



The Role of Nurses in Greening the Health System



CANADIAN NURSES ASSOCIATION
ASSOCIATION DES INFIRMIÈRES ET INFIRMIERS DU CANADA

This workbook has been prepared by CNA to provide information on a particular topic or topics. The views and opinions expressed in this report do not necessarily reflect the views of the CNA Board of Directors.

All rights reserved. Permission to photocopy or download for individual use is granted. Further reproduction in any manner, including posting to a website, is prohibited without prior written permission of the publisher. Permission may be obtained by contacting CNA at permissions@cna-aiic.ca.

© Canadian Nurses Association
50 Driveway
Ottawa, ON K2P 1E2

Tel.: 613-237-2133 or 1-800-361-8404
Fax: 613-237-3520
www.cna-aiic.ca

May 2008

ISBN 978-1-55119-216-1

Acknowledgments

The Canadian Nurses Association would like to acknowledge the significant contribution of the members of the Environmental Health Reference Group to the preparation of this paper. The members of the reference group are:

Chelsea Albo

Western Regional Director
Canadian Nursing Students' Association

Heather Anderson, BN, M.Ed.
Instructor
Portage College

Penelope A. Barrett, PhD,
B.Ed.(Nurs.), RN, RM(Aust.), FRCNA
Associate Professor
University of Northern British Columbia

Carol Bassingthwaighe, MSN, RN
Lecturer
University of British Columbia

Paul Boudreau, RN, BScN
Policy Analyst
Association of Registered Nurses of Prince Edward Island

Nancy Brookes, RN, M.Sc.(A), PhD,
CPMHN(C)
Nurse Scholar
Royal Ottawa Health Care Group

Andrea Chircop, RN, MN, PhD(c)
Assistant Professor
Dalhousie University

Kim English, RN, BScN, MN
Trent/Fleming School of Nursing
Faculty
University of Trent

Candace Franke, RN
Staff Nurse
Saskatoon Surgicentre Inc.

Gloria Fraser, RN, MHST
Nurse Education Coordinator
Women's College Hospital

Donna Goodridge, PhD, RN,
CHPCN(C)
Assistant Professor
University of Saskatchewan

Fiona Hanley, RN, M.Sc.
Lecturer
McGill University

Patricia A. Hansen-Ketchum, RN, MN
Assistant Professor
St. Francis Xavier University

Jean Harrowing, RN, PhD(c)
Lecturer
University of Lethbridge

Roberta Heale, RN(EC), MN, DNP(c)
Assistant Professor
Laurentian University

Laurie Higgins, RN, BN
Learning Facilitator
Atlantic Health Sciences
Corporation

Billie Hilborn, RN, BScN, M.H.Sc.
PhD Student – Nursing and
Bioethics
University of Toronto

Cindy Hunt, DrPH, RN
Associate Dean, Nursing, School of
Health Sciences
Humber Institute of Technology
and Advanced Learning

Kristine Hutchison, RN, BN
Representing the Community
Health Nurses Association of
Canada
Manager Public Health – Iqaluit
Department of Health and Social
Services, Nunavut

Sarah Liberman, RN, BScN
Policy Analyst
Saskatchewan Registered Nurses'
Association

Priscilla Lockwood, RN, MSN, ENC(C)
Representing the Canadian
Association for Rural and Remote
Nursing
Staff Nurse
Tofino General Hospital, Vancouver
Island Health Authority

Jackie Mace, RN, ONC(C)
Clinical Manager, Orthopaedics
The Ottawa Hospital, General
Campus

Jessica Madrid, RN, BScN
Public Health Nurse
Northern Interior Health Unit,
British Columbia

Marjorie McDonald, RN, PhD
Associate Professor
University of Victoria





Bonnie McLeod, RN, BScN, CPN(C)
Representing the Operating Room
Nurses Association of Canada
Clinical Nurse Educator –
Perioperative
Fraser Health Authority

Jayne Ménard, RN, BTSN
Program Manager
St. Mary's General Hospital

Sharolyn Mossey, RN, MScN
Assistant Professor, Nursing Vice-
Dean, Professional Schools
Laurentian University

Tricia Newport, RN, BScN
Home Care Nurse
Health and Social Services, Yukon
Government

Eileen Owen-Williams, DNP, FNP,
CNM, SANE-A
Associate Professor Coordinator,
Family Nurse Practitioner Program
University of Northern British
Columbia

Pammla Petrucka, RN, BScN, MN, PhD
Associate Professor
University of Saskatchewan

Janet Purvis, RN, B.Sc., MN
National Practice Consultant
VON Canada

Charlene Schiffer, RN, BScN,
R.R.Pr., TTP
Treasurer
Canadian Holistic Nurses
Association

Kari Simonson, RN, MN
Clinical Coordinator: Research &
Aboriginal Health
Canmore General Hospital

Lori Strudwick, RN, BN
Community Health Nurse
Watson Lake Hospital/Health
Centre, Yukon Government

Kendra Swinn
National Community and Public
Health Officer
Canadian Nursing Students'
Association

Hilda Swirsky, RN, BScN, M.Ed.
Representing the Registered
Nurses' Association of Ontario
Clinical Nurse
Mount Sinai Hospital

Joyce Woods Surrendi, RN, BN, BA,
M.Ed., PhD
Nursing Educator
Mount Royal College

Contents

Acknowledgments	/ i
Introduction	/ 1
Background	/ 1
Energy Use and Production of Greenhouse Gases and Other Emissions	/ 3
Waste Production	/ 5
Incineration of Medical Waste	/ 5
Use of Toxic Substances	/ 6
Mercury in Health-Care Products	/ 6
Cleaning Products	/ 9
DEHP in PVC Products	/ 10
Pesticides	/ 11
Nurses and Green Teams	/ 13
Conclusions	/ 14
References	/ 15

Introduction

This paper is the second in a series on nursing and environmental health that is part of a centennial project of the Canadian Nurses Association (CNA).

The purpose of the paper is to support and enhance nurses' contribution to reducing the negative environmental impacts caused by the health system in which they work. It provides information on the health system's use of energy and toxic substances, as well as its generation of waste and waste streams. It also offers ideas about what nurses can do to decrease the environmental impact of hospitals and other health-care facilities.

Background

Nurses in many settings have been active in “greening” the Canadian health system through initiatives that support energy conservation, waste reduction and the use of environmentally preferable products. Beyond their contributions to greening their workplaces, nurses are also engaged through their professional associations¹ in developing health policy that supports sustainable development² within the health system.

Jameton and Pierce have proposed that “health care professionals can offer leadership both in devising environmentally sound health care practices and in articulating the principles of sustainable health” (2001, p. 368). These authors also suggest that reducing the environmental impact of health care is an ethical responsibility, given that the sector currently contributes to the “declining condition of the natural environment [which] is beginning to affect the health of populations in many parts of the world” (p. 365).

Canada has nearly 600 hospitals (Canadian Institute for Health Information, n.d.) and many more long-term care facilities (Statistics Canada, 2007), health clinics and physicians' offices. The health sector accounts for just over 9% of Canada's gross domestic product (GDP), which makes it a significant contributor to the economy (Conference Board of Canada, 2007). Although the sector provides services to improve and maintain the health of Canadians, it may also undermine health through its substantial use of energy and other resources such as paper, wood, metals and water, as well as its production of waste. For example, incinerators in hospitals are the largest source of dioxin emissions to air in Canada (Canadian Council of Ministers of the Environment [CCME], 2007).

Case Study: Greening a Hospital

The New Women's College Hospital (WCH) has been a leader in hospital greening since the inception of the WCH Green Team in 1989. The members of this team are staff from all hospital areas, including several registered nurses, who strive to:

- green hospital services;
- purchase eco-friendly products and services; and
- engage, inspire and educate WCH staff in green initiatives and values.

¹ These include national, provincial and territorial associations, as well as specialty professional nursing organizations.

² “Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs” (World Commission on Environment and Development, 1987, p. 43).





Improving indoor air quality

Gloria, the nurse education coordinator at the Environmental Health Clinic, has worked hard to improve indoor air quality and decrease asthma triggers at WCH. She has developed information cards and new signage for a fragrance-free initiative for distribution throughout the hospital, and she has advocated for the use of scent-free, eco-friendly cleaning products. Gloria also attends the monthly teleconference on the Clean Air Challenge for Hospitals.

Initiating energy conservation strategies

Jane, a family practice nurse, monitors her work area for energy conservation. She checks that team members use screen savers or shut off their monitors when not in use. She suggests that lights and water taps be turned off when staff leave the office. Jane is also advocating for the purchase and use of recycled paper in all hospital departments.

Advocating for a mercury-free environment

Jane initially joined the WCH Green Team to advocate for a mercury-free environment in the family practice department. She has raised the issue of converting to mercury-free blood pressure equipment with the hospital's management.

Gloria has advocated for a mercury-free environment at WCH at the monthly meetings of the occupational health and safety committee. Fluorescent light bulbs and mercury-based blood pressure equipment are now being replaced by mercury-free products.

Developing recycling initiatives

Anne and Noreen, two nurses from the Neonatal Intensive Care Unit (NICU), researched and met with several recycling service companies to find ways to reduce landfill waste generated by diapers and polystyrene products. WCH was the first hospital in Toronto to recycle diapers, and it now recycles more diapers than any of the other downtown hospitals.

Reducing use of polyvinyl chloride products

Jane, Gloria, Anne and Noreen are researching strategies for reducing the use of polyvinyl chloride (PVC) products in the cafeteria, the NICU, and the rest of hospital. For example, Anne and Noreen want to replace the PVC tubing currently used in the NICU with neoprene tubing, as recommended by Health Canada.

Increasing awareness

- *Earth Week* All of the nurses continue to engage, inspire and educate WCH staff on "Energy Conservation" and "Being Mercury-Free," the themes of Earth Week in April 2007. Gloria developed a poster and brochure for the "Being Mercury-Free" theme.
- *Occupational Health and Safety Day* Educational information on being fragrance-free and mercury-free was displayed at the Green Team Booth during the WCH Occupational Health and Safety Day in November 2007. Green Team nurses were available to answer questions on the potential effects of fragrances and mercury use in the hospital.
- *Developing a Green Team website* The WCH Green Team is developing an evidence-based website, which will be available to all hospital staff on the intranet.

• *Green Leadership Award* In 2007, the first WCH Green Leadership Award was presented to the nurses and other staff of the NICU to recognize their efforts in recycling, their use of eco-friendly and mercury-free hospital products, and their promotion of a fragrance-free environment. All of the NICU staff members are active in promoting a fragrance-free environment for new moms, their babies and family members. Elizabeth and other nursing staff members are researching and designing an eco-friendly new NICU. The next project involves promoting strategies for reducing the use of PVC products in the nursery.

Energy Use and Production of Greenhouse Gases and Other Emissions



Electricity is produced from both renewable (hydroelectricity and wind) and non-renewable (fossil fuels such as coal and natural gas) resources. Burning fossil fuels contributes to the production of greenhouse gases (GHGs) and air pollution. GHGs lead to climate change, which is starting to have a profound effect on human health and ecosystems worldwide (Intergovernmental Panel on Climate Change, 2007; Health Canada, 2005a). Air pollution has been linked to increased mortality and morbidity from respiratory and cardiovascular disease (Health Canada, 2006; Pope & Dockery, 2006). Although hydroelectric and wind power do not release GHGs, the power generated from these sources is insufficient to meet all of Canada's energy needs, and they must be supplemented by electricity from fossil fuels (National Round Table on Energy and the Environment, 2001).

In 1997, an international study found that Canadian hospitals used six times more electricity than those in Switzerland and 2.5 times more than the average for hospitals in other countries in the Organisation for Economic Co-operation and Development (Centre for the Analysis and Dissemination of Demonstrated Energy Technologies, 1997). Although the Canadian climate influences the amount of energy used for heating, some commentators attribute part of the difference in energy use to the fact that electricity costs less in Canada than in other countries (Jefferson, 2006).

Many Canadian hospitals were built when energy costs were much lower, which meant that administrators were more concerned about capital costs than about ongoing operating expenses (Jefferson, 2006). Over time, as these older hospitals were expanded, the original, inefficient systems were extended rather than updated. As a result, the upfront costs to improve energy efficiency are now daunting. A study of Ontario hospitals conducted in 2004-05 found that their energy use had actually increased by 2.3% since a similar survey in 2003 (Jefferson, 2006). This increase occurred despite the fact that since 2000, many hospitals had voluntarily signed up as "Energy Innovators,"³ committing to reduce GHG emissions and obtaining retrofit funding from Natural Resources Canada (NRCan) (Canadian College of Health Service Executives [CCHSE], 2004). NRCan and the CCHSE are to be applauded for their Energy Innovators Initiative, which helps hospitals become more energy efficient, but there is still work to be done in this area.

Increasing electricity costs over the next few years will prompt health-care institutions to make further investments in energy efficiency, and the need for infrastructure funding through programs like the ecoENERGY Retrofit Incentive for Buildings will continue.

³ The Energy Innovators Initiative was co-sponsored by Natural Resources Canada and the Canadian College of Health Service Executives.

Nursing strategies for reducing energy use in hospital settings

There are two main ways in which nurses can help reduce energy use in hospitals and other health-care settings. The first relates to operations in the buildings where nurses work: supporting the use of energy-efficient light bulbs, turning lights and equipment off when not in use, promoting the use of local foods (which require less energy to transport) and making sure doors are closed as much as possible to prevent heat exchange with the outdoors.

The second relates to more substantive changes. Such changes can be promoted by hospital green teams, with participation from nurses and other staff members. A document prepared by NRCan (2003) provides useful information on setting benchmarks for energy use in hospitals and other health-care settings and also identifies a variety of best practices, including:

- upgrading insulation as part of other projects (e.g., new construction or reroofing)
- checking insulation for condensation and water penetration
- insulating attics
- draft-proofing windows and doors
- installing double- or triple-glazed windows, preferably with low-emissivity glass
- installing automatic doors in locations where external doors are frequently left open
- installing plastic curtains inside delivery doors

For more information

NRCan has more information on the ecoENERGY Retrofit Incentive for Buildings program, which funds projects to increase energy efficiency:

<http://oee.nrcan.gc.ca/commercial/financial-assistance/existing/retrofits/index.cfm?attr=o>

The Ontario Hospital Association has information on applying to NRCan for retrofit funding to increase energy efficiency: http://www.oha.com/client/oha/oha_lp4w_lnd_webstation.nsf/page/Energy+Innovators+Initiative

NRCan also sponsors the Energy Star program, which identifies energy-efficient products:

<http://oee.nrcan.gc.ca/energystar/english/consumers/index.cfm>

The Ontario Hospital Association has prepared a paper on opportunities for energy efficiency in Ontario hospitals that includes information on the Energy Conservation Act:

[http://www.oha.com/client/OHA/OHA_LP4W_LND_WebStation.nsf/resources/Energy+Efficiency/\\$file/Energy+Efficiency+Opportunities+feb28.pdf](http://www.oha.com/client/OHA/OHA_LP4W_LND_WebStation.nsf/resources/Energy+Efficiency/$file/Energy+Efficiency+Opportunities+feb28.pdf)

The findings of an NRCan survey comparing energy management by hospitals are available at

<http://www.c2p2online.com/documents/HospitalEnergycomparison.pdf>

The Building Green Hospitals Checklist is available from the Canadian Coalition for Green Health Care:

<http://www.c2p2online.com/documents/BuildingGreenHospitalsChecklist.pdf>

Waste Production

Food production and laundry services are just two of the many hospital activities that resemble those of the hotel industry. These activities produce both recyclable and compostable wastes, such as paper, plastic, polystyrene, cardboard and food scraps. Other hospital activities, including those involving patient care, produce biomedical and other wastes that need special handling.

One strategy for improving the management of hospital waste is to reduce the amount of waste sent for incineration. Aging medical incinerators emit dioxin, mercury and other heavy metals – all of which are harmful to health (Hancock, Whate, Wolnik & Del Matto, 2001; CCME, 2001). Hospitals in countries in the European Union are proposing to control infection and reduce environmental impact by more strategic cleaning and use of reusable products and appropriate processing of disposable (single-use) items (Daschner & Dettonkofer, 1997). In the United States, some firms process single-use hospital items so that they can be reused safely (Schultz, 2000). These approaches would reduce the quantity of disposable items, including PVC plastics, in the waste stream.



INCINERATION OF MEDICAL WASTE

Although infectious waste requires sterilization and biomedical waste requires incineration, in practice both types of waste are often incinerated, as are paper, cardboard and other “regular” waste (Davies & Lowe, 1999; Hancock, 2001). Separating waste streams reduces emissions from incineration facilities, and managing health-care waste in an environmentally sound manner can lead to significant cost savings (Sattler, 2002). For example, a biomedical waste program set up by the Ottawa Hospital allowed the hospital to decommission its on-site incinerator and cut operating costs (Hancock, Whate, Wolnik & Del Matto, 2001). Such savings are likely to increase as charges for waste disposal rise over time. In some European hospitals, the costs of medical waste disposal have led to significant reduction efforts (Bencko, Kapek & Vins, 2003).

Although incineration remains the most common disposal method for biomedical waste, it appears that much of the solid waste currently being incinerated at hospitals could go to landfill sites. For example, the Ontario Ministry of the Environment estimated that although 10% of solid waste produced by hospitals is handled as biomedical waste (and therefore incinerated), 39% of this amount in fact required no special handling (Hancock, 2001). Such unnecessary incineration is of concern because older medical incinerators were excluded from directives to reduce dioxin emissions from incineration (CCME, 2001), which may be why the health-care sector is now the largest contributor to dioxin and furan emissions to air in Canada (CCME, 2007).

Dioxins and furans are among the “dirty dozen” persistent organic pollutants identified by the United Nations Environment Programme and are subject to international emission-reduction agreements. Human exposure to dioxins and furans occurs almost exclusively through food, since these compounds are fat soluble and accumulate as they move up the food chain. The evidence on the toxicity of dioxins is incontrovertible, and the most toxic (2,3,7,8-tetrachlorodibenzo-p-dioxin) has been identified as a human carcinogen (Wigle, 2003). Like dioxins, furans are polyhalogenated aromatic hydrocarbons that readily disperse and persist in the environment (Wigle, 2003).

Strategies for reducing medical waste incineration

The CCME (2001) has identified several strategies for reducing incineration of medical waste:

- waste diversion initiatives to minimize the amount destined for disposal (i.e., waste reduction and material reuse)
- waste segregation initiatives to identify materials that will emit dioxins, furans and other air pollutants and to divert them for recycling or other non-incineration disposal options
- combustion control strategies to improve the performance of existing incinerators
- use of alternative disposal or treatment technologies (e.g., anaerobic digestion of wastes, with recovery of materials and combustion of biogas)

Nursing strategies for reducing waste

Nurses can be very influential in:

- introducing recycling programs for hospital waste, 45% of which may be paper (Hancock, 2001)
- supporting the purchase of reusable linens in hospital and clinic settings and reducing the use of disposable linens
- asking suppliers to reduce packaging
- ensuring that only material needing incineration goes to the medical incinerator by educating staff and making waste receptacles available and accessible
- working with other members of the hospital staff to purchase health-care products that do not contain toxic substances such as mercury, so they do not end up in the waste stream (please see next section).

For more information

Environment Canada provides links on waste reduction in the health sector:

<http://www.ec.gc.ca/cppic/En/refView.cfm?refId=826>

A success story on waste reduction is available from the Hospital for Sick Children:

<http://www.on.ec.gc.ca/success-stories/on/valerie-e.html> and

<http://www.c2p2online.com/documents/SickChildrenHospital.pdf>

Use of Toxic Substances

A number of toxic substances are used to support patient care activities. Here we review mercury, toxic compounds used in cleaning products, and di(2-ethylhexyl)phthalate (DEHP) in PVC products. These three have been selected primarily because they are widely used in the health-care system and less toxic alternatives are available. A range of drugs and radioisotopes are also used within hospitals. Improper disposal of drugs has received increased attention in recent years because trace amounts of medications are being identified in the environment (Health Canada, 2005b). Nurses can promote the appropriate disposal of these products within hospital and community settings. Regulations from the Canadian Nuclear Safety Commission guide the safe disposal of radioisotopes (Government of Canada, 2004).

MERCURY IN HEALTH-CARE PRODUCTS

Mercury is a regulated toxic substance under the 1999 Canadian Environmental Protection Act, and Canada has committed to several national and international agreements to reduce its release into the environment (Environment Canada, 2002a). Mercury is usually emitted in its inorganic form through combustion processes



such as coal-fired power generation, metal mining and waste incineration (Health Canada, 2004). Once in the environment, it is transformed by bacteria into methyl mercury, an organic compound that can readily enter the brain, where it remains indefinitely. In pregnant woman, it also crosses the placenta and accumulates in the fetal brain and other tissues, potentially leading to developmental delays even at relatively low exposures. Humans are most commonly exposed to mercury by eating fish (Health Canada, 2004).

In hospitals and other health-care settings, mercury is used in batteries, fluorescent light bulbs and equipment such as thermometers, blood pressure cuffs and manometers on laboratory and patient care equipment. If a mercury spill results from breakage of such equipment, any mercury that is not properly disposed of evaporates and can be inhaled, exposing health-care personnel and patients (Lipscomb, 2004). For institutions with a broad range and high numbers of products containing mercury, there is a strong likelihood that at least some mercury-containing products will be incinerated, leading to wider mercury emissions. To reduce the risks posed by this toxic substance, it is important to find alternatives for mercury-containing products in hospitals and to be aware which products contain mercury, to ensure that they are handled with care and disposed of appropriately.

Health Effects of Mercury

In 1956, industrial emissions of mercury in Minamata Bay, Japan, were identified as the cause of Minamata disease, which was occurring among those who ate fish from the bay (Ui, 1992). Those affected experienced personality changes, tremors, changes in vision, deafness, loss of muscle coordination and sensation, memory loss, intellectual impairment and even death (Health Canada, 2004; Ui, 1992). Similar symptoms were observed in 1970 among residents of Grassy Narrows, Ont., who ate fish contaminated by mercury discharged by a paper company (Indian and Northern Affairs Canada, 2004). Exposure of pregnant women and young children to even low levels of mercury can have undesirable consequences for the children, including a negative impact on cognitive functioning (as measured by the intelligence quotient), delays in walking and talking, lack of coordination, blindness and seizures (Health Canada, 2004). Accordingly, Health Canada issues fish advisories specifying the maximum number of servings of fish that pregnant women and young children can safely eat each week, and provincial governments issue similar advisories for sport fish. For a recent fish advisory from Health Canada (2007a), see http://www.hc-sc.gc.ca/ahc-asc/media/advisories-avis/2007/2007_31_e.html

Nursing strategies for reducing mercury use in health care

Many hospitals in Canada and the United States have already committed to reducing the number of products they use that contain mercury. In Canada, the Canadian Coalition for Green Health Care⁴ and Healthcare EnviroNet⁵ provide leadership in this area. Environment Canada has also been promoting mercury reduction in hospitals (Environment Canada, 2004). U.S. organizations active in this area include Health Care Without Harm⁶ and Hospitals for a Healthy Environment.⁷ Additional details on each of these organizations and their guidance on reducing mercury in hospitals can be found in the later section “For more information.”

4 “The Canadian Coalition for Green Health Care is a coalition of member groups concerned with and dedicated to minimizing the adverse environmental and human health impact of Canada’s health care system” (<http://www.greenhealthcare.ca/>).

5 “The purpose of Healthcare EnviroNet is to provide the health care community with access to environmental information, products, and services that support a commitment to quality health care, protection of the environment, and sustainability” (http://www.c2p2online.com/main.php3?session=§ion=84&doc_id=170).

6 “Health Care Without Harm is an international coalition of hospitals and health care systems, medical professionals, community groups, health-affected constituencies, labor unions, environmental and environmental health organizations and religious groups” (<http://www.noharm.org/us/aboutUs/missionGoals>).

Nurses can work with other staff, for example on green teams or occupational health and safety committees, to take the following actions to reduce the number of products containing mercury in hospitals and other health-care settings:⁸

- Make a commitment to becoming mercury-free. Get the support of senior management and staff to eliminate mercury from your institution. Assign someone to lead the initiative, and form a mercury-free team with staff from across the hospital.
- Conduct an audit to identify all sources and uses of mercury in the health-care setting. Mark medical products containing mercury with a sticker to alert staff that they require special disposal and should be kept out of the general waste stream.
- Identify alternative mercury-free products, and develop a plan, including a budget, categorizing these items as immediately or gradually replaceable. Identify appropriate disposal procedures for the replaced items.
- Implement a mercury-free purchasing policy so that new products will not contain mercury. The policy should include reagents and other “background” uses of mercury. The cost of these items is dropping as more health-care facilities request them.
- Review mercury spill procedures with all staff as part of orientation and continuing education activities, so they can protect themselves in the event of equipment breakage.
- Discuss the impact of mercury on environmental health as part of these learning sessions, to stress the importance of appropriate disposal of products containing mercury.
- Participate in municipal recycling programs for products containing mercury, such as fluorescent bulbs and batteries.
- Hold a mercury thermometer disposal day for staff and residents of the surrounding community, and ensure proper disposal of the thermometers that are collected.
- When teaching new parents how to care for newborns, recommend use of non-mercury thermometers as a way of avoiding mercury spills in the home.



For more information

Many excellent sources of information are available to help hospitals and other health-care facilities become mercury-free.

Health Care EnviroNet offers links to several sources of information on reducing mercury use in hospitals:
http://c2p2online.com/main.php3?session=§ion=87&doc_id=183

Environment Canada describes federal and provincial activities related to managing mercury-related risks to health and the environment: <http://www.ec.gc.ca/mercury/en/index.cfm>

Hospitals for a Healthy Environment has a number of mercury fact sheets on their website, as well as a newsletter published by the ECRI Institute on how hospitals can go mercury-free:
<http://www.h2e-online.org/docs/hhmmaug2007.pdf>

Health Care Without Harm has a resource guide on making the practice of medicine mercury-free:
http://www.noharm.org/library/docs/Going_Green_Making_Medicine_Mercury_Free.pdf

7 Hospitals for a Healthy Environment (H2E) represents a national movement for environmental sustainability in health care. H2E was jointly founded by the American Hospital Association, the U.S. Environmental Protection Agency, Health Care Without Harm and the American Nurses Association. To achieve its vision, mission and goals, H2E educates health-care professionals about ways to prevent pollution and provides a wealth of practical tools and resources to facilitate the industry's shift toward environmental sustainability:
<http://cms.h2e-online.org/about/>

8 This list is adapted from Sattler, B. (2002).

The World Health Organization's policy paper on mercury in health care provides an international perspective on becoming mercury-free: http://www.who.int/water_sanitation_health/medicalwaste/mercurypolpaper.pdf

Barbara Sattler (2002), a nurse known for her work in the area of environmental health, has published an independent study module that includes a discussion of mercury in health-care settings: <http://www.noharm.org/details.cfm?ID=798&type=document>

CLEANING PRODUCTS

In hospitals and other health-care facilities, low-level disinfectants are used to clean hard surfaces in patient rooms, halls and other locations. These products can be used to remove microbes from hard surfaces (disinfection) or to reduce microbial levels on hard surfaces (sanitization) (Environment Canada, 2007). However, some disinfectants pose occupational health risks to staff, and they can also represent a threat to the environment. The general guideline should always be to choose the least toxic product available to clean any surface (for details on finding such products, see the section "For more information").

Nursing strategies for reducing the use of toxic cleaning products

In North America, cleaning products are evaluated by the EcoLogo⁹ program, which "compares products/services with others in the same category, develops rigorous and scientifically relevant criteria, and awards the EcoLogo to those that are environmentally preferable throughout their entire whole life a thorough evaluation and auditing process" (EcoLogo Program, n.d.). Looking for cleaning products that have been evaluated by this program is a good first step in choosing the least toxic product. EcoLogo's evaluation of cleaning and janitorial products is found on http://www.ecologo.org/en/certifiedgreenproducts/category.asp?category_id=21.

Health and safety committees and green teams provide a good forum for nurses, housekeeping staff and others to reduce the amounts of toxic compounds used in cleaning. The steps involved include:

- identifying the cleaning products being used in different parts of the hospital and determining whether they have been certified by the EcoLogo program;
- reviewing the information in the Labour Environmental Alliance Society's (n.d.) publication *Cleaners and Toxins*, a 24-page booklet that provides information on how to select cleaning products for the workplace (this guide can be used in conjunction with the EcoLogo program to identify less toxic cleaning products);
- considering the microfibre cleaning system, which uses far less cleaning product and water than conventional methods (it is used by York Central Hospital in Richmond Hill, Ont., and supported by the Sustainable Hospitals project¹⁰ in the United States); and
- identifying the appropriate cleaning products for cleaning and disinfecting each area of the hospital and developing a plan, including a budget, to replace existing cleaning products with less toxic products.

For more information

Healthcare EnviroNet provides links to websites on environmentally sustainable cleaning products:

http://www.c2p2online.com/main.php3?session=§ion=87&doc_id=489

9 "EcoLogo is North America's most widely recognized and respected certification of environmental leadership. By setting standards and certifying products in more than 120 categories, EcoLogo helps you identify, trust, buy, and sell environmentally preferable ('green') goods and services" (<http://www.ecologo.org/en/>).

10 The website of the Sustainable Hospitals Program (http://www.sustainablehospitals.org/cgi-bin/DB_Index.cgi) states that this organization "provides technical support to the healthcare industry for selecting products and work practices that eliminate or reduce occupational and environmental hazards, maintain quality patient care and contain costs. We support and collaborate with healthcare institutions, clinicians, unions representing healthcare practitioners, students, and government, as well as environmental and healthcare advocacy groups."

The EcoLogo site has information about its program to identify environmentally sustainable products, as well as links to other sites for environmentally sound purchasing:
<http://www.ecologo.org/>

DEHP IN PVC PRODUCTS

PVC is a primary component in 25% of all medical products. In the United States, the health sector consumes nearly 3 million pounds (1.36 million kilograms) of plastic medical products each year (Davies & Lowe, 1999). DEHP is a chemical additive used to increase the flexibility of PVC products such as catheters, tubing and bags used to administer blood, plasma, drugs and other fluids (Health Canada, 2003). Medical devices that contain DEHP have some advantages over potential substitutes: for example, they allow longer storage time for blood that is intended for transfusion (Health Canada, 2003).



Effects of DEHP

In animal models, particularly rodents, exposure to DEHP during pregnancy and early infancy has a variety of effects, including birth defects and changes in the liver, kidneys and reproductive system. Of greatest concern are the effects on the developing testes of young animals (Health Canada, 2003). Although there is some indication that primates are less sensitive than rodents, there is a theoretical possibility of harm to young males exposed to high levels of DEHP (Health Canada, 2003).

DEHP does not bind chemically to the PVC plastic and can therefore leach into any fluid with which it has prolonged contact. No adverse effects of exposure to DEHP from medical devices have been reported; however, findings from certain toxicology studies (Health Canada, 2003) have raised concerns. Male newborns, pregnant women, infants, young children and (possibly) peripubertal males are the groups most susceptible to the adverse effects of DEHP (Health Canada, 2003).

The medical procedures of greatest concern (i.e., causing highest exposure in the most susceptible subgroups), include:

- volume exchange transfusion in newborns and infants
- extracorporeal membrane oxygenation in newborns and infants
- cardiac surgery in newborns and infants
- administration of total parenteral nutrition solutions containing lipids to newborns and infants
- enteral nutrition in newborns and infants
- various intensive care procedures for sick newborns
- intravenous infusion of lipophilic drugs or drugs containing surfactants to infants and children

For these procedures, Health Canada's expert advisory group has recommended that alternative measures be introduced to protect those at risk (Health Canada, 2003).

The use of PVC products also increases the chlorine content in hospital wastes, and if such products are incinerated, dioxin emissions also rise. Incineration of PVC products should always be avoided (Environment Canada, 2002b). Unfortunately, problems may occur even if PVC products are not incinerated; for example, DEHP can be expected to leach out of PVC products in landfill sites (Brown, Holland, Boyd, Thresh, Jones & Ogilvie, 2000). As more hospitals request alternatives to PVC, the costs of such products will drop.

Nursing strategies for reducing exposure to DEHP in high-risk populations

Nurses working in pediatric settings can promote the use of alternative products for the procedures listed earlier. The use of alternatives to PVC plastics can also be supported through green teams where these products are available.

For more information

Health Canada's draft position statement on DEHP in medical devices provides a good overview of the main issues:

http://www.hc-sc.gc.ca/dhp-mps/md-im/activit/sci-consult/dehp/dehp_position_draft_ebauche_e.html

Health Care Without Harm has a fact sheet on DEHP and PVC products:

<http://www.noharm.org/details.cfm?ID=1277&type=document>

Information on alternatives to PVC products can be found at the Health Care Without Harm website:

<http://www.noharm.org/us/pvcDehp/pvcFree>

Barbara Sattler (2002) has published an independent study module that includes a discussion on the issue of DEHP and PVC products in health-care settings: <http://www.noharm.org/details.cfm?ID=798&type=document>

The European Union has a draft strategy for reducing the risk of exposure to DEHP through medical and other products: <http://www.noharm.org/details.cfm?type=document&id=709>

PESTICIDES

Pesticides are used to control or eliminate unwanted or harmful organisms, including insects (e.g., insecticides to kill mosquitoes and thus reduce the risk of transmission of West Nile virus), rodents (e.g., rodenticides to kill rats and thus reduce the risk of transmission of infection), fungi and moulds (e.g., fungicides to reduce growth of mould in the home) and weeds that compete with food crops (e.g., herbicides to promote greater crop yields).

However, a large body of research has indicated that the benefits of pesticides come with risks, particularly for children (Basrur, 2002; Wigle, 2003; Sanborn, Cole, Kerr, Vakil, Sanin & Bassel, 2004). As a review of the literature on the effects of pesticides and human health published by the Toronto Health Department (Basrur, 2002) concluded, "These substances are intended to be harmful to living organisms and because they are released into the environment, they pose an exposure and potential health risk to other organisms, including humans" (p. 1).

An analysis of the literature reviews discussing pesticides and health is beyond the scope of this paper, but two Canadian reviews on the state of the science in this area are available:

Pesticides literature review (Sanborn, Cole, Kerr, Vakil, Sanin & Bassel, 2004):

<http://www.ocfp.on.ca/local/files/Communications/Current%20Issues/Pesticides/Final%20Paper%2023APR2004.pdf>

Lawn and garden pesticides: A review of human exposure and health effects research (Basrur, 2002):

http://www.toronto.ca/health/pesticides/pdf/pesticides_lawnandgarden.pdf



Countries around the world have taken steps to ensure that people benefit from pesticides with minimal or no harm to the environment and human health. In Canada, the Pest Management Regulatory Agency (PMRA) is responsible for regulating pest control products and enforcing compliance with the Pest Control Products Act. The mandate of the PMRA is to prevent unacceptable risks to people and the environment from the use of pest control products. To help reduce these risks, the PMRA has prepared information for the public on the responsible use of pesticides, including alternatives:
<http://www.pmra-arla.gc.ca/english/consum/consum-e.html>.

Strategies for reducing pesticide use

Health-care facilities are intended to provide a healthy environment for patients; in many hospitals this has meant using integrated pesticide management (IPM) to address pest problems. IPM “is a philosophy and system of managing pests that provides a framework for removing life support systems for pests (food, water, and nesting space) along with least hazardous methods such as traps and sticky tapes before moving on to chemical solutions” (Sattler, 2002, p. 34). When chemicals are used, the least toxic alternative should be selected. These strategies can be used both within the hospital (to deal with insects and rodents) and on the surrounding grounds (to deal with weeds, grubs and other pests).

PMRA (Health Canada, 2007b) suggests the following strategies for reducing or eliminating the use of pesticides:

- Question whether a pest problem really exists.
- Understand pest behaviour.
- Modify the physical environment to make it less attractive to pests.
- Modify the physical environment to repel the pest.

PMRA also offers fact sheets that provide specific information on using an IPM approach to deal with a broad range of indoor and outdoor pests: <http://www.pmra-arla.gc.ca/english/consum/pnotes-e.html>

Nursing strategies for reducing pesticide use

Nurses can work with other staff in health-care settings to promote the use of alternatives to pesticides. One of the most important things nurses can do is simply ask questions such as: What pesticides are being used at the hospital? What alternatives have been considered? Sometimes pesticide use is simply a continuation of long-term practices; questioning existing norms in this situation is often a good way to initiate change.

For more information

The Responsible Pest Management website, created by Environment Canada with the Federation of Canadian Municipalities and maintained by the Canadian Centre for Pollution Prevention, has useful information:
<http://www.pestinfo.ca/>

A paper by Kagan Owens (2003) provides a more detailed discussion of alternatives to pesticide use in hospitals in *Healthy Hospitals: Controlling Pests without Harmful Pesticides*:
<http://www.noharm.org/details.cfm?ID=864&type=document>

St. Mary's Hospital in Kitchener, Ont., has won awards for its chemical-free approach to pest control:
<http://www.c2p2online.com/documents/StMarys-lawns.pdf>

Health Canada's healthy lawns website includes information on integrated pest management for lawns:
<http://www.healthylawns.net/>



Leadership by Organizations of Health-Care Professionals

CNA and the Canadian Medical Association (CMA) issued a joint position statement on environmentally responsible activity in the health sector that addressed the issue of reducing medical waste (CNA & CMA, 2005). This position statement proposes the following roles for professional associations (pp. 2-3):

Information sharing:

- 1 supporting and encouraging educational initiatives for individual practitioners on environmentally responsible practices in a variety of health care settings,
- 2 sharing information on successful practices nationally and among professional groups,
- 3 encouraging research by health professionals and others on:
 - a) the environmental determinants of health, e.g. health effects of contaminants, and
 - b) ways the health sector can move towards environmentally responsible practices, e.g. minimizing waste production and practicing safe waste disposal, and,
- 4 supporting the efforts of all Canadians to find environmentally responsible ways to perform their daily activities;

Lobbying individual legislators and governments regarding the need to:

- 1 initiate stricter legislation, e.g. reduce carbon dioxide emissions, and ban all use of CFCs [chlorofluorocarbons] before the end of this century,
- 2 initiate pricing policies that reflect the full environmental costs of goods and services, and,
- 3 provide incentives to promote the use of more energy efficient technologies and non-polluting energy sources; and,

Encouraging international professional bodies and their members to lobby their governments to promote sustainable environments, e.g. address the problem of toxic waste disposal in the Third World.

Nurses and Green Teams

Nurses are influential contributors to building design, institutional procedures and purchasing decisions. They can be key members of teams created within health-care facilities that work to reduce their environmental footprint. Several hospitals across Canada have established green teams, including Cambridge Memorial Hospital,¹¹ Women's College Hospital, Montreal Children's Hospital and Alberta Children's Hospital. Consisting of staff members from departments across the institution, the teams focus on promoting energy efficiency, product longevity, non-toxicity and attractiveness of the environment. For a description of the green team at Women's College Hospital, please see the text box at the beginning of this paper.

Hospitals for a Healthy Environment (n.d.) has proposed the following objectives for green teams:

- "To develop, implement and manage operational infrastructure to maintain waste management and minimization programs
- To develop, implement and communicate work practice changes that achieve environmentally friendly practices and outcomes

¹¹ For a description of the green team at Cambridge Memorial Hospital, see <http://www.c2p2online.com/documents/CambridgeHospital.pdf>

- To coordinate staff education on methods, strategies, and action plans to specifically decrease medical waste in their departments and facilities, as well as recycle appropriate products, and positively affect financial implications
- To monitor the program and initiate alternatives to existing practices that will positively affect the environment as well as financial ramifications to the hospital
- To collect, measure and report on environmental performance. Use data to prioritize goals and action plans.”

Many hospitals already have health and safety committees, and their terms of reference could be easily expanded to encompass these objectives.

Conclusions

This paper has looked at how health-care facilities can minimize their environmental footprint by reducing their use of energy and toxic substances as well as their waste production. Other steps in creating sustainable hospitals include exploring the potential for major renovations that will further increase energy efficiency. Reducing the environmental footprint of health care more generally would involve exploring the sustainability of the health system and identifying more effective ways to use resources across the system (Guenther & Hall, 2007).

Although it is expensive to renovate existing health-care facilities, programs are available to address some of these costs. Progress has been made in building new facilities that are designed with a lower environmental burden in mind. For example, facilities may be built on reclaimed brownfields, close to public transportation and using environmentally friendly building materials. Such facilities may be certified for Leadership in Energy and Environmental Design (also known as the LEED designation); more information on this program is available from the Canada Green Building Council: <http://www.cagbc.org/>.

The comfort and design of the physical setting in which health care is provided are important to healing (Chan & Sanoff, 1988). Appropriate lighting, clear signage, use of colour, reduction of clutter and access to nature all promote the health and well-being of patients and staff (Chan & Sanoff, 1988; Schweizer, Gilpin & Frampton, 2004; Young-Mason, 2002).

Pierce and Jameton, in their monograph exploring the ethics of environmentally responsible health care, begin by saying that “the foundation of human health rests on healthy, stable ecosystems” (2004, p. 1). They argue that one of the reasons for the unsustainability of U.S. health care is its degradation of the quality of the environment, which paradoxically leads to more disease. The U.S. health system consumes 15% of that country’s GDP, in contrast to the 9% of GDP used to support the Canadian health system. Yet the two countries have the same concerns about sustainability, as use of resources and the associated costs rise each year. Over the long term, considerations of sustainability and environmental responsibility may lead us to think differently about our health system and what we expect from it.

References

- Basrur, S. (2002). *Lawn and garden pesticides: A review of human exposure and health effects research*. Toronto: Toronto Public Health. Retrieved August 7, 2007, from http://www.toronto.ca/health/pesticides/pdf/pesticides_lawnandgarden.pdf
- Bencko, V., Kapek, J., & Vins, O. (2003). Hospital waste treatment and disposal in the general university hospital: Current situation and future challenges. *Indoor and Built Environment*, 12(1-2), 99-104.
- Brown, K., Holland, M., Boyd, R., Thresh, S., Jones, H., & Ogilvie, S. (2000). *Economic evaluation of PVC waste management: A report produced for the European Commission Environment Directorate*. Retrieved September 24, 2007, from http://ec.europa.eu/environment/waste/studies/pvc/economic_eval.pdf
- Canadian College of Health Service Executives. (2004). *Canadian health care innovators: Turning energy dollars into health care dollars ... for a healthier planet*. Retrieved August 8, 2007, from http://www.cchse.org/oeo_innovators.htm
- Canadian Council of Ministers of the Environment. (2001). *Canada-wide standards for dioxins and furans*. Retrieved June 19, 2007, from http://www.ccme.ca/assets/pdf/d_and_f_standard_e.pdf
- Canadian Council of Ministers of the Environment. (2007). *Review of dioxins and furans from incineration in support of a Canada-wide standard review*. Retrieved October 2, 2007, from http://www.ccme.ca/assets/pdf/df_incin_rvw_rpt_e.pdf
- Canadian Institute for Health Information. (n.d.). *Hospital expenses net of recoveries, by province, territory and Canada – 1999-2000 to 2003-2004 and preliminary 2004-2005*. Retrieved December 5, 2007, from http://secure.cihi.ca/cihiweb/dispPage.jsp?cw_page=statistics_results_source_cmdb_e
- Canadian Nurses Association & Canadian Medical Association. (2005). *Joint CNA/CMA position statement on environmentally responsible activity in the health care sector*. Ottawa: CNA. Retrieved September 5, 2007, from http://www.cna-aiic.ca/CNA/documents/pdf/publications/PS33_Joint_Stat_Envir_Resp_Activity_Health_Sector_Feb_2006_e.pdf
- Centre for the Analysis and Dissemination of Demonstrated Energy Technologies. (1997). *Saving energy with energy efficiency in hospitals*. Sittard, Netherlands: Author.
- Chan, T., & Sanoff, H. (1988). The patient's view of their domain. *Design Studies*, 9(1), 40-55.
- Conference Board of Canada. (2007). *A Canadian climate change strategy: Getting the basics right*. Ottawa: Author.
- Daschner, F. D., & Dettenkofer, M. (1997). Protecting the patient and the environment – new aspects and challenges in hospital infection and control. *Journal of Hospital Infection*, 36(2), 7-15.



Davies, T., & Lowe, A. (1999). *Environmental implications of the health care service sector*. Washington, DC: Resources for the Future.

EcoLogo Program. (n.d.). *See our criteria*. Retrieved January 21, 2008, from <http://www.ecologo.org/en/seeourcriteria/>

Environment Canada. (2002a). *Current mercury reduction initiatives in Ontario hospitals*. Retrieved August 8, 2007, from <http://www.ec.gc.ca/nopp/docs/fact/en/mercOntHpl.cfm>

Environment Canada. (2002b). *Pollution prevention in the health sector*. Retrieved August 13, 2007, from <http://www.ec.gc.ca/nopp/docs/fact/en/health.cfm>

Environment Canada. (2004). *Mercury and the environment*. Retrieved September 10, 2007, from <http://www.ec.gc.ca/MERCURY/SM/EN/sm-mcp.cfm>

Environment Canada. (2007). *Environmental choice program: Certification criteria document: Disinfectants and disinfectant-cleaners*. Retrieved August 16, 2007, from <http://www.environmentalchoice.com/images/ECP%2520PDFs/CCD166DisinfectantandDisinfectant.pdf>

Government of Canada. (2004). *Canadian nuclear safety commission*. Retrieved December 3, 2007, from http://www.canadabusiness.ca/servlet/ContentServer?pagename=CBSC_FE%2Fdisplay&lang=en&cid=1081944205885&c=Regs

Guenther, R., & Hall, A. G. (2007). Healthy buildings: Impact on nurses and nursing practice. *OJIN: The Online Journal of Issues in Nursing*, 12(2). Retrieved September 6, 2007, from <http://nursingworld.org/MainMenuCategories/ANAMarketplace/ANAPeriodicals/OJIN/TableofContents/Volum e122007/May31/HealthyBuildings.aspx>

Hancock, T. (2001). *Doing less harm: Assessing and reducing the environmental and health impact of Canada's health system*. Canadian Coalition for Green Health Care. Retrieved August 15, 2007, from http://www.c2p2online.com/documents/CCGHC_DoingLessHarm.pdf

Hancock, T., Whate, R., Wolnik, C., & Del Matto, T. (2001). *Success stories*. Canadian Coalition for Green Health Care. Retrieved August 7, 2007, from <http://www.c2p2online.com/documents/BOOKLET.pdf>

Health Canada. (2003). Draft position statement on DEHP in medical devices for stakeholder consultation. Retrieved August 8, 2007, from http://www.hc-sc.gc.ca/dhp-mps/md-im/activit/sci-consult/dehp/dehp_position_draft_ebauche_e.html

Health Canada. (2004). *It's your health: Mercury and human health*. Retrieved August 9, 2007, from http://www.hc-sc.gc.ca/iyh-vsv/environ/merc_e.html

Health Canada. (2005a). *Your health and a changing climate: Information for health professionals*. Ottawa: Minister of Health.



Health Canada. (2005b). *It's your health: Proper use and disposal of medication*. Retrieved December 5, 2007, from http://www.hc-sc.gc.ca/iyh-vsv/med/disposal-defaire_e.html

Health Canada. (2006). *Health effects of air pollution*. Retrieved October 2, 2007, from http://www.hc-sc.gc.ca/ewh-semt/air/out-ext/effe/health_effects-effets_sante_e.html#4

Health Canada. (2007a). *Health Canada's revised assessment of mercury in fish enhances protection while reflecting advice in Canada's Food Guide*. Retrieved August 9, 2007, from http://www.hc-sc.gc.ca/ahc-asc/media/advisories-avis/2007/2007_31_e.html

Health Canada. (2007b). *Responsible pesticide use*. Retrieved January 23, 2008, from <http://www.pmr-arla.gc.ca/english/consum/consum-e.html>

Hospitals for a Healthy Environment. (n.d.). *Waste reduction: Form a team*. Retrieved October 2, 2007, from <http://cms.h2e-online.org/ee/waste-reduction/getting-started/form-a-team/#GreenTeamEcologyorEnvironmentalCommittee>

Indian and Northern Affairs Canada. (2004). *Fact sheet: English-Wabigoon River mercury compensation*. Retrieved September 27, 2007, from http://www.ainc-inac.gc.ca/pr/info/ewr_e.html

Intergovernmental Panel on Climate Change. (2007). *Climate change 2007: Impacts, adaptations and vulnerability*. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge: Cambridge University Press.

Jameton, A., & Pierce, J. (2001). Environment and health: Sustainable health care and emerging ethical responsibilities. *Canadian Medical Association Journal*, 164(3), 365-369.

Jefferson, J. (2006). *Energy efficiency opportunities in Ontario hospitals*. Toronto: Ontario Hospital Association. Retrieved August 7, 2007, from [http://www.oha.com/client/OHA/OHA_LP4W_LND_WebStation.nsf/resources/Energy+Efficiency/\\$file/Energy+Efficiency+Opportunities+feb28.pdf](http://www.oha.com/client/OHA/OHA_LP4W_LND_WebStation.nsf/resources/Energy+Efficiency/$file/Energy+Efficiency+Opportunities+feb28.pdf)

Labour Environmental Alliance Society. (n.d.). *Cleaners and toxins*. Retrieved August 8, 2007, from <http://leas.ca/UserFiles/File/pdf/Toxins%20Guide.pdf>

Lipscomb, J. (2004). Occupational health risks in the health care industry. In B. Sattler & J. Lipscomb (Eds.), *Environmental health and nursing practice* (pp. 11-26). New York: Springer Publishing Company.

National Round Table on Energy and the Environment. (2001). *Non renewable resource indicators*. Retrieved August 8, 2007, from http://www.nrtee-trnee.ca/eng/programs/current_programs/SDIndicators/cluster-groups/ClusterGroup_BackGroundDocuments_NonRenewable-Resources_e.htm#1

Natural Resources Canada. (2003). *Benchmarks and best practices for acute and extended health care facilities: A guide for energy managers and finance officers*. Retrieved August 7, 2007, from <http://www.oee.nrcan.gc.ca/publications/infosource/pub/ici/eii/m144-7-2003e.cfm?attr=20>

Owens, K. (2003). *Health hospitals controlling pests without pesticides*. Washington, DC: Beyond Pesticides & Health Care Without Harm. Retrieved August 8, 2007, from http://www.beyondpesticides.org/hospitals/Healthy_Hospitals_Report.pdf

Pierce, J., & Jameton, A. (2004). *The ethics of environmentally responsible health care*. Oxford University Press: New York.

Pope, C. A., & Dockery, D. W. (2006). Health effects of fine particulate air pollution: Lines that connect. *Journal of Air and Waste Management Association*, 54, 709-742.

Sanborn, M., Cole, D., Kerr, K., Vakil, C., Sanin, L., & Bassel, K. (2004). *Pesticides literature review*. Toronto: Ontario College of Family Physicians. Retrieved August 9, 2007, from <http://www.ocfp.on.ca/local/files/Communications/Current%20Issues/Pesticides/Final%20Paper%2023APR2004.pdf>

Sattler, B. (2002). Environmental health in the health care setting. *The American Nurse*, 34(2), 26-40. Retrieved August 8, 2007, from <http://www.noharm.org/details.cfm?ID=798&type=document>

Schultz, J. (2000). Reprocessing single-use medical devices. In *Setting healthcare's environmental agenda: Papers and proceedings from the October 16, 2000 conference*. Falls Church, VA: Health Care Without Harm. Retrieved August 15, 2007, from <http://www.noharm.org/details.cfm?type=document&ID=477>

Schweizer, M., Gilpin, L., & Frampton, S. (2004). Healing spaces, elements of environmental design that make an impact on health. *Journal of Alternative and Complementary Medicine*, 10(supplement 1), S-71-S-83.

Statistics Canada. (2007, May 30). *Residential care facilities 2004/2005*. The Daily. Retrieved July 30, 2007, from <http://www.statcan.ca/Daily/English/070530/do70530d.htm>

Ui, J. (1992). Minimata disease. In J. Ui (Ed.), *Industrial pollution in Japan*. Tokyo: United Nations University Press. Retrieved August 9, 2007, from <http://www.unu.edu/unupress/unupbooks/uu35ie/uu35ieoc.htm>

Wigle, D. (2003). *Child health and the environment*. New York: Oxford University Press.

World Commission on Environment and Development. (1987). *Our common future*. Oxford: Oxford University Press.

Young-Mason, J. (2002). The role of beauty, color, light, and nature in the healing process. *Clinical Nurse Specialist*, 16(4), 221-222.



CANADIAN NURSES ASSOCIATION
ASSOCIATION DES INFIRMIÈRES ET INFIRMIERS DU CANADA