industry. The Parties' believe that this information transfer will provide the health care industry with enhanced tools for minimizing the production of persistent, bioaccumulative and toxic ("PBT") pollutants and reducing the volumes of waste generated. Such reductions are beneficial to the environment and will reduce the waste disposal costs incurred by the health care industry. The Parties to this MOU hereby affirm the Congressional goals and principles set forth in the Pollution Prevention Act ("PPA"), 42 U.S.C. 13101 through 13109, particularly the goal of reducing the generation of pollution at its source, preferentially to the recycling, treatment and/or disposal of such waste.

3.0 AUTHORITY.

Section 6604(b)(5) of the PPA, 42 U.S.C. 13103(b)(5), directs U.S. EPA, among other things, to facilitate the adoption of source reduction techniques by businesses, including the distribution of source reduction information to businesses.

4.0 ROLES AND RESPONSIBILITIES OF THE PARTIES.

The Parties intend to undertake the following activities pursuant to this MOU:

1. Virtual Elimination of Mercury Waste. The Parties intend to work together to develop a Mercury Waste Virtual Elimination Plan that will set forth a strategy for achieving the goal of virtually eliminating mercury-containing waste from the health care industry waste stream by the year 2005.

2. Total Waste Volume Reduction. The Parties intend to work together to develop a Model Waste Volume Reduction Plan that will assist in reducing the total volume of all wastes (including both regulated and non-regulated waste) generated by the health care industry, with an initial goal of achieving a thirty-three percent (33%) reduction in all hospitals by 2005 and an overall goal of achieving a fifty percent (50%) reduction by 2010.

3. Seminars. The Parties intend to co-sponsor a series of Health Care Industry Waste Management Seminars ("Seminars") to be held at various locations across the United States. The Seminars will be the primary vehicle by which technical information on P2 opportunities will be transferred to the health care professionals, and will focus upon transferring technical information related to decreasing health care industry waste volume, minimizing the production of PBT pollutants, improving waste stream segregation, reducing waste management costs and ensuring regulatory compliance for regulated waste streams.

4. Software Distribution. In order to facilitate the successful completion of the Seminars and the virtual elimination of mercury-containing waste, U.S. EPA intends to provide for distribution at the various Seminars up to 300 copies of the software program entitled "Mercury In Medical Facilities" that has been developed by Purdue University with assistance from the Region 5 Software Development Unit ("SDU"). Purdue University maintains a copyright on this software program, but, insofar as the software was developed with Federal Government assistance, the software may be freely copied and disseminated. The Parties will mutually decide how the up to 300 total software copies will be distributed among the various Seminars.

5. Industry P2 Information. AHA intends to develop baseline information on the P2 activities of the health care industry and to monitor P2 progress over time. To obtain this information, AHA will develop, with review and comment by U.S. EPA, an information questionnaire to be distributed to health care professionals by AHA at various times in the future. The first distribution will be used to determine the baseline P2 information and subsequent distributions will be used to monitor industry P2 progress. AHA will gather all responses to the questionnaires. Insofar as U.S. EPA will not be sponsoring the distribution of the questionnaire, the distribution of the questionnaire is not subject to the requirements of the Paperwork Reduction Act ("PRA"), 44 U.S.C. 3501 through 3520.

6. Review of Industry P2 Information. Throughout the duration of this MOU, the Parties intend to work together to review and compile the information obtained from the baseline and progress questionnaires (Item #5). U.S. EPA agrees that, unless required by law, the identity of any survey participant need not be revealed by AHA to U.S. EPA. From this information, the Parties will be able to disseminate more effectively P2 information and to monitor the success of the Mercury Waste Virtual Elimination Plan (Item #1) and the Model Waste Volume Reduction Plan (Item #2).

7. Chemical Waste Minimization. The Parties intend to work together to develop, for various kinds of chemical waste, a Model Chemical Waste Minimization Plan ("Model Plan"). The first Model Plan will pertain to mercury-containing waste ("Model Plan For Mercury"). The Model Plan For Mercury is presently being developed by the State of Illinois with assistance from U.S. EPA. When that plan is completed, U.S. EPA, with comments from AHA, will make such modifications to the Model Plan For Mercury as are necessary to reflect current knowledge, best management practices and any other circumstances experienced by the health care industry. Other chemical wastes will be addressed by future Model Plans. AHA intends to disseminate each Model Plan to as wide an audience in the health care industry as is reasonably possible. Both AHA and U.S. EPA intend to make each Model Plan available to the public on their respective Internet home pages. Each such Internet presentation shall properly reflect the relative contributions of the Parties and any third party (such as the State of Illinois with respect to the Model Plan For Mercury) to the development of the particular Model Plan.

8. Ethylene Oxide and PBT Pollutant Information. The Parties intend to

work together to investigate P2 opportunities with respect to ethylene oxide and PBT pollutants.

9. Industry Input on U.S. EPA Guidance. To the extent feasible and practical, U.S. EPA will solicit comments by AHA and the AHA Environmental Leadership Council (as established pursuant to this MOU) on U.S. EPA's policies and technical guidance specifically affecting the health care industry's waste streams. AHA's comments will be limited to the practicality and feasibility of the matters set forth in the policies and technical guidance. Such input shall not be sought with respect to any adjudication or any rulemaking that is subject to the notice and comment requirements set forth in the Administrative Procedure Act ("APA") at 5 U.S.C. 553(b).

10. AHA Environmental Leadership Council. AHA will develop an AHA Environmental Leadership Council ("the Council") that will be responsible for making recommendations to the AHA on educational and outreach activities, recommending content experts to participate in programs and/or the development of products such as the Model Plans, monitoring progress toward established environmental goals, selecting the award recipients for national recognition programs, and assisting in the publication of an annual report documenting the hospital industry's progress toward P2.

11. Awards/Recognition. The Parties intend to work together to determine national "success stories" of the implementation of P2 activities toward health care industry waste generation. Successful P2 activities shall be recognized by awards or other recognition by U.S. EPA, AHA and/or the Parties acting jointly.

4.1 The Parties understand that other organizations and/or coalitions who promote environmentally responsible practices have a vested interest in the goals described in this MOU. Furthermore, the Parties recognize that these stakeholders play an important role in the partnership to advance P2 in the health care industry. In recognition of this fact, the Parties will allow for the participation of stakeholders in the manner set forth in Attachment #1 to this MOU.

5.0 FUNDING. The Parties shall attempt to secure reasonable funding to allow for the successful completion of the activities described herein. Both Parties, however, expressly acknowledge that the activities under this MOU shall be subject to the availability of appropriated funds and personnel of each Party, or the approval of other sources of funding. Nothing in this MOU or elsewhere shall be construed as establishing a contract (or other legally binding commitment) obligating U.S. EPA or AHA to provide money, goods or services of any kind to any legal entity.

6.0 AGREEMENTS.

In order to foster the successful completion of this MOU, the Parties agree to the following terms and conditions:

1. Each Party pledges in good faith to go forward with this MOU and to further the goals and purposes of this MOU, subject to the terms and conditions of this MOU. The Parties shall attempt to resolve disputes through good faith discussions.

2. Either Party may unilaterally withdraw at any time from this MOU by transmitting a signed writing to that effect to the other Party. This MOU and the public/private partnership created thereby shall be considered terminated sixty (60) days from the date the non-withdrawing Party actually receives the notice of withdrawal from the withdrawing Party.

3. By mutual agreement, which may be either formal or informal, the Parties may modify the list of intended activities set forth in Paragraph 4.0 above and/or determine the practical manner by which the goals, purposes and activities of this MOU will be accomplished. However, any modification to any other written part of this MOU must be made in writing and signed by both Parties or their designees.

4. Nothing in this MOU shall be construed to authorize or permit any violation of any Federal, State or local law imposed upon the Parties, including, but not limited to, the PRA, APA, or the Anti-Deficiency Act, 31 U.S.C. 1342.

5. Nothing in this MOU shall be construed to authorize or permit any violation of any Federal, State or local law, including, but not limited to, any environmental law administered and/or enforced by U.S. EPA, by any person, including, but not limited to, any health care provider organization.

6. AHA agrees that it does not expect, nor will it ever seek to compel from U.S. EPA in any judicial forum, the payment of money, services or other thing of value from U.S. EPA based upon the terms of this MOU. The foregoing provision does not in any way affect any legal rights accruing to AHA by virtue of any other law, contract and/or assistance agreement.

7. AHA understands and acknowledges that, as an institution of the Federal Government, U.S. EPA has a duty to refrain from providing any commercial entity an exclusive privilege without receiving payment therefore and, as a consequence, that U.S. EPA's relationship with AHA in no way affects, alters or otherwise constrains U.S. EPA's right to provide similar (or identical) services to, or establish similar (or identical) relationships with, any other entity.

8. AHA understands that U.S. EPA's participation in this MOU does not constitute an endorsement, express or implied of (a) any policy advocated by AHA, the Council or any stakeholder; or (b) any good or service offered or sold by AHA, the Council or any stakeholder.

9. Insofar as U.S. EPA's participation in this MOU consists of rendering tech-

nical assistance to accomplish the goals of the MOU, U.S. EPA expressly reserves the right to abstain from expressing a position, either formal or informal, on any matter of law, policy or science related in any way to the subject matter of this MOU, including, but not limited to, any matter of law, policy or science related to any PBT pollutant. Nothing in this MOU shall constitute any commitment by U.S. EPA to investigate or reinvestigate any position, either formal or informal on any matter of law, policy or science.

10. AHA shall maintain full right, title and interest in any intellectual property right, including a copyright, in any work product developed solely by AHA under this MOU. Intellectual property developed by AHA with financial assistance from U.S. EPA shall be subject to theconditions set forth in U.S. EPA's applicable assistance regulations (e.g., 40 C.F.R. 30.36). Any intellectual property developed collaboratively by the Parties will also be governed by the Federal Copyright Statute at Title 17 of the United States Code or by the Federal Patent Statute at Title 35 of the United States Code.

11. Information on source reduction received by U.S. EPA pursuant to this MOU shall be made available to the public pursuant to Section 6606(b) of the PPA, 42 U.S.C. 13105(b).

7.0 PRIMARY CONTACTS.

The Parties intend that the work under this MOU shall be carried out in the most efficient manner possible. To that end, the Parties intend to designate individuals that will serve as primary contacts between the Parties. The Parties intend that, to the maximum extent possible and unless otherwise approved by the other Party, all significant communications between the Parties shall be made through the primary contacts. The designated primary contacts for the Parties are listed in Attachment #2 to this MOU.

8.0 TERMINATION.

Unless extended by a written agreement executed by both Parties, this MOU shall terminate exactly five (5) years from the date upon which this MOU becomes fully executed by all signatories listed below.

The Parties, on this 24th day of June, 1998, hereby agree to the foregoing MOU, which shall be effective immediately upon full execution by the signatories listed below.

For the United States Environmental Protection Agency:

Dr. William H. Sanders, III, Director
Office of Pollution Prevention and Toxics
Office of Prevention, Pesticides
and Toxic Substances
U.S. EPA

David A. Ullrich
Acting Regional Administrator
U.S. EPA, Region 5

For the American Hospital Association:

Jonathan T. Lord, M.D.
Chief Operating Officer
American Hospital Association

Health Care Without Harm
1755 S Street, NW
Suite 6B
Washington, DC 20009
Phone: 202.234.0091
Fax: 202.234.9121
www.noharm.org
info@hcwh.org

This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care.* For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.

Alternatives* to Polyvinyl Chloride (PVC) and Di-2-Ethylhexyl Phthalate (DEHP) Medical Devices

Products detailed in this publication include:

Ambulatory Products

Bedding Products

Blood bags:
- fresh frozen plasma
- packed red blood cells
- platelets
- platelet rich plasma

Body Bags

Central line catheters and PICC lines
- introcan safety catheters
- midline catheters
- percutaneous catheter introducers
- peripherally-inserted central catheters (PICC)

Dialysis, peritoneal
- rigid dialysate containers
- peritoneal catheters

Enteral feeding sets
- bags and tubing
- extension sets

Enteral feeding nasogastric tubes
- PEG tubes
- gastrostomy tubes
- nasoenteric tubes
- nasogastic tubes
- nasojejunal tubes
- pediatric clear straight catheters

Epidural vessel catheters

Gloves, Examination

Intravenous (IV) products:
- administration sets
- bags
- infusion tubes

Patient ID Bracelets

Respiratory Therapy Products
- endotracheal tubes
- masks, aerosol and oxygen
- oxygen hood
- tracheostomy tubes

Sequential Compression Devices

Total parental nutrition
- bags
- catheters
- tubing

Umbilical vessel catheters

Urinary drainage catheters
- Foley catheters
- urethral catheters for pediatrics
- urinary catheters

Wound Drains and Drainage Systems
- drains
- nephrostomy catheters
- surgical and wound drains
- thoracic catheters

Office Supplies

Shower Curtains

* Health Care Without Harm does not endorse any of these products, has not tested them for safety or efficacy, and does not take responsibility for the accuracy of the information or product performance. Listing here is based solely on information provided by the manufacturer. Non-PVC products may contain much smaller amounts of DEHP. Flexible PVC-free products still must be tested to ascertain whether they are in fact DEHP-free. Products that contain latex and chlorine are excluded from this table: latex products because of concerns over latex allergies and chlorine containing products because of concerns over lifecycle hazards. Exceptions are made for the few PVC products for which few or no non-PVC products are available. In those cases non-DEHP products are identified. This table is a work-in-progress.

Sources: Sustainable Hospitals Project, 2000, "Alternative Products," see http://sustainablehospitals.org (Lowell: Sustainable Hospitals Project, UMass Lowell); and Tickner, Joel, et al, 1999, The Use of Di-2-Ethylhexyl Phthalate in PVC Medical Devices: Exposure, Toxicity, and Alternatives (Lowell: Lowell Center for Sustainable Production, UMass Lowell); and all information was verified through telephone contacts with manufacturer representatives or review of manufacturer website information.

Pub 3-05 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care.* For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.
This version: October 15, 2001

Alternatives to Polyvinyl Chloride (PVC) and Di-2-Ethylhexyl Phthalate (DEHP) Medical Devices (Part 1 of 4)

Products	Manufacturer	Telephone	Webpage	Material	Comments
Ambulatory Products	Many manufacturers including Merry Walker Corp.	815-678-3388	www.merrywalker.com	Steel	Product: Merry Walker
Bedding Products	Precision Dynamics Corp.	800-847-0670	www.pdcorp.com	Polyethylene	Disposable mattress and pillow covers, draw sheets
Blood Bags	Baxter Healthcare, Fenwal Division	800-766-1077	www.baxter.com	Polyolefin Non-DEHP PVC	Bags for platelets, platelet rich plasma and fresh frozen plasma Bags for packed red blood cells
Body Bags	LASAN Plastics, Inc.	207-693-4817	www.lasan.com	Polyethylene/polypropylene blend	
Central Line Catheters and PICC Lines	B. Braun	800-227-2862	www.bbraunusa.com	Polyurethane or Teflon Teflon or polyurethane	Percutaneous catheter introducers Central venous catheter, introcan safety catheter
	Becton Dickinson	201-847-6800	www.bd.com	Silicone or polyurethane	Peripherally-inserted central catheter, midline catheter
	Klein-Baker Medical	210-696-4061	www.neocare.com	Silicone	Peripherally-inserted central catheter (neonates)
	Utah Medical Products, Inc.	800-533-4984	www.utahmed.com	Silicone	Peripherally-inserted central catheter (neonates)
	Vygon	800-544-4907	www.vygonusa.com	Polyurethane or Silicone Polyurethane	Peripherally-inserted catheter (adults and neonates) Midline catheters (pediatrics or adults)
Dialysis, Peritoneal	B. Braun	800-621-0445	www.bbraunusa.com	Polypropylene/polyethylene comonomer	Rigid peritoneal dialysate container
	Degania Silicone	401-658-0130	www.deganiasilicone.com	Silicone	Peritoneal catheter
Enteral Feeding Sets	Children's Medical Ventures	800-377-3449	www.childmed.com	Non-DEHP PVC	Enteral set
	CORPAK MedSystems	800-323-6305	www.corpakmedsystems.com	Multi-layer bag: nylon, ethylene vinyl acetate, polypropylene Non-DEHP PVC	Non-PVC bag Non-DEHP tube
	Kendall Healthcare	800-962-9888	www.kendallhq.com	Non-DEHP PVC	Non-DEHP bag & tube
	Vygon	800-544-4907	www.vygonusa.com	Polyethylene	Extension set tubes

Alternatives to Polyvinyl Chloride (PVC) and Di-2-Ethylhexyl Phthalate (DEHP) Medical Devices (Part 2 of 4)

Products	Manufacturer	Telephone	Webpage	Material	Comments
Enteral Feeding--Nasogastric (NG) Tubes	CORPAK MedSystems	800-323-6305	www.corpakmedsystems.com	Silicone Polyurethane	Gastotrostomy tube for neonates PEG tube for neonates, nasoenteric feeding tube
	C. R. Bard, Inc.	800-545-0890	www.bardmedical.com	Silicone Polyurethane	Nasogastric tube for neonates Pediatric clear staright catheter
	Kendall Healthcare	800-962-9888	www.kendallhq.com	Polyurethane	Nasogastric tube, PEG feeding tube
	Kimberly-Clark (Ballard Medical Devices)	800-524-3557	www.kchealthcare.com	Silicone	PEG feeding tube, gastrotomy feeding tube, jejunal feeding tube
	Klein-Baker Medical	210-696-4061	www.neocare.com	Silicone	Feeding tube for neonates
	Ross	800-231-3330	www.ross.com	Polyurethane Silicone	Nasoenteric feeding tube, nasojejunal feeding tube Gastrostomy tube (some peds), PEG tube
	Utah Medical Products, Inc.	800-533-4984	www.utahmed.com	Silicone	Nasogastric and nasojejunal tubes (neonates/peds)
	Vygon	800-544-4907	www.vygonusa.com	Polyurethane Silicone	Gastric feeding tubes for infants, sump tube (Salem or Replogal) Nasojejunal tubes
	Zevex	800-970-2337	www.zevex.com	Polyurethane	Nasoenteric feeding tube
Epidural Vessel Catheters	B. Braun	800-227-2862	www.bbraunusa.com	Polyamide (Nylon)	Epidural vessel catheter
	Vygon	800-544-4907	www.vygonusa.com	Polyethylene, polyurethane or polyamide (nylon)	Epidural vessel catheter
Gloves, Examination	Allegiance Healthcare Corp.	800-964-4227	www.allegiance.net	Nitrile	
	Ansell-Perry	800-321-9752	www.ansellhealthcare.com	Nitrile	
	Best Manufacturing Co.	800-241-0323	www.bestglove.com	Nitrile	
	ECI Medical Technologies	902-543-6655	www.ecimedical.com	Styrene butadiene	
	Maxxim Medical	800-727-7951	www.maxximmedical.com	Polyurethane	

Alternatives to Polyvinyl Chloride (PVC) and Di-2-Ethylhexyl Phthalate (DEHP) Medical Devices (Part 3 of 3)

Products	Manufacturer	Telephone	Webpage	Material	Comments
Gloves, Examination (continued)	Safeskin Corporation	800-462-9993	www.safeskin.com	Nitrile	
	SmartCare Inc.	800-822-8956	www.smartcare.com	Nitrile	
	Tillotson Healthcare Corp.	800-445-6830	www.thcnet.com	Nitrile	
Intravenous (IV) Bags and Tubing	B. Braun	800-227-2862	www.bbraunusa.com	Multi-layer bag: Polypropylene/polyethylene copolymer, polyester, elastomer laminate Polypropylene/polyethylene copolymer Polyethylene	IV bag (Excel) IV bag (PAB) IV set with PVC-free tube (no longer manufacturing, but still available from some vendors)
	Budget Medical Products	800-569-1620	www.icumed.com	Non-DEHP PVC	IV tube
	Children's Medical Ventures	800-377-3449	www.childmed.com	Non-DEHP PVC	IV administration sets
	Curlin Medical	714-893-2200	www.curlinmedical.com	Non-DEHP PVC	Infusion tube
Office Supplies: 3-ring binders	Available from standard office supply companies	800-847-0670		Polyethylene, cardboard	
Patient ID Bracelets	Precision Dynamics Corp.	800-521-5123	www.pdcorp.com	Tyvek®	Appropriate for short stays
	TabBand	800-940-3993	www.tabband.com	Tyvek®, polypropylene and polyethylene	
	Wristband & Medical Specialty Products	800-348-6064	www.wristbandsupply.com	Tyvek®	Appropriate for short stays
Respiratory Therapy Products	Bivona Medical Technologies	800-847-8000	www.bivona.com	Silicone	Endotracheal tube, tracheostomy tube
	DHD Healthcare	800-553-5214	www.dhd.com	Silicone	Aerosol mask
	Rusch	800-533-4984	www.ruschinc.com	Red rubber or silicone	Reusable endotracheal tube
	Utah Medical Products, Inc.	800-932-0760	www.utahmed.com	Co-polyester--polyethylene foam and polypropylene	Disposable infant oxygen hood
	Vital Signs	800-962-9888	www.vital-signs.com	Polyester	Oxygen or aerosol applications-Aero2Mask

Alternatives to Polyvinyl Chloride (PVC) and Di-2-Ethylhexyl Phthalate (DEHP) Medical Devices (Part 4 of 4)

Products	Manufacturer	Telephone	Webpage	Material	Comments
Sequential Compression Device	Kendall Healthcare	800-846-3000	www.kendallhq.com	Polyolefins	
Shower Curtains	Brookstone	800-222-6883	www.brookstone.com	Tyvek®	
	Many manufacturers			Nylon	
Total Parenteral Nutrition	Abbott	800-766-1077	www.abbott.com	Non-DEHP PVC	Empty IV bag and tube
	Baxter Healthcare, Fenwal Division	800-544-4907	www.baxter.com	Ethylene vinyl acetate	TPN bag
	Vygon	800-962-9888	www.vygonusa.com	Polyurethane	Catheter for parenteral nutrition and mid/long-term IV therapy (See PICC lines above)
Umbilical Vessel Catheters	Kendall Healthcare	210-696-4061	www.kendallhq.com	Polyurethane	Umbilical vessel catheter
	Klein-Baker Medical	800-533-4984	www.neocare.com	Silicone	Umbilical vessel catheter (neonates)
	Utah Medical Products, Inc.	800-544-4907	www.utahmed.com	Silicone or polyurethane	Umbilical vessel catheter
	Vygon	800-545-0890	www.vygonusa.com	Polyurethane	Umbilical vessel catheter
Urinary Catheters	C.R. Bard	800-658-0130	www.bardmedical.com	Polyurethane	Urethral catheter for pediatrics
	Degania Silicone	210-696-4061	www.deganiasilicone.com	Silicone	Foley catheter
	Klein-Baker Medical	800-533-4984	www.neocare.com	Silicone	Urinary drainage catheter (neonates)
	Utah Medical Products, Inc.	800-545-0890	www.utahmed.com	Silicone	Urinary catheters
Wound Drains/Drainage Systems	C.R. Bard	401-658-0130	www.bardmedical.com	Silicone	Drains
	Degania Silicone	800-533-4984	www.deganiasilicone.com	Silicone	Surgical and wound drains, thoracic catheter, nephrostomy catheter (may fit neonates)
	Utah Medical Products, Inc.		www.utahmed.com	Silicone	Thoracic catheter

Health Care Without Harm does not endorse any of these products, has not tested them for safety or efficacy, and does not take responsibility for the accuracy of the information or product performance. Listing here is based solely on information provided by the manufacturer. Non-PVC products may contain much smaller amounts of DEHP. Flexible PVC-free products still must be tested to ascertain whether they are in fact DEHP-free. Products that contain latex and chlorine are excluded from this table: latex products because of concerns over latex allergies and chlorine containing products because of concerns over lifecycle hazards. Exceptions are made for the few PVC products for which few or no non-PVC products are available. In those cases non-DEHP products are identified. This table is a work-in-progress.

Sources: Sustainable Hospitals Project, 2000, "Alternative Products," see http://sustainablehospitals.org (Lowell: Sustainable Hospitals Project, UMass Lowell); and Tickner, Joel, et al, 1999, The Use of Di-2-Ethylhexyl Phthalate in PVC Medical Devices: Exposure, Toxicity, and Alternatives (Lowell: Lowell Center for Sustainable Production, UMass Lowell); and all information was verified through telephone contacts with manufacturer representatives or review of manufacturer website information.

Health Care Without Harm
1755 S Street, NW
Suite 6B
Washington, DC 20009
Phone: 202.234.0091
Fax: 202.234.9121
www.noharm.org
info@hcwh.org

This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.

List of Resolutions on PVC, Dioxins, Mercury

Resolution or Ordinance	Date	Issues Covered
American Medical Association	March 2001	Mercury, Lead, Benzene
American Medical Women's Association	Nov. 1999	PVC, Dioxin, Incineration
American Nurses Association	1997	PVC, Incineration, Mercury
American Public Health Association	Nov. 1996	PVC, Dioxin
Association of Bay Area Governments	Sep. 1999	PVC, Dioxin
California Medical Association	March 2001	DEHP
California Medical Association	Feb. 1998	PVC, Dioxin
California Medical Association	March 2000	PVC, Dioxin, Incineration
California Medical Association	March 2000	Mercury
Catholic Health Association of Minnesota	April 1999	PVC, Dioxin
Chicago, Illinois City Council	July 2001	Mercury
Chicago Medical Society	1998	PVC, Dioxin
Chicago Medical Society	Oct. 2001	Mercury
Chicago Medical Society	Oct. 2001	DEHP in NICUs
Church of the Brethren General Board	Oct. 1996	PVC, Dioxin
City and County of San Francisco, CA	Sep. 1998	PVC, Dioxin
City and County of San Francisco Commission on the Environment	March 1999	PVC, Dioxin
City Council of Ann Arbor, Michigan	July 2000	Mercury
City Council of Duluth, Minnesota	March 2000	Mercury
City of Berkeley, California	Oct. 1998	PVC, Dioxin
City of Berkeley, California	Oct. 2000	PVC, Dioxin
City of Boston, Massachusetts	Nov. 2000	Mercury
City of Los Angeles, California	Aug. 2000	Mercury
City of San Francisco, California	Feb. 2000	Mercury
Cohasset, Massachusetts City Council	March 2001	Mercury
Common Council of Stoughton, Wisconsin	Oct. 2000	Mercury
Council of Dane County, Wisconsin	July 2000	Mercury
County of Santa Clara Office of the Board of Supervisors	June 1998	PVC, Dioxin
Fergus Falls, Minnesota City Council	Dec. 2000	Mercury

Pub 1.06 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care.* For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.
This version: October 15, 2001

Haverhill, Massachusetts City Council	March 2001	Mercury
International Council of Nurses	1998	PVC, Dioxin, Latex, Mercury, Incineration
International Society of Doctors for the Environment	Oct. 1999	PVC, Dioxin
Marin County Board of Supervisors	Dec. 1999	PVC, Dioxin
Massachusetts Medical Society	Nov. 2000	Mercury
Minnesota Academy of Family Physicians	April 1999	PVC, Dioxin
Minnesota Health and Housing Alliance	Dec. 1999	PVC, Dioxin
Minnesota Medical Association House of Delegates	Oct. 1998	PVC, Dioxin
Minnesota Public Health Association	1996	PVC, Dioxin
Natick, Massachusetts City Council	April 2000	Mercury
Oakland City Council	Feb. 1999	PVC, Dioxin
Racine, Wisconsin Common Council	March 2001	Mercury
Religious Action Center of Reform Judaism	April 1999	PVC, Dioxin, Incineration, Mercury
State of Indiana	May 2001	Mercury
State of Maine	June 2001	Mercury
State of Maryland	May 2001	Mercury
State of Minnesota	April 2001	Mercury
State of New Hampshire	June 2000	Mercury
State of Oregon	Aug. 2001	Mercury
State of Rhode Island	July 2001	Mercury
Tenet Healthcare Corporation	Oct. 1999	PVC, Dioxin
United Methodist Church	April 1996	PVC, Dioxin
United Methodist Church	2000	PVC, Dioxin
Universal Health Services	May 1999	PVC, Dioxin
Village Board of DeForest, Wisconsin	Sept. 2000	Mercury
Wisconsin Public Health Association	June 2001	Mercury
Worcester, Massachusetts City Council	May 2001	Mercury

Health Care Without Harm

1755 S Street, NW
Suite 6B
Washington, DC 20009
Phone: 202.234.0091
Fax: 202.234.9121
www.noharm.org
info@hcwh.org

This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care.* For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.

Resources on PVC and DEHP in Health Care

US Government Publications

U.S. Food and Drug Administration (FDA), Center for Devices and Radiological Health. 2001. *Safety Assessment of Di(2-ethylhexyl) Phthalate (DEHP) Released from PVC Medical Devices*. Rockville, MD: U.S. FDA.

National Toxicology Program, Center for the Evaluation of Risks to Human Reproduction (CERHR). 2000. *NTP CERHR Expert Panel Report on Di (2-ethylhexyl) Phthalate*. Webpage: http://cerhr.niehs.nih.gov/news/index.html

United State Environmental Protection Agency (US EPA). 2000. *Draft Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) and Related Compounds*. Washington, DC: US EPA. Webpage: http://www.epa.gov/ncea/pdfs/dioxin/part1and2.htm.

European Government Publications

Swedish National Chemicals Inspectorate. 2000. *Risk Assessment: bis(2-ethylhexyl) phthalate* (Final Draft). Solna, Sweden.

Danish Ministry of Environment and Energy. 1999. *Action Plan for Reducing and Phasing Out Phthalates in Soft Plastics*. Copenhagen, Denmark.

European Commission. 2000. *Green Paper on Environmental Issues of PVC*. Webpage: www.europa.eu.int/comm/environment/pvc/index.htm

European Commission. 2000. Five PVC studies:

1. *The Influence of PVC on the Quantity and Hazardousness of Flue Gas Residues from Incineration*
2. *Economic Evaluation of PVC Waste Management*
3. *The Behaviour of PVC in Landfill*
4. *Chemical Recycling of Plastics Waste (PVC and Other Resins)*
5. *Mechanical Recycling of PVC Wastes*

Webpage: www.europa.eu.int/comm/environment/waste/facts_en.htm

Other Materials on PVC or DEHP in Healthcare

Health Care Without Harm. 2001. *Dioxin, PVC and Health Care*. Washington, DC: Health Care Without Harm. Webpage: www.noharm.org.

Health Care Without Harm. 2001. *Reducing PVC Use in Hospitals*. Washington, DC: Health Care Without Harm. Webpage: www.noharm.org.

Health Care Without Harm. 2001. *A Summary of the FDA Safety Assessment of DEHP Released from PVC Medical Devices*. Washington, DC: Health Care Without Harm. Webpage: www.noharm.org.

Rossi M. 2000. *Neonatal Exposure to DEHP and Opportunities for Prevention*. Falls Church, VA: Health Care Without Harm. Webpage: www.noharm.org.

Rossi M, Schettler T. 2000. "PVC White Paper." In *Proceedings from Setting Healthcare's Environmental Agenda* (San Francisco, CA). Falls Church, VA: Health Care Without Harm.

Schettler T. 1999. *Do We Have a Right to Higher Standards? C. Everett Koop, MD and an ACSH Panel Review the Toxicity and Metabolism of DEHP*. Falls Church, VA: Health Care Without Harm. Webpage: www.noharm.org.

Schettler T. 2001. *DEHP Exposures During the Medical Care of Infants: A Cause for Concern*. Washington, DC: Health Care Without Harm. Webpage: www.noharm.org.

Silas J. 2001. *A Summary of the Expert Panel Report of the National Toxicology Program on DEHP and its Risks to Human Reproduction*. Washington, DC: Health Care Without Harm. Webpage: www.noharm.org.

Tickner J, Schettler T, Guidotti T, McCally M, Rossi M. 2001. "Health Risks Posed by Use of Di-2-Ethylhexyl Phthalate (DEHP) in PVC Medical Devices: A Critical Review." *American Journal of Industrial Medicine*, 39:100-111.

Pub 3-08 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.
This version: October 15, 2001

Tickner J, Hunt P, Rossi M, Haiama N, Lappe M. 1999. *The Use of Di-2-Ethylhexyl Phthalate in PVC Medical Devices: Exposure, Toxicity, and Alternatives*. Lowell: Lowell Center for Sustainable Production, University of Massachusetts Lowell. Webpage: www.noharm.org.

University of Massachusetts Lowell, Sustainable Hospitals Project. 2000. "Alternative Products." Webpage: www.sustainablehospitals.org.

Video: "First Do No Harm: PVC and Medicine's Responsibility." Western Lake Superior Sanitary District, MN. (2000). (For copies contact Health Care Without Harm at hcwh@chej.org or 202-234-0091).

Health Care Without Harm

1755 S Street, NW
Suite 6B
Washington, DC 20009
Phone: 202.234.0091
Fax: 202.234.9121
www.noharm.org
info@hcwh.org

This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.

Resources on PVC and DEHP in Health Care

US Government Publications

U.S. Food and Drug Administration (FDA), Center for Devices and Radiological Health. 2001. *Safety Assessment of Di(2-ethylhexyl) Phthalate (DEHP) Released from PVC Medical Devices.* Rockville, MD: U.S. FDA.

National Toxicology Program, Center for the Evaluation of Risks to Human Reproduction (CERHR). 2000. *NTP CERHR Expert Panel Report on Di (2-ethylhexyl) Phthalate.* Webpage: http://cerhr.niehs.nih.gov/news/index.html

United State Environmental Protection Agency (US EPA). 2000. *Draft Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) and Related Compounds.* Washington, DC: US EPA. Webpage: http://www.epa.gov/ncea/pdfs/dioxin/part1and2.htm.

European Government Publications

Swedish National Chemicals Inspectorate. 2000. *Risk Assessment: bis(2-ethylhexyl) phthalate* (Final Draft). Solna, Sweden.

Danish Ministry of Environment and Energy. 1999. *Action Plan for Reducing and Phasing Out Phthalates in Soft Plastics.* Copenhagen, Denmark.

European Commission. 2000. *Green Paper on Environmental Issues of PVC.* Webpage: www.europa.eu.int/comm/environment/pvc/index.htm

European Commission. 2000. Five PVC studies:

1. *The Influence of PVC on the Quantity and Hazardousness of Flue Gas Residues from Incineration*
2. *Economic Evaluation of PVC Waste Management*
3. *The Behaviour of PVC in Landfill*
4. *Chemical Recycling of Plastics Waste (PVC and Other Resins)*
5. *Mechanical Recycling of PVC Wastes*

Webpage: www.europa.eu.int/comm/environment/waste/facts_en.htm

Other Materials on PVC or DEHP in Healthcare

Health Care Without Harm. 2001. *Dioxin, PVC and Health Care.* Washington, DC: Health Care Without Harm. Webpage: www.noharm.org.

Health Care Without Harm. 2001. *Reducing PVC Use in Hospitals.* Washington, DC: Health Care Without Harm. Webpage: www.noharm.org.

Health Care Without Harm. 2001. *A Summary of the FDA Safety Assessment of DEHP Released from PVC Medical Devices.* Washington, DC: Health Care Without Harm. Webpage: www.noharm.org.

Rossi M. 2000. *Neonatal Exposure to DEHP and Opportunities for Prevention.* Falls Church, VA: Health Care Without Harm. Webpage: www.noharm.org.

Rossi M, Schettler T. 2000. "PVC White Paper." In *Proceedings from Setting Healthcare's Environmental Agenda* (San Francisco, CA). Falls Church, VA: Health Care Without Harm.

Schettler T. 1999. *Do We Have a Right to Higher Standards? C. Everett Koop, MD and an ACSH Panel Review the Toxicity and Metabolism of DEHP.* Falls Church, VA: Health Care Without Harm. Webpage: www.noharm.org.

Schettler T. 2001. *DEHP Exposures During the Medical Care of Infants: A Cause for Concern.* Washington, DC: Health Care Without Harm. Webpage: www.noharm.org.

Silas J. 2001. *A Summary of the Expert Panel Report of the National Toxicology Program on DEHP and its Risks to Human Reproduction.* Washington, DC: Health Care Without Harm. Webpage: www.noharm.org.

Tickner J, Schettler T, Guidotti T, McCally M, Rossi M. 2001. "Health Risks Posed by Use of Di-2-Ethylhexyl Phthalate (DEHP) in PVC Medical Devices: A Critical Review." *American Journal of Industrial Medicine*, 39:100-111.

Pub 3-08 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care.* For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.
This version: October 15, 2001

Tickner J, Hunt P, Rossi M, Haiama N, Lappe M. 1999. *The Use of Di-2-Ethylhexyl Phthalate in PVC Medical Devices: Exposure, Toxicity, and Alternatives*. Lowell: Lowell Center for Sustainable Production, University of Massachusetts Lowell. Webpage: www.noharm.org.

University of Massachusetts Lowell, Sustainable Hospitals Project. 2000. "Alternative Products." Webpage: www.sustainablehospitals.org.

Video: "First Do No Harm: PVC and Medicine's Responsibility." Western Lake Superior Sanitary District, MN. (2000). (For copies contact Health Care Without Harm at hcwh@chej.org or 202-234-0091).

Health Care Without Harm

1755 S Street, NW
Suite 6B
Washington, DC 20009
Phone: 202.234.0091
Fax: 202.234.9121
www.noharm.org
info@hcwh.org

This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.

The Mercury Problem Fast Facts

- Mercury is a neurotoxic, heavy metal that is linked to numerous health effects in wildlife and people.
- Mercury can be found throughout hospitals in products such as thermometers, sphygmomanometers, dilation and feeding tubes, batteries, fluorescent lamps, thermostats, and bleach.
- The most likely routes of exposure are inhalation of inorganic mercury vapor after a spill or during a manufacturing process, or ingestion of methylmercury from contaminated fish.
- Mercury can pose a significant health threat when spilled in a small, poorly ventilated room.
- A report issued by the National Academy of Sciences National Research Council estimated that every year 60,000 children are at risk of being born in the United States with neurological problems that could lead to poor school performance because of exposure to methylmercury in utero.[i]
- A study by the Centers for Disease Control estimated that 1 in 10 women currently have mercury levels in their bodies high enough to cause neurological effects in their offspring.[ii]
- There is approximately 1 gram of mercury in a typical fever thermometer. This is enough mercury to contaminate a lake with a surface area of about 20 acres, to the degree that fish would be unsafe to eat.[iii]
- There are over 1,900 fish advisories in place on water bodies across the U.S. due to mercury contamination.
- In March 2001, the FDA released a consumer advisory that warned pregnant women not to eat shark, swordfish, king mackerel or tilefish, because they contain enough mercury to damage the fetus's nervous system. Young children, nursing mothers and women who may become pregnant were advised to avoid those fish as well.[iv]
- Hospitals contribute 4-5% of the total wastewater mercury load.[v]
- There is up to 50 times more mercury in medical waste than in general municipal waste, and the amount of mercury emitted from general medical waste incinerators averages more than 60 times that from pathological incinerators.[vi]
- Medical and solid waste that contains mercury or has been contaminated by mercury is considered hazardous waste and should be kept out of the waste stream.
- In 2000, the mercury from fever thermometers accounted for 17 tons or 10% of mercury in the municipal solid waste stream.[vii]
- In 2000, mercury from batteries made up 98 tons or 57% of mercury in the municipal solid waste stream.[viii]
- Legislation banning the sale of mercury thermometers has been passed in the cities of Duluth, MN; Ann Arbor, MI; San Francisco, CA Boston, MA; Chicago, IL; and in the states of Maryland, Maine, Minnesota and New Hampshire. Legislation is pending in a host of other cities, states and in Congress.

Pub 2-01 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*.
For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.
This version: October 15, 2001

Notes

i. National Academy of Sciences National Research Council, July 2000. "Toxicological Effects of Methylmercury."

ii. CDC Morbidity and Mortality Weekly Report. "Blood and Hair Mercury Levels in Young Children and Women of Child Bearing Age-United States." 1999 Vol 50, No 08,140. 03/02/2001

iii. Personal Communication, Jamie Harvie, PE. Institute for a Sustainable Future. 218-525-7806.

iv. U.S. Food And Drug Administration, Center for Food Safety and Applied Nutrition, www.cfsan.fda.gov March 2001.

v. Personal Communication, Western Lake Superior Sanitary District, Duluth, MN.

vi. USEPA. Mercury in Medical Waste: Keeping Mercury out of Medical Waste. www.epa.gov/reg5oair/glakes/fact1.htm

vii. USEPA. Background Information on Mercury Sources and Regulations. www.epa.gov/grtlakes/bnsdocs/ merc-srce/merc_srce.html#Table 2B

viii. USEPA. Background Information on Mercury Sources and Regulations. www.epa.gov/grtlakes/bnsdocs/mercsrce/ merc_srce.html#Table 2B

Health Care Without Harm

1755 S Street, NW
Suite 6B
Washington, DC 20009
Phone: 202.234.0091
Fax: 202.234.9121
www.noharm.org
info@hcwh.org

This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.

Making Medicine Mercury-Free

A Resource Guide for Mercury-Free Medicine

Mercury Elimination—Preventive Medicine for Human Health and The Environment

Health Care Without Harm (HCWH) is an international coalition of more than 340 organizations in 37 countries, working together to eliminate pollution from health care practices without compromising safety or care. Health Care Without Harm is committed to transforming the health care industry so that it is no longer a source of environmental harm.

Why Mercury has No Business in the Health Care Business

Mercury can be found in many health care devices, including fever thermometers, blood pressure cuffs, and esophageal dilators. Mercury is also found in many chemicals and measurement devices used in health care laboratories. If these products are spilled, broken or disposed of improperly, there is a potential for significant harm to human health and the environment. Medical waste incinerators, as well as municipal waste incinerators, emit mercury when they burn wastes that contain mercury. According to the U.S. Environmental Protection Agency (EPA), medical waste incinerators are the fourth largest source of mercury to the environment.[1] Hospitals are also known to contribute 4-5% of the total waste water mercury load.[2]

Mercury-containing devices improperly disposed of in a landfill are also a potential source of harm. Mercury fever thermometers alone contribute about 17 tons of mercury to solid waste landfills annually.[3]

Health Implications

Mercury is a reproductive toxin and a potent neurotoxin—it affects the brain and the central nervous system. Pregnant women, women of childbearing age and small children are at the greatest risk. Mercury can cross the placenta and cause irreparable neurological damage to the fetus. A National Academies of Science report from July, 2000 showed that 60,000 children are born in the United States each year with neurological problems that could lead to poor school performance because of exposure to methylmercury in utero.[4] In March, 2001 a study from the Centers for Disease Control and Prevention sampled the mercury levels in the blood, hair and urine of women and children and found that one in 10 women have mercury levels high enough to cause their children neurological damage — putting about 395,000 babies a year in danger.[5]

Environmental Implications

Mercury in the air is transported to water bodies primarily through precipitation. Mercury released to the environment can cause early death, weight loss, and reproductive problems in wildlife. In fish, (methyl) mercury can concentrate to levels one million times higher than those in the surrounding water. Over forty states have fish consumption advisories because of widespread mercury contamination.

Pub 2-02 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.
This version: October 15, 2001

Economic Implications

Many hospitals are now required to meet strict wastewater treatment discharge limits for mercury, and this regulatory trend is likely to continue. Mercury spill training is costly and in some parts of the country, JCAHO has issued recommendations to hospitals for inadequate staff training on mercury clean-up. There are also countless stories of mercury spills in hospitals where mercury cleanup costs have been substantially higher than the cost of mercury-free alternatives. By eliminating mercury, hospitals can not only protect the health of local communities, but their "bottom line" as well.

Regulatory Implications

By Federal law, mercury is a regulated waste; as a result, its management can be quite expensive. Using mercury-containing devices requires a "mercury management policy" and a spill response plan for emergencies. Costs associated with mercury spills are high — often in the thousands of dollars — and can pose health risks for health care staff and patients. Compliance with regulations for disposal of mercury-contaminated waste with a hazardous waste hauler may result in incineration of the waste, with subsequent mercury emissions to the environment. In addition, elemental mercury recycling may keep it out of the environment in the short-term, but its reuse in new products poses the same eventual risk to human health.
Hospitals can avoid the risk of mercury management altogether by using non-mercury alternatives. As leading health care institutions across the country, such as Dartmouth-Hitchcock Medical Center, the Mayo Clinic and the National Institutes of Health now recognize, safe and effective alternatives exist for nearly all traditional health care uses of mercury, from temperature and blood pressure measurement to fixatives used in the lab.

How Health Care Without Harm is Addressing the Problem

In 1998, Health Care Without Harm kicked off the 'Making Medicine Mercury-Free' program by asking hospitals to take a pledge to phase-out mercury-containing products in their facilities. HCWH has also provided educational and technical resources to those hospitals implementing mercury elimination programs. As of August, 2001, over 600 hospitals and clinics had signed the pledge to go mercury-free.

In September, 2001 HCWH and the Hospitals for a Healthy Environment (H2E) partnership merged their pledge programs into one national pledge initiative. H2E is a partnership between HCWH, the American Hospital Association (AHA), the American Nurses Association (ANA) and the Environmental Protection Agency (EPA). As part of this collaboration, HCWH will continue to assist health care providers in meeting this important mercury elimination goal.

What States and Cities are Doing

Communities across the country are holding mercury thermometer exchanges in an effort to get the toxic metal out of family medicine cabinets and to educate the community about the dangers of mercury. The exchanges are designed so that residents can bring in their mercury thermometers for recycling and receive a new non-mercury alternative at the same time. To assist in these efforts, HCWH has developed a resource guide entitled *How to Plan and Hold a Mercury Fever Thermometer Exchange*. You can order this and several other publications or sign up for the H2E listserv by filling out the form on page four.

Cities and *states* across the country are taking a proactive approach to mercury elimination. For example, San Francisco, CA; Ann Arbor, MI; Duluth, MN; Boston, MA; Chicago, IL; and states, such as New Hampshire, Maine, Maryland and Minnesota have prohibited the sale, manufacture and distribution of mercury thermometers within their jurisdictions. City, state and federal legislation is pending across the country to eliminate the use of mercury and mercury-containing products.

What Your Hospital Can Do

- **Take the Making Medicine Mercury-Free Pledge** and join the hundreds of medical facilities across the country that have begun the process of eliminating their use of mercury. The eventual elimination of mercury-containing products is the only way to keep mercury out of the environment and to reduce its impacts on human health. To take the pledge, please visit the website (www.h2e-online.org) and gain recognition for your commitment to improving environmental health. Once you have embarked on your mercury elimination program, you will be eligible to receive a Making Medicine Mercury Free Award.
- **Join the H2E listserv** to share and learn technical information, find educational tools and identify practical strategies for mercury elimination and discuss other pollution prevention and waste minimization issues. To join the listserv, go to the HCWH website (www.noharm.org) and click on the H2E logo.
- **Conduct a mercury audit** to identify all uses and sources of mercury in your institution.
- **Commit to eliminate the use of mercury** by investigating opportunities to phase out mercury-containing items where fewer barriers exist and immediate steps can be taken. For example, investigate replacing mercury-filled patient

thermometers with digital or electronic thermometers; replacing mercury with water in Miller-Abbott Tubes, replacing mercury-containing bougies or esophageal dilators with silicon ones; or replacing mercury-filled blood pressure measuring devices with aneroid units.

- **Implement a "Mercury-Free Purchasing Policy."** Assign materials management staff to communicate with suppliers about the policy and to work with staff on finding non-mercury alternatives.
- **Educate and train your employees** about facility protocols, including information about mercury and its effects on human health and the environment.
- **Hold a mercury thermometer exchange** for your employees.
- **Discontinue sending mercury thermometers home** with the parents of newborns and other patients.

For more information, please contact:
Health Care Without Harm
1755 S Street, NW, Suite 6B
Washington, DC 20009
www.noharm.org
Phone: 202-234-0091
Fax: 202-234-9121
E-mail: info@hcwh.org

You may also contact the technical staff listed on the H2E website (www.h2e-online.org) for continued technical assistance and support.

Resource List

Publications

How to Plan and Hold a Mercury Fever Thermometer Exchange
Mercury Thermometers and Your Family's Health
Making Medicine Mercury Free
The Mercury Problem- Fast Facts
What's Wrong With Mercury Thermometers?
Health Care Without Harm, 1755 S St., NW Suite 6B Washington, DC 20009
(202) 234-0091 or info@hcwh.org

Becoming a Mercury-Free Facility: A Priority to be Achieved by the Year 2000. Hollie Shaner, RN, MSA. AHA/ASHES -1-800-AHA-2626

Blueprint for Mercury Elimination Western Lake Superior Sanitary District; (38-page book of interest 218-722-3336, free).

Eliminating Mercury Use in Hospital Laboratories: A Step toward Zero Discharge: Public Health Reports, July/August 1999 Volume 114 p353-358.

Medical waste pollution prevention. Keep mercury out of the wastewater stream. U.S. Environmental Protection Agency, Region 5. Chicago, IL.

Mercury. Western Lake Superior Sanitary District. Duluth, MN.

Mercury Pollution Prevention in Healthcare: A Prescription for Success. National Wildlife Federation, Great Lakes Natural Resource Center. NWF/Great Lakes Natural Resource Center, 506 East Liberty, 2nd Floor, Ann Arbor MI 48104- 2210. (734) 669-3351.

Mercury Use in Hospitals and Clinics 20-minute video and guidebook. Minnesota Office of Environmental Assistance, 520 Lafayette Road N., 2nd Floor, St. Paul, MN 55155, (612) 296-3417, (800) 657-3843.

Pollution Prevention for Hospitals and Medical Facilities and Best Management Practices for Hospitals and Medical Facilities Palo Alto Regional Water Quality Control Plant, 2501 Embarcadero Way, Palo Alto CA 94303. (415) 329- 2598

Reducing Mercury Use in Health Care, Promoting a Healthier Environment, A How-to Manual. Monroe County, New York Department of Health (716) 292-3935

The Case Against Mercury: Rx for Pollution Prevention (poster and booklet). Created in cooperation with U.S. Environmental Protection Agency. Terrine Institute, 4 Herbert Street, Alexandria VA 22305, Region 5.(703) 548-5473 www.terrene.org.

Video

Agents of Change: Mercury Waste Solutions. American Hospital Association: 1-800-AHA-2626

Mercury and the Healthcare Professional (17 minutes). Minnesota Office of Environmental Assistance and the US EPA, Region 5. Contact Emily Moore, Minnesota Office of Environmental Assistance, 520 Lafayette Road N., 2nd Floor, St. Paul MN,55155- 4100. (612) 215-0201.

Web Resources

Health Care Without Harm
www.noharm.org

Hospitals for a Healthy Environment (H2E)
www.h2e-online.org

First Do No Harm, Environmental Working Group, 1997.
www.ewg.org/pub/home/HCWC/hcwh.html

Harvard University: Laboratory Thermometers
www.uos.harvard.edu/ehs/factsheets/ea_mercury_therm.html

Indiana Department of Environmental Management: Factsheet on Mercury Thermometers
www.state.in.us/idem/ctap/mercury/thermometers.html

Massachusetts Water Resources Authority
www.mwra.state.ma.us

Massachusetts Medical, Academic and Scientific Community Organization (MASCO)
www.masco.org/mercury

Mercury in Medical Waste: Keeping Mercury Out of Medical Waste
www.p2pays.org/ref/01/00792.htm

Mercury Use Reduction & Waste Prevention in Medical Facilities
Educational software for the Web by USEPA Region 5 and Purdue University
www.epa.gov/seahome/mercury/src/title.htm

Minnesota Office of Environmental Assistance: Mercury for Health Professionals
www.moea.state.mn.us/res/V7_2/mercury.cfm

National Institutes of Health: Mad as a Hatter—Campaign for a Mercury-Free NIH
www.nih.gov/od/ors/ds/nomercury/

Notes

1. 1997 Mercury Report to Congress
2. Personal communication, Western Lake Superior Sanitary District, Duluth, MN.
3. (U.S. Environmental Protection Agency, 1996, Mercury Study Report to Congress, Science Advisory Board Review Draft, Vol. 2, p. 4-19, p. ES-3.)
4. CDC Morbidity and Mortality Weekly Report. "Blood and Hair Mercury Levels in Young Children and Women of Child-Bearing Age—United State." 1999 Vol. 50 No. 08:140, 03/02/2001.
5. National Academies of Science, National Research Council, July 2000. "Toxicological Effects of Methylmercury."

Making Medicine Mercury-Free

Contact Name: _____

Title: _____

Organization: _____

Address: _____

City, State,Zip: _____

Phone: (_____) _____ Fax: (_____) _____

I am interested in HCWH educational materials. Please send me the following publications:

- ❍ How to Plan and Hold a Mercury Thermometer Exchange
- ❍ Mercury Thermometers and your Family's Health
- ❍ Replacing Mercury Sphygmomanometers
- ❍ The Mercury Problem- Fast Facts
- ❍ Thermometer Fact Sheet
- ❍ Hospitals for a Healthy Environment (H2E) Information

❍ Please sign me up to the H2E listserve. My email address is:

_____

For a complete list of materials produced by HCWH, visit our website at www.noharm.org.

We'd like to know about any programs you have initiated in your facility, or any mercury related concerns or needs you might have. Please feel free to use the space below or attach/fax a separate sheet.

_____

_____

_____

_____

_____

_____

Fax back form to HCWH at 202-234-9121 or email info@hcwh.org for more information.

Health Care Without Harm
1755 S Street, NW
Suite 6B
Washington, DC 20009
Phone: 202.234.0091
Fax: 202.234.9121
www.noharm.org
info@hcwh.org

This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.

Instruments, Products, and Laboratory Chemicals Used in Hospitals That May Contain Mercury

This list should not be assumed to be complete. You may want to check one of the following resources for updates and additions:
www.masco.org
www.nih.gov/od/ors/ds/nomercury/
www.sustainablehospitals.org

Thermometers

- Body temperature thermometers
- Clerget sugar test thermometers
- Heating and cooling system thermometers
- Incubator/water bath thermometers
- Minimum/maximum thermometers
- National Institute of Standards and Technology calibration thermometers
- Tapered bulb (armored) thermometers

Sphygmomanometers

Gastrointestinal tubes

- Cantor tubes
- Esophageal dilators (bougie tubes)
- Feeding tubes
- Miller Abbott tubes

Dental amalgam

Pharmaceutical supplies

- Contact lens solutions and other ophthalmic products containing thimerosal or phenylmercuric nitrate
- Diuretics with mersalyl and mercury salts
- Early pregnancy test kits with mercury-containing preservative
- Merbromin/water solution
- Nasal spray with thimerosal, phenylmercuric acetate or phenylmercuric nitrate
- Vaccines with thimerosal (primarily in hemophilus, hepatitis, rabies, tetanus, influenza, diphtheria and pertussis vaccines)
- Cleaners and degreasers with mercury-contaminated caustic soda or chlorine

Batteries (medical use)

- Alarms
- Blood analyzers
- Defibrillators
- Hearing aids
- Meters
- Monitors
- Pacemakers
- Pumps
- Scales
- Telemetry transmitters
- Ultrasound
- Ventilators

Batteries (non-medical uses)

Lamps

- Fluorescent
- Germicidal
- High-intensity discharge (high pressure sodium, mercury vapor, metal halide)
- Ultraviolet

Electrical equipment

- Tilt switches
- Air flow/fan limit control
- Building security systems
- Chest freezer lids
- Fire alarm box switches
- Lap-top computer screen shut-off
- Pressure control (mounted on bourdon tube or diaphragm)
- Silent light switches (single-pole and three-way)
- Temperature control (mounted on bimetal coil or attached to bulb device)
- Washing machine (power shut off)

Float control

- Septic tanks
- Sump pumps

Thermostats (non-digital)

Thermostat probes in electrical equipment

Pub 2-03 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.
This version: October 15, 2001

Reed relays (low voltage, high precision analytical equipment)

Plunger or displacement relays (high current/high voltage applications)

Thermostat probes in gas appliances (flame sensors, gas safety valves)

Pressure gauges
- Barometers
- Manometers
- Vacuum gauges

Other devices, such as personal computers, that utilize a printed wireboard
- Blood gas analyzer reference electrode (Radiometer brand)
- Cathode-ray oscilloscope
- DC watt hour meters (Duncan)
- Electron microscope (mercury may be used as a damper)
- Flow meters
- Generators
- Hitachi Chem Analyzer reagent
- Lead analyzer electrode (ESA model 3010B)
- Sequential Multi-Channel Autoanalyzer (SMCA) AU 2000
- Vibration meters

Laboratory Chemicals That May Contain Mercury (Compiled in 1997)

This list is intended to demonstrate the wide variety of laboratory chemicals that may contain mercury. It was derived from examining the Massachusetts Water Resources Authority Mercury Source Identification Program Database.

Some of the chemicals may contain added mercury and others may contain mercury as a contaminant in a feedstock. If the mercury is a contaminant, its presence or absence may vary from lot to lot. In the case of kits, it is necessary to consider separately each of the reagents that make up the kit.

This list should not be assumed to be complete. Request that vendors disclose mercury concentration on a Certificate of Analysis for all chemicals ordered.

- Acetic acid
- Ammonium reagent/Stone analysis kit
- Antibody test kits
- Antigens
- Antiserums
- Buffers
- Calibration kits
- Calibrators
- Chloride
- Diluents
- Enzyme Immunoassay test kits
- Enzyme tracers
- Ethanol
- Extraction enzymes
- Fixatives
- Hematology reagents
- Hormones
- Immunoelectrophoresis reagents
- Immunofixationphoresis reagents
- Immu-sal
- Liquid substrate con
- Negative control kits
- Phenobarbital reagent
- Phenytoin reagent
- Positive control kits
- Potassium hydroxide
- Pregnancy test kits
- Rabbit serum
- Shigella bacteria
- Sodium hypochlorite
- Stains
- Standards
- Sulfuric acid
- Thimerosal
- Tracer kits
- Urine analysis reagents
- Wash solutions

Health Care Without Harm
1755 S Street, NW
Suite 6B
Washington, DC 20009
Phone: 202.234.0091
Fax: 202.234.9121
www.noharm.org
info@hcwh.org

This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care.* For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.

Thermometer Fact Sheet

What is the problem with mercury fever thermometers?

Very small amounts of mercury can do significant damage. One gram of mercury is enough to contaminate all the fish in a lake with a surface area of 20 acres. A typical mercury thermometer contains approximately 0.7 grams of mercury (700 milligrams), but larger thermometers can contain as much as three grams. Both short term and long term exposure to mercury can cause serious health problems for humans and wildlife.

How toxic is mercury?

Mercury affects the nervous system and can impair the way we hear, talk, see, walk, feel and think. Humans are exposed to mercury through contaminated air, water or food or directly through the skin. In fact, long before we had scientific facts to prove mercury's toxicity, there was evidence that mercury poisoning resulted in nerve damage. In the 1800's hat makers were exposed to mercury during the wool felting process. The strange and unpredictable behavior of Lewis Carroll's "Mad Hatter" in Alice of Wonderland was a portrayal of hat makers who had gone "mad" from mercury poisoning.

Does one broken fever thermometer really pose a health risk to the consumer?

Yes, it can if not cleaned up properly. Every year, there are 15,000 phone calls to poison control centers about broken mercury thermometers. When a mercury thermometer breaks, the liquid silver-colored metal can spill onto the floor or carpet. Breaking one fever thermometer is unlikely to threaten the health of the consumer if the spilled mercury is cleaned up properly. However, if the consumer fails to clean up mercury either because he or she is unaware that it has broken or because it is difficult to gain access to the mercury (for instance because it has seeped through a carpet), then the mercury will eventually evaporate into the air and reach dangerous levels in indoor air. The risks increase if the consumer attempts to clean up a mercury spill with a vacuum cleaner, or if the mercury is heated. The danger of significant mercury exposure is greatest in a small, poorly ventilated room.

Actual Case Studies[1]

- In one case, exposure resulted when 1.1 grams of mercury from a broken fever thermometer were collected and placed in a pan that was laid on a hot kitchen stove. As a result, the mercury vaporized quickly. Two elderly patients developed severe pulmonary edema, diarrhea, confusion, tremors, and coma, and died after 7 and 17 days of hospitalization. A third patient developed a skin rash that cleared up after 3 weeks.
- Another case involved a 32 month-old girl who was afflicted by hypertension, irregular heartbeat, apathy, irritability, excessive sweating and acrodynia as the result of exposure to mercury spilled from a broken thermometer onto carpet. Three months of treatment were required before her condition improved.
- Three children, ranging in ages from 20 months to six years old, were exposed to mercury from a thermometer that had been spilled on a carpet. They developed symptoms including loss of appetite and weight loss; sensitivity to light; pink, sweating, and scaling palms; eczema and itching. The two more severely affected children required four months of therapy before complete recovery.

Do fever thermometers really contain enough mercury to affect the environment?

Yes. If you dispose of a mercury thermometer in your regular garbage and

Pub 2-04 This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.
This version: October 15, 2001

that trash is burned in an incinerator, mercury vapors will be released into the air. Mercury from landfilled garbage can seep into groundwater or can be released into the air as a toxic vapor. Airborne mercury eventually falls to earth, often into rivers and lakes, where microorganisms transform the mercury into a highly toxic form called methylmercury. Methylmercury builds up in aquatic animals, including fish. It accumulates in muscle tissue, and so, unlike some other pollutants, it cannot be trimmed away when cooking the fish. Mercury poses the greatest threat to people who eat large amounts of contaminated fish. For pregnant women, eating contaminated fish poses a special risk because mercury crosses the placenta into the developing child.

While the amount of mercury in an individual thermometer may seem small, the total amount contained in thermometers is significant. The United States Environmental Protection Agency considers mercury thermometers one of the largest sources of mercury to the solid waste stream, estimated at 17 tons per year. Clearly, thermometers are a meaningful source of mercury to the environment that can be easily reduced by switching to non-mercury thermometers.

What happens if a mercury fever thermometer breaks in a child's mouth?

It is also common for children to break fever thermometers in their mouths. Mercury that is swallowed poses a low risk in comparison with the risk of breathing mercury vapor. The mercury passes that through the body and is minimally absorbed, but it will contaminate the environment when it enters the waste water system.

What are the alternatives to mercury thermometers?

Several types of non-mercury thermometers are available commercially. These include:

- Digital electronic thermometers
- Glass gallium-indium-tin (galinstan) thermometer
- Flexible forehead and ear canal thermometers

A recent statement by the American Medical Association indicated that non-mercury fever thermometers are adequate diagnostic tools.

What are the risks that an alternative thermometer could poison the user?

There is no known or anticipated risk.

What are the environmental consequences of non-mercury thermometers?

The known environmental damages caused by alternative thermometers are significantly less than those presented by mercury thermometers. The primary environmental concern arising from use of alternative thermometers relates to the disposal of button cell batteries used in digital electronic or ear canal thermometers. Button cell batteries used in digital thermometers contain significantly less mercury than a mercury thermometer—roughly 3.5 to 11 milligrams of mercury per battery.

When a mercury thermometer or a button cell battery is thrown away and burned in an incinerator, much of the mercury that it contains is likely to be emitted to the atmosphere. However, a mercury thermometer that breaks in the home, or that breaks in the solid waste system prior to burial in a landfill, will release significantly more of its mercury than will a button cell battery.

Notes

1. See Environmental Protection Agency website: www.epa.gov/glnpo/bnsdocs/hg/thermafaq.html

Health Care Without Harm
1755 S Street, NW
Suite 6B
Washington, DC 20009
Phone: 202.234.0091
Fax: 202.234.9121
www.noharm.org
info@hcwh.org

This publication is part of *Going Green: A Resource Kit for Pollution Prevention in Health Care*. For additional copies of this or other publications included in the kit, or to find out how to get a complete kit, visit Health Care Without Harm on the Web at www.noharm.org.

E-8A5.1

How to Plan and Hold a Mercury Fever Thermometer Exchange

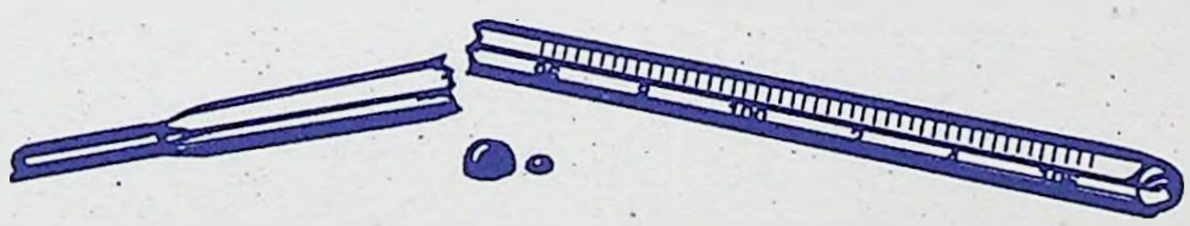
A Mercury Fever Thermometer Exchange is an event at which participants turn in mercury fever thermometers brought from their homes and, in return, receive a non-mercury fever thermometer or a voucher for an alternative thermometer. These exchanges not only educate about the environmental and public health effects of mercury; they also provide participants with the opportunity to be part of the solution to the mercury problem.

The Problem with Mercury Thermometers

Mercury thermometers are made of glass the size of a straw, with a silvery-white liquid inside. Mercury fever thermometers have been used for decades as a first step in caring for someone who feels sick. But, ironically, the mercury thermometer can be a risk to the health of families and communities. Mercury is a toxic substance that can harm both humans and wildlife.

Many families have had a mercury thermometer in their medicine chest for years without breaking it. But mercury thermometers are very easy to break and very difficult to clean up. To function properly, mercury thermometers must be "shaken down" before use, creating a constant high potential for breakage. Public health officials across the country report a steady stream (over 18,000 to poison control centers in 1998 alone) of concerned calls from broken mercury thermometers. Fever thermometers are the largest single source of mercury discarded annually in municipal solid waste, estimated at 17 tons of mercury per year.

When a mercury thermometer breaks, it is difficult to clean up properly. Sometimes parents may not know that their child has broken a thermometer. Sometimes mercury from the broken thermometer spills into a crack in the floor or soaks into a carpet. If mercury spills from a thermometer and is not cleaned up, it will all evaporate, potentially reaching dangerous levels in indoor air. A single broken fever thermometer, containing 0.5 to 1.5 grams of mercury, is enough to create a health risk if it evaporates into a small, poorly ventilated room.



Mercury affects the human brain, spinal cord, kidneys and liver. It affects the ability to feel, see, taste and move. It can cause tingling sensations in the fingers and toes, a numb sensation around the mouth and tunnel vision. Long-term exposure to mercury can result in symptoms that get progressively worse and lead to personality changes, stupor and coma. Wildlife populations, especially loons, are already exhibiting effects of mercury poisoning. There is already so much mercury pollution that 39 states are currently warning residents not to eat certain species of fish caught in all or some of the state's lakes, rivers, streams and coastal waters.

In pregnant women, mercury can pass through the placenta, where it affects fetal development by preventing the brain and nervous system from developing normally. Affected children show lowered intelligence, impaired hearing and poor coordination. Their verbal and motor skills may be delayed. Because of these threats to the developing fetus, the federal government recommends that women who are pregnant or who may become pregnant not eat mercury-contaminated fish.

Planning Your Exchange

INTRODUCTION

The success of an exchange or roundup depends on the successful promotion of the event. If people do not know about the event, you've lost your opportunity to collect thermometers and to educate about the health and environmental impacts of mercury. Your audience will define the way you promote and plan your exchange, and therefore its budget and ultimate success.

Experience has shown that there are three main types of exchanges, based on the audience you are trying to engage. These exchanges are:

- Hospital and Other Workplace Exchanges
- School Exchanges
- Community Exchanges

Workplace and school exchanges are relatively simple exchanges to undertake. Primarily, this is because your audience is easily defined. You have a few direct and straightforward means to inform possible participants about the event. Promotion is therefore simple and inexpensive. In addition, the audience is a "known quantity" and easily estimated. Based on either number of employees or number of students, a simple formula can then be used to estimate the quantity of exchange thermometers or vouchers needed. This helps simplify budgeting.

Relative to workplace and school exchanges, community exchanges are more complex. You may need to use a wide variety of promotion mechanisms including paid advertising. You may not be able to adequately determine the demand for alternative thermometers or coupons and be required to adopt a "while supplies last" approach. Fundraising from a broad range of potential sources may be required before you can hold a community exchange.

Yet, all three types of exchanges can be highly successful events not only in the number of thermometers collected, but in terms of environmental and public health education. Like any project, their success is dependent on good planning. This guide is intended not only to help encourage you to undertake a thermometer exchange, but to help and assist you in the process so that it is a success.

Why Hold a Mercury Fever Thermometer Exchange?

AN OPPORTUNITY FOR EDUCATION

A mercury fever thermometer exchange can provide a wonderful opportunity to educate about the hazards of mercury. An exchange can also inform people on the actions they can take to reduce the risk of mercury contamination of the environment and to protect the health of their families and the community. If you host a staff exchange in your workplace, it can be a part of an employee wellness program or a kick-off or culmination event for an in-house mercury elimination program.

EASY TO COORDINATE WITH BIG PAYOFFS

Mercury thermometer exchanges are worth the effort they take to put together, since the benefits of an exchange are numerous.

- When given information about the hazards of mercury thermometers, people are eager to find a safe place to get rid of them.
- Providing a free non-mercury alternative is a big bonus. People are always thankful to get something for free, especially when the associated benefits are so positive.
- The public image and media opportunities are sizable.

This is a win-win situation for everyone and the public and the press will be receptive to that message.

CHOOSING A NON-MERCURY FEVER THERMOMETER

While there are a variety of mercury-free fever thermometers available in the market place, there are only two main types that fall within the budget of an exchange. These alternatives are the Geratherm thermometer, and the digital thermometer. The Geratherm functions like, and is somewhat similar to, a mercury thermometer. Instead of mercury, it contains galinstan, an alloy of gallium, tin and indium. The digital thermometer is electronic and uses a button battery for power. The table on the right highlights some of their benefits and drawbacks.

	Geratherm *	Digital *
Cost Estimate (1999)	$2.80	$4.00
Advantages	Relatively inexpensive.	Easy to use and read. Can have message printed on case.
Disadvantages	Poor data on long term environmental impacts of galinstan. May be confused for a mercury thermometer.	Somewhat expensive Contains button battery that should be recycled.

* See appendix B for contact information

THERMOMETER REPLACEMENT OR VOUCHER

One decision that needs to be made early in the planning process is whether you want to distribute non-mercury thermometers, or work with local retailers to accept vouchers for a free or discounted non-mercury replacement. Either option will work, but it is important to keep in mind that the easier it is for a participant to exchange their thermometer for a new one, the more likely they will participate in a program. Using a voucher may be perceived as adding an extra step or hurdle. In addition, should you decide to work with a retailer on a voucher program, it is important to ensure that they do not sell mercury thermometers.

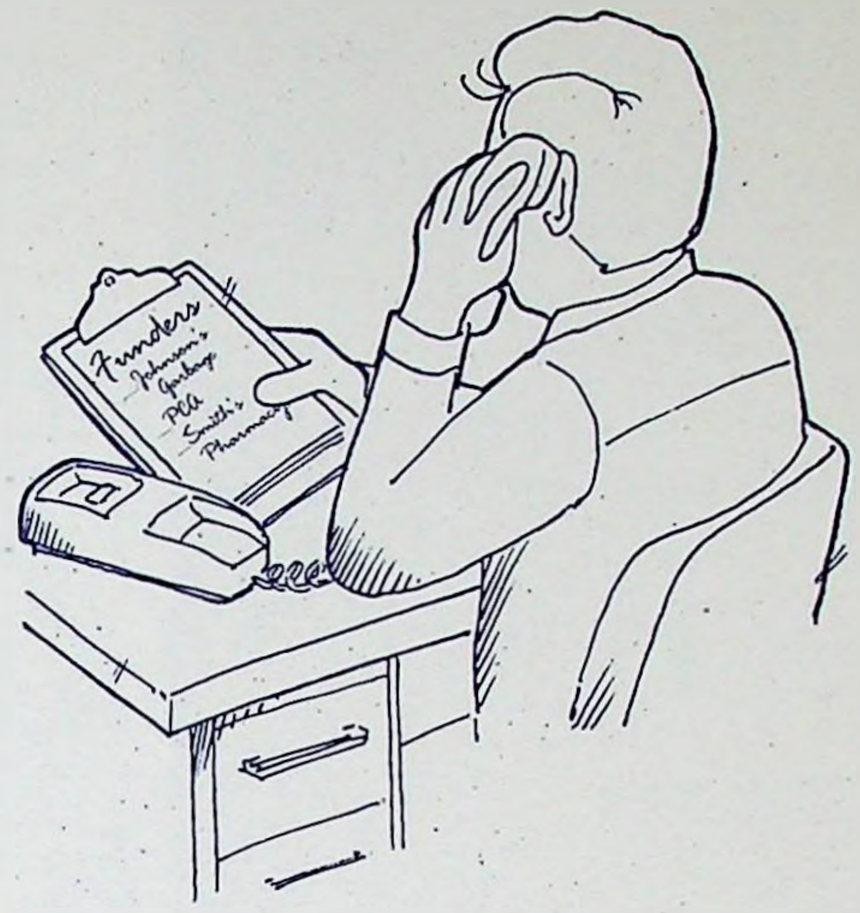
ESTIMATING HOW MANY THERMOMETERS ARE NEEDED

Deciding how many thermometers are needed is important for budgeting. As discussed earlier, the number of thermometers brought in is directly related to promotion of the event. If only one mercury-free thermometer is exchanged per household, a reliable estimate for workplace and school events is easy to determine. For school roundups, experience has determined an exchange rate range of 18% to 25% on a student population basis, and for the workplace an exchange rate of 11% to 18% based on quantity of employees. If the event is well-promoted and you have good support within the school or workplace, you can estimate an exchange rate on the high end of the range given. For small schools and workplaces (less than a population of 500), the return rate is also typically on the higher end of this range. Because some participants in an exchange bring in more than one mercury thermometer, an extra level of confidence is added in the estimate of thermometers needed. This table gives two examples of how to estimate the amount of thermometers that will be needed.

Location	Anywhere Hospital	Anywhere High School
Population	4000 employees	600 students
Expected exchange rate	11% to 18%	18% to 25%
Level of exchange awareness (guess-timate based on population size and level of promotion)	Low to medium	High
Estimated exchange rate	13%	25%
Exchange factor	.13	.25
Quantity of thermometers needed	4000 x .13= 390	600 x .25= 150

FUNDING

Before you go looking for funding, it is important to know what you are asking for. Is it money, thermometers, or other in-kind support? The simplest exchange requires thermometers (or vouchers), disposal, and perhaps some money for printed promotional materials. Compared to many programs, the funding budget for a thermometer roundup can be rather small.



Your funding may also be helped if you have an opportunity to piggyback an exchange with a community or children's health fair, an Earth Day event, or a local household hazardous waste collection. If so, issues such as planning and publicity may be easier to handle. It may be worth checking into your local community calendar to see if such opportunities exist.

Some mercury exchanges can get quite involved, with high profile names invited to attract media, or food at a reception to attract participation. High-profile events will typically require a higher budget. While these niceties can turn the work of organizing a simple exchange into a spiraling quest for funding, they can also provide excellent benefits. See the following section on receptions.

When looking for funding for your exchange, there are a variety of avenues that you can explore. Because mercury exchanges are a "feel good" type of event, they are often well received by potential sponsors. Consider both the public health and environmental aspects when soliciting funds. Furthermore, funding may be in-kind. Do not ignore free food for a reception, free disposal, and most importantly, free advertising or promotional items. The following is a list of some sources that may be able to help your fundraising.

POTENTIAL SPONSORS AND THEIR INVOLVEMENT

- **Corporate Sponsors**
  - A mercury exchange is a way for them to be seen as environmentally responsible.
  - It may fit with a corporate employee wellness program.
  - It may fit with a need to be seen as a good community citizen.

- **State or Local Pollution Control Agencies**
  In many areas of the country, mercury is increasingly an area of regulatory concern. Your state or local agency may have money targeted for mercury.

- **Pharmacy Chains/Thermometer Vendors**
  The larger pharmacy chains may be able to give some form of discount program and/or free thermometers. Some thermometer vendors have given out complimentary thermometers.

- **Solid and/or Hazardous Waste Haulers**
  Many "haulers" have a financial interest in assuring their loads are mercury-free. In addition, a mercury exchange is an excellent way for this industry to promote itself as environmental and community stewards.

- **Hospitals**
  In 1998, the American Hospital Association signed an agreement to virtually eliminate their use of mercury. In 1999, over 100 hospitals signed Health Care Without Harm's pledge to practice mercury-free medicine. Your hospital may be interested in being involved to help promote their mercury reduction efforts, and promote their mission of community health.

- **Wastewater Treatment Plants**
  Wastewater treatment (WWT) plants have mercury discharge permits that are becoming more stringent. Some permits may have conditions, which allow the WWT plant to do pollution prevention work as a means to meet their permit. A mercury thermometer exchange is an excellent means to do, and educate on, mercury pollution prevention.

- **Household Hazardous Waste (HHW) Collection Facilities**
  These facilities are in the business of collection of HHW and may be able to offer free disposal. Based on their knowledge of mercury waste generators, they may be able to offer good leads on related businesses in town.

MERCURY THERMOMETER DISPOSAL

Experience has shown that those helping with the exchange and those turning in their thermometer will want to know the eventual fate of the mercury in the thermometers.

Currently, the mercury in mercury thermometers and other mercury-containing devices is recycled using a process called "roast, retort and distillation." Basically, the mercury-containing items are crushed, and heated so that the mercury evaporates and is thus separated from the glass and other debris. The gaseous mercury is then retorted or condensed back to a liquid state. The liquid mercury is then distilled to remove impurities and can be used again in new, mercury-containing products.

It may be a surprise to many that their mercury may actually return back to commerce in another mercury device. While there is broad agreement on the serious toxicity of mercury, and our governments have called for its phase out, it is still sold in products for which viable, cost-competitive alternatives exist. This is yet another reason why a mercury thermometer exchange can be so important, for they can be used to educate homeowners on other places where mercury can be found in the home and alternatives to its use.

To get a list of all facilities in your area that can provide this process, contact either your hazardous waste hauler, or your state department of environmental protection/services.

In choosing a facility, check references and with state officials to insure the facility is fully permitted and that there are no EPA or OSHA violations against the facility. This is very important. So do your homework on a facility before you send your mercury to them.

Ask the mercury reclamation facility how they want the mercury contained and labeled for the collection, storage, and transportation of the mercury thermometers. They will probably want the thermometers collected in a Department of Transportation (DOT) approved shipping container. They should be able to provide you with this assistance.

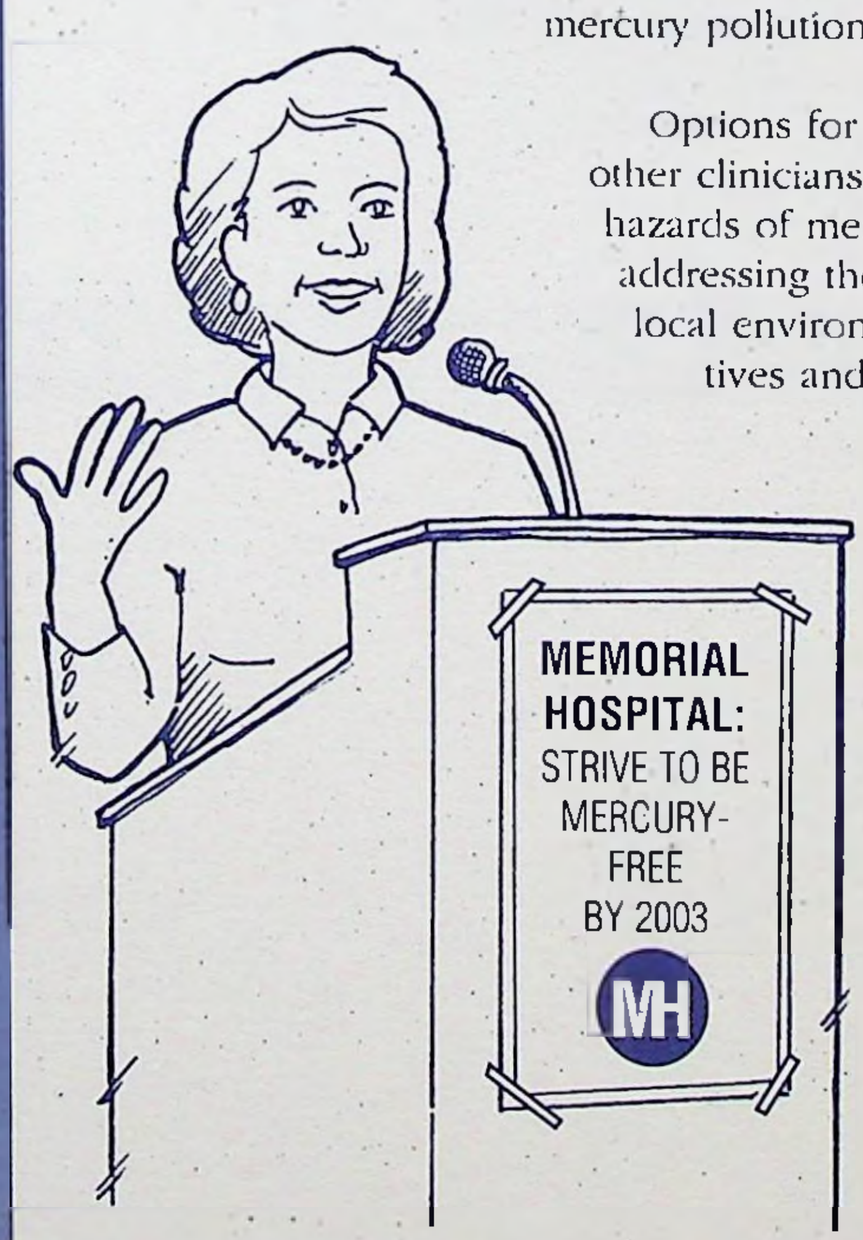
RECEPTION

A workplace reception can be a great way to help promote the exchange, but at the same time can require a lot of planning time. This must be weighed with the fact that a well-planned reception can produce excellent benefits. High-visibility events often attract the interest of senior management. As senior management gets involved in the planning and implementation of the round-up, they gain a vested interest in the long-term success of the mercury elimination program, not simply as a one-time event organized by the general staff. At a large urban Boston hospital mercury thermometer round-up reception, senior management announced that they would design a program to eliminate all mercury-containing blood pressure measuring devices and replace them with non-mercury alternatives.

Benefits of High Visibility Exchange:

HCWH's round-up at a Boston hospital focused on clinical fever thermometers. Because of the success of this event, senior management took it upon themselves to put a policy in place to round up all research laboratory mercury thermometers and replace them with non-mercury alternatives. The bottom line was that a larger event attracted the attention of decision makers who bought into the program.

In the hospital setting, by virtue of medical profession involvement, a reception can help draw attention to mercury as a public health issue. At a reception, it is useful to have a display on mercury, mercury-free alternatives in the home and workplace, and mercury pollution prevention literature.



Options for speakers include physicians or other clinicians that can speak to the health hazards of mercury, state or federal speakers addressing the status of mercury legislation, local environmental organization representatives and workplace staff on what that organization is doing to address mercury reduction/elimination.

Having at least cookies and punch available during the event is also a good idea. One of the event's goals is to provide additional information about mercury hazards. Providing food means that people will stick around and give you more time to give them that information. Providing cookies is also celebratory and adds to the positive atmosphere of the event.

PUBLICITY

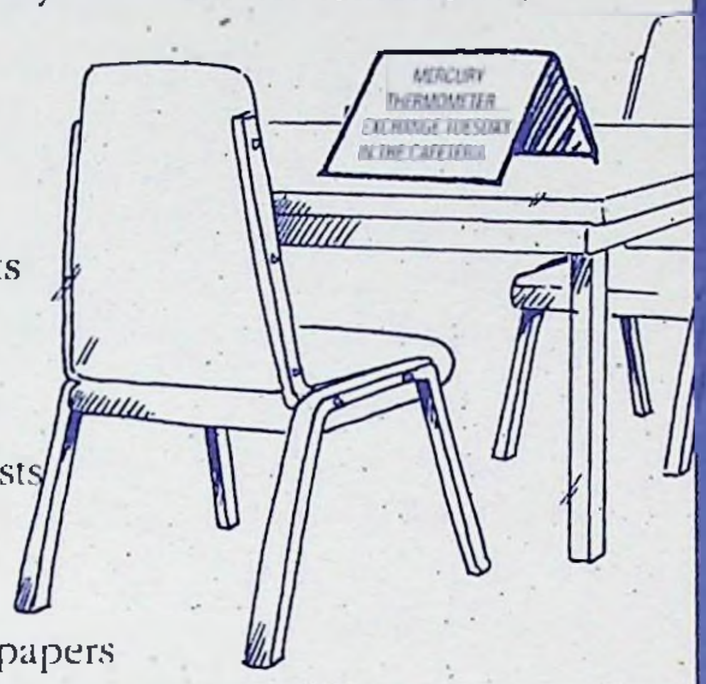
There are a variety of ways to publicize your exchange. The following list provides some ideas on how to get the word out. (See Appendix A for templates)

Workplace and School Exchanges

- Fliers (send home with students)
- Classroom of departmental meeting presentations by peers
- Table tents - cafeteria, lunch room or staff lounges
- Newsletters, including small neighborhood papers or "shoppers"
- E-mail announcements (the day before event, post an automatic announcement "don't forget your mercury thermometer tomorrow!")
- Announcement in payroll checks

Community Events

- Fliers
- Public service television and radio spots
- Newspapers
- Community Websites
- Community, health and environmental organizations' newsletters and e-mail lists



Event Coverage

- Contact radio (on-site coverage), newspapers and television stations ahead of time to cover event.
- Submit articles to magazines, trade journals and community organizations to summarize the event's success.

EDUCATIONAL OPPORTUNITIES

Before the event, collect enough educational materials to distribute. Listed are just of sampling of information you might want to provide.

- HCWH's Making Medicine Mercury-Free*
- HCWH's Mercury Thermometers and Your Family's Health* (available in English or Spanish)
- HCWH's How to do a Mercury Fever Thermometer Exchange*
- HCWH's Mercury-free Thermometer Pharmacy Campaign information
- Your state fish advisories
- List of other mercury-containing items in the home and workplace
- Local and state contact information about mercury disposal options for other mercury-containing household items

* Please be sure to contact HCWH 3-4 weeks in advance with an estimate of how many copies are needed

SAFETY AND ENVIRONMENTAL LOGISTICS

It is important to make sure that in all promotional materials, participants are told to bring in their thermometers in a rigid container, and to place the container in a zip-lock bag, as a second measure of protection. The original case in which the thermometer was bought works perfectly, but any other non-breakable container (toothbrush case or plastic soft drink bottle with screw-on top) will also work. These precautions are important to prevent the thermometer from breaking on the way to the exchange, and to protect the health and safety of the participant, should it still break.

Work with workplace or state safety or hazardous materials specialists during the event planning process to ensure that regulatory and compliance issues are being considered. If you are going to transport the collected thermometers to the disposal facility, it is important to ensure that transport and labeling regulations are being followed. Mercury destined for reclamation is considered a federally designated "universal waste", but contact your state's hazardous materials section to ensure you will be in compliance with your state's environmental requirements.

Someone with mercury spill cleanup training, and a mercury spill kit should be available at the event.

LOCATION AND SCHEDULE OF THE EXCHANGE

It is important to time the event of your exchange so that it is convenient for those participating in the exchange.

In a workplace with shift workers, try at a minimum to schedule the exchange over one shift change. It is easy for exchange participants to turn in their thermometer at the beginning or end of their shift. If possible, try to hold the exchange for at least two hours, but longer is preferable. The longer it is open, the greater the chance that word of mouth will remind workplace staff of the event. For school events, make sure the exchange occurs when students are able to participate. Before school starts and during lunch are times that have proved successful for school exchanges.

Holding the exchange in a popular community meeting area will also help the success of the exchange. Typically, the most successful meeting place is the work or school cafeteria. Setting up the "exchange table" outside the cafeteria doors will guarantee a steady stream of people. In many hospitals, there is a shift change at the lunch hour. Accounting for location and timing will help the exchange tremendously.

OTHER CONSIDERATIONS

Establish Guidelines

Many exchange participants will bring in more than one mercury thermometer from their home. Make sure people understand that they can bring in as many as they have. At the same time, it is important to have a clear guideline on how many non-mercury thermometers they can take home. Many exchanges have adopted a policy of one mercury- free alternative per family. This way, participants aren't discouraged from bringing in more than one thermometer, and are encouraged to collect those from other family households.

It is also important to have a policy on accepting other mercury-containing equipment. Unless you want to be inundated by mercury-containing devices, never advertise your collection as anything but a thermometer exchange. At the same time, it is hard to turn away someone trying to do the right thing by bringing in their thermostat or other mercury-containing device. Thermometer exchanges have accepted a five-pound bottle of mercury, thermostats and other mercury devices. The choice is yours, but having a good guideline in place before the day of your exchange can save you lots of headaches.

Mercury from Home or Business

On a related note, some workplaces will ask whether they can dispose of some of their business waste through your exchange program. It can be difficult when a representative from a department you have not worked with asks for a special favor, hoping to save on mercury disposal costs. It is especially difficult if you do not work in the workplace and get caught in a struggle between that department and the one helping facilitate the exchange. Again, the choice is yours to make. What you should be aware of is that many states regulate business waste differently than household waste. If you are deliberating whether to take workplace mercury through your program, it is advisable to check with your state regulators, and/or disposal facility to see if you will be violating any state laws. You should be prepared when the science department head asks if you could take the sixty broken

lab thermometers they have been storing, or the hospital maintenance department asks you to take in fifteen pounds of mercury.

Plan for Success

Either due to good promotion or a small budget you should also be prepared with a contingency plan in case you run out of thermometers. Will you offer a voucher that the participant can redeem in the future, will you turn them away, or do you promote the exchange of free thermometer only "while quantities last"?

It is also good to be prepared for people wanting to exchange a thermometer the day after the event, or after the exchange has closed for the day. There will typically be employees that will be reminded of the exchange only when they see the exchange table on the day of the event. To collect from these latecomers, you can hold and advertise subsequent make-up days, or in the case of a workplace exchange, provide the time and office or other location where they can drop them off during working hours. This is particularly important where the workplace has three shifts. It may be logistically too difficult to hold the exchange during the second shift change. Providing the third shift with an option not only makes the exchange inclusive but also more successful. Finally, make sure to make participants aware of the hours and location of the local household hazardous waste facility. They might have mercury or other wastes that they want to get rid of responsibly.

Close the Loop

Some states such as Minnesota, have banned the distribution of mercury thermometers by hospitals to new parents. The loophole that still exists is that most pharmacies still sell mercury basal and fever thermometers. If you have the time and resources, send letters to all your local pharmacies and ask them to stop selling mercury thermometers, once those still in stock are sold. Follow your letter with a phone call, about one week after you have mailed the letter. (See Appendix C for a sample letter). This is especially important if you are doing an exchange in a hospital. It can be very embarrassing to your efforts if a reporter covering the event inquires at the hospital pharmacy and finds them still selling mercury thermometers.

Finally, educate yourself and have information available, which can answer questions raised on the accuracy of mercury alternatives. (See Appendix D for more information.)

Exchange Day

COLLECTION PROCEDURE

Participants remove unbroken thermometer from their rigid container and place it on the piece of plastic (or thin bubble wrap) which is spread on a tray. If thermometer is broken, place back in rigid container and place in large collection container.

Keep track of number of thermometers collected and number of families participating (which should be the same as the number of non-mercury thermometers exchanged). A flip chart may be used to visually show progress throughout exchange event.

When tray "fills up", wrap stack of unbroken thermometers in plastic, wrap with rubberband or tape, and place "wad" in collection container. The collection container should be labeled "Mercury Thermometers" and have a lid (five gallon containers used in food service or for drywall spackle work well.) Participants should not reach in or place their thermometers directly into container.

Broken thermometers should be placed directly into collection container.

EVENT DAY CHECKLIST

- ☐ Table and chairs for volunteers
- ☐ Banner/posters (see appendix A)
- ☐ Mercury spill kit and emergency procedure in place
- ☐ Collection tray
- ☐ Plastic wrap or thin bubble wrap
- ☐ Collection bucket with lid
- ☐ Sign "Mercury Thermometers Collection" on bucket
- ☐ Large trash can for rigid thermometer holders
- ☐ Flip chart, marker – tracking participation
- ☐ Media, public affairs readiness

If Holding a Reception:

- ☐ Number of tables ____, table cloths
- ☐ Vendor accommodations
- ☐ Speaker podium, PA system
- ☐ Food, drinks and trash containers

Appendix A – Fact Sheets and Flyers*

HOW CAN I PREVENT MERCURY POLLUTION?

Improper mercury disposal includes pouring it down drains, putting it in the trash, and burning it in barrels and incinerators.

HERE'S WHAT YOU CAN DO:

- Know which products contain mercury.
- Avoid buying products that contain mercury whenever non-mercury substitutes are available.
- Recycle mercury-containing products through Household Hazardous Waste (HHW) collections in your area. (Call your town office for more information).
- Conserve energy to reduce reliance on coal burning for fuel, which is a major source of mercury pollution.

MAKING MEDICINE MERCURY-FREE MERCURY THERMOMETER SWAP

EARTH DAY CELEBRATION
THURSDAY, APRIL 22
*HOSPITAL ROTUNDA, 11am-4pm**

- Hospital Staff - bring in your home mercury thermometer for a free digital non-mercury thermometer.
- Reception at noon. Speakers from (your hospital) community, invited speakers, and Health Care Without Harm.
- Find out more about mercury — what your hospital is doing to eliminate its use and what you can do in your home to minimize/eliminate its hazards.

* 3rd shift - go by Housekeeping Office, 6:30am, April 22.

* Available electronically at www.noharm.org

Appendix B – Mercury-free Thermometer Vendors

(HCWH does not endorse any of the following vendors)

Digital Thermometers

Becton Dickenson
1 Becton Drive
Franklin Lakes, NJ 07417
201-847-6800
www.bd.com

PolyMedica Corporation
11 State Street
Woburn, MA 01801
781-933-2020
www.polymedica.com

Omron Healthcare,Inc.
300 Lake View Parkway
Vernon Hills, IL 60061
800-231-3434
www.omronhealthcare.com

Geratherm Thermometer

R.G. Enterprises
2000 Town Center, Suite 1900
Southfield, MI 48075
800-992-9497
email rgenterprises@msn.com

MERCURY CONTAINING PRODUCTS	ALTERNATIVES/EXAMPLES
Thermometers	Digital thermometers (don't forget to recycle the battery)
Batteries	Alkaline batteries (look for mercury-free batteries, dispose of others at local HHW collections)
Thermostats, switches	Electronic or mechanical devices – dispose of the mercury-containing items at local HHW collections
Contact lens solution	Solution without Thimerosal – check ingredients
Light bulbs (fluorescent, mercury vapor, neon, metal halide, hp sodium)	Tungsten Filament (dispose of mercury-containing lightbulbs at local HHW collections)
Soaps (including antibacterial soap)	Soaps without Triclosan
Detergents/cleaners/bleach: Clorox	Clorox Plus® (not other Clorox®), Austin

THE CASE AGAINST MERCURY: THE PROBLEM WITH MERCURY THERMOMETERS

- Mercury causes a variety of health effects, particularly for young children, including nervous system damage, liver damage, kidney damage, muscle tremors, impaired coordination, and mental disturbances.
- A thermometer contains about 0.5-1.5 grams of mercury. One gram of mercury can contaminate a twenty-acre lake with enough mercury to cause public advisories (warnings) to limit consumption of fish caught in that lake.
- Fever thermometers are the source of 17 tons of mercury discarded annually in the municipal solid waste!
- Eliminating even small amounts of mercury has a beneficial effect on the environment, and reduces the potential for human mercury poisoning.
- (Your hospital) is committed to eliminating non-essential uses of mercury and mercury-containing products. Removing mercury thermometers is a responsible action in continuing to serve the health care needs of our communities while protecting the environment. Digital thermometers provide comparable accuracy and do not compromise patient care in any way.
- Thank you to Acme Technologies Inc. – A Waste Management Company for the donation of the digital thermometers for this event! For more information contact the Office of Safety and Environmental Programs, (phone number).

RADIO AD

Radio Script for Mercury Thermometer Exchange

- 30 second spots -

Many families have had a mercury thermometer in their medicine chest for years, without it breaking. Yet, public health officials warn that a broken thermometer can pose a serious risk to your family's health and the environment. Even if you've never broken a mercury thermometer, it doesn't mean you never will.

Protect your family's health – Bring your mercury thermometer to (collection facility) before it breaks and receive a non-mercury replacement free while supplies last.

For more information, call (your organization and phone number).

Appendix C – Mercury-free Thermometer Pharmacy Campaign Draft Letters*

Your address here

Dear Pharmacy,

As you may know, mercury has been identified as a major source of environmental pollution. It is also widely recognized that elemental mercury and mercury compounds are hazardous to human health. Because of these concerns, there are now many voluntary and legislative initiatives around the country aimed at eliminating the use of products containing elemental mercury or mercury compounds.

In Spring 1999, USA Today ran an article entitled, "Mercury Thermometers Fall Out of Favor". This article highlighted the concerns with mercury, numerous programs around the country collecting mercury thermometers, and mercury-free thermometer promotions. Some states, such as Minnesota, have banned the distribution of mercury-containing thermometers to new parents by hospitals. Across the country, communities and organizations are holding mercury thermometer exchanges or take-back initiatives.

Yet there remains one large problem with these mercury thermometer initiatives. Many pharmacies still sell mercury thermometers. To close this loophole we are writing to invite you to be a voluntary partner in (your program). To become a partner, we are asking that you sign on to the national Mercury-free Thermometer Pharmacy (MTP) campaign sponsored by Health Care Without Harm (HCWH). HCWH is an international campaign with over 250 participating organizations, including over 70 hospitals and other health-based organizations such as the American Nurses Association, and the American Public Health Association. The campaign is focused on transforming the healthcare industry so that it is no longer a source of environmental harm by eliminating pollution in healthcare practices.

The Mercury-free Thermometer Pharmacy (MTP) campaign is aimed at promoting those pharmacies that practice mercury pollution prevention. All that is required to become a MTP is a written commitment, on your letterhead, to voluntarily discontinue the sale of mercury basal and fever thermometers once those in stock are sold (a sample letter is enclosed). In turn, MTPs will be promoted nationally on the HCWH website (www.noharm.org).

We hope that you take this opportunity to be a community leader in pollution prevention by signing on to the MTP campaign. Please find enclosed a copy of HCWH's Mercury Thermometer educational brochure. Should you have further questions please do not hesitate to contact me at (phone number).

Sincerely,

* Available electronically at www.noharm.org

PHARMACY LETTERHEAD

HCWH
P.O. Box 6806
Falls Church, VA 22040

Dear HCWH,

Our Pharmacy has recognized that mercury has been identified as a major source of pollution. We are also aware that elemental mercury and mercury compounds are known to be hazardous to human health and the environment.

We support the efforts of Health Care Without Harm, the American Hospital Association (AHA) and the Environmental Protection Agency (EPA) calling on hospitals to reduce the volume and toxicity of their waste, specifically eliminating the use of mercury.

We recognize that mercury basal and fever thermometers if used incorrectly, or broken, may contribute mercury to the environment. We also recognize that cost-effective mercury-free alternatives to these products exist for our customers.

We are therefore pleased to become a Mercury-free Thermometer Pharmacy (MTP). In becoming a MTP, we commit to ending the sale of both basal and mercury thermometers once our current inventory has been sold. Please add our name to your national list of pharmacies that have discontinued the sale of mercury-containing thermometers.

Sincerely,

Appendix D

SELECTING NON-MERCURY FEVER THERMOMETERS

Alternatives to glass/mercury thermometers are quite appealing as they are easier and faster to use and avoid the shortcomings of glass/mercury thermometers. The risks of broken glass and exposure to mercury are eliminated, as well as the cost of a clean-up and disposal of mercury from a broken thermometer. With the variety of alternatives available, it is essential that one make an educated choice, to ensure that the tool satisfies the task. Here are some points worth thinking about when you consider thermometers:

1. ACCEPTABLE STANDARDS OF ACCURACY

Thermometers for medical use are typically tested to voluntary standards set by the American Society of Testing and Materials (ASTM)[1]. The following table shows the maximum error allowed. One sees that glass/mercury and electronic thermometers have the same requirements over the range of 96.4 - 106 F.

Thermometer Type	ASTM Procedure1	Maximum Error over Temperature Range Shown				
		<96.4 F	96.4 < 98.0 F	98.0 -102.0 F	>102 -106 F	>106F
Mercury in Glass	E667-861 (reapproved 1991)	+ 0.4	+ 0.3	+ 0.2	+ 0.3	+ 0.4
Electronic Thermometers	E1112-86 1 (reapproved 1991)	+ 0.5	+ 0.3	+ 0.2	+ 0.3	+ 0.5

It is important to note that many thermometers read out to a smaller division than the accuracy of the thermometer itself. For example, digital thermometers which read to 0.1 degrees F may be accurate only to + 0.2 F or less. If the accuracy is + 0.2 degrees F, the true temperature of a thermometer reading 98.9 F is in the range of 98.7 – 99.1 degrees Fahrenheit. Therefore when selecting a thermometer, one must look closely at the accuracy, rather than the smallest increment reported.

2. ACCURACY OF GLASS/MERCURY THERMOMETERS

Inherent in any discussion of alternatives is the assumption that glass/mercury thermometers are accurate. Data suggests that our faith in glass/mercury thermometers may be misplaced.

Leick-Rude and Bloom[2] describe a study in which axillary temperature in neonates was taken with non-mercury thermometers and compared with a "standard" of glass/mercury thermometers. For the purpose of the study, the accuracy of each glass/mercury thermometer was tested as a condition of accepting it for the study. 25% of the glass/mercury thermometers tested differed from the reference thermometer by >0.2 degrees Centigrade and were deemed unacceptable for use in the study. The authors cite another study in which 28% of glass/mercury thermometers were discarded because they differed by more than 0.1 degree Centigrade from the reference thermometer. The authors raise concern as to the accuracy of glass/mercury thermometers for general use, when one out of four of those tested was not deemed accurate enough. (In fact, the ASTM standard for glass/mercury medical thermometers specifies a maximum allowable error of + 0.1 C in the cited range).

3. FAVORING THE OLD STANDARD

Chamberlain and Terndrup[3] remind us that "Whenever a new clinical test is introduced, investigators measure its accuracy by comparing it to an accepted standard, termed the 'gold standard'. Because of this comparison to the old standard, initial testing will, by definition, favor the old method, even if the new clinical test is a better test".

4. USE OF RECTAL, ORAL, OR AXILLARY READINGS AS A REFERENCE FOR TYMPANIC TEMPERATURE

The publication "The Clinical Utility of Ear Thermometers[4]" describes different methods and their limitations for measuring body temperature. It cites that the medically accepted "gold standard" for core temperature is pulmonary artery blood temperature. However this is an invasive technique, so rectal, oral, or axillary readings are often used as a crude estimate of body core temperature. Each site is reflective of a different blood supply, with separate rates of change with a rising or falling body temperature. Additionally, each site has variables unique to that site that influence the body temperature measured. The publication concludes that since each site provides its own characteristic temperature properties, comparing a tympanic temperature directly with oral, axillary, or rectal temperatures is inherently flawed.

The lesson here is that with an understanding of how tympanic thermometers work, they offer a safe, convenient alternative to oral, axillary, or rectal temperature measurement. Education is critical to satisfactory performance, and manufacturers are well prepared to advise and coach clinicians on the use of their products.

5. CUSTOMER SATISFACTION

Numerous interviews with users of non-mercury thermometers provide convincing evidence that alternatives are viable and well-received in health care facilities.

REFERENCES:

1) 1997 Annual Book of ASTM Standards, Roberta A. Storer, Editorial Services Director, American Society of Testing and Materials (ASTM), West Consholocken, PA
2) MK Leick-Rude and Bloom LF, "A comparison of temperature-taking methods in neonates", Neonatal Network; August, 1998, Volume 17 No. 5, pp. 21-37
3) James M. Chamberlain, MD, and Thomas E. Terndrup, MD, "New light on ear thermometer readings" Contemporary Pediatrics; March, 1994.
4) The Clinical Utility of Ear Thermometers, Published by Braun Thermoscan, Pub. No. 0996-267P-R1097

Provided by the Sustainable Hospitals Project

A project within the Lowell Center for Sustainable Production at the University of Massachusetts Lowell, providing technical support to health care facilities. Visit our website: www.uml.edu/centers/LCSP/hospitals/ or contact us at shp@uml.edu or 978-934-3386 for more information.

HEALTH CARE WITHOUT HARM • P.O. BOX 6806 • FALLS CHURCH, VA 22040
703-237-2249 • FAX: 703-237-8389 • EMAIL: NOHARM@IATP.ORG • WWW.NOHARM.ORG

Environmental Site Assessment and Preliminary Risk Assessment for Mercury.
Kodaikanal Thermometer Factory, Tamil Nadu
Summary Report prepared for
Hindustan Lever Limited (HLL)
Dated 24 May 2001.

Contents

2.4. Medical Surveillance

" The medical surveillance comprises an annual medical checkup of all employees and monthly monitoring of mercury in urine. The annual medical checkup consists of physical examination with special attention to mouth, gums, skin, teeth, hair and neurological symptoms such as tremors or unsteady gait. ----- "

---

* Oral cavity is a target organ for chronic exposure.

---

* A classic sign of exposure to high concentrations of mercury is inflammation of inside of the mouth *.

" Gingivitis is the most common gastro-intestinal disorder encountered in mercury poisoning "

" There may be a bluish line on the tooth edge of the gums - - - "

Encyclopaedia of occupational health and safety, ILO, Geneva.

Elemental mercury, inorganic compounds, organic compounds

New Jersey State Department of Health,
Division of Occupational and Environmental Health

Chronic Health Effects

" 1. Gum problems. The gums become spongy, soft and develop ulcers, the teeth get loose, sores may develop and there may be increased salivation "

General.

Para 1: We are happy that the information has come to your notice.

2. no comments

3 - The adverse effects of mercury on the health are many. The "preliminary health assessment" has to be followed by a more detailed study.

4. as above.
gum and skin allergy related problems are indicative of mercury poisoning and hence need for detailed study

5. We had requested for greater details which were promised but seen given.

6. Repetition

7. We cannot furnish details asked for of the persons examined by us, as we are bound by confidentiality.
protocol?
Confidentiality;
Preliminary Study with gum & teeth problems, typical of mercury

8. Issues raised can be settled by a detailed study as suggested by us.

9. Confidentiality.

---

30 ex-workers; How did we get them?
Examined same day — preliminary assessment
Methodology given.

= We have stated that the signs looked for were not found to have major neuro-psychiatric problem. — Depression not related to mercury exposure.
= Frequent absenteeism due to health problems.
Resigned their jobs — due to health factors.
= Suggestion has to have a community survey of the population.