

## Greening Healthcare: Ideas for Your Campus

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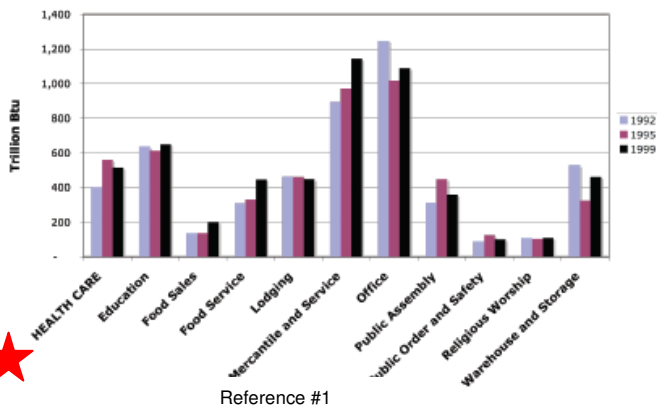
### Greener Buildings Mitigate Global Warming and Promote Health

#### Issue:

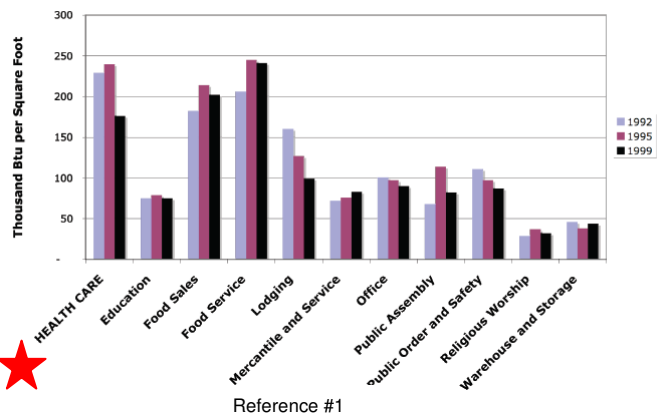
The built environment is both consumptive and polluting, as buildings account for approximately 40% of both energy use and atmospheric emissions in the United States. Hospitals are among the most resource intensive type of buildings. More than \$16 billion is spent on construction efforts each year by the healthcare industry, and this amount is expected to increase to \$20 billion by 2010.<sup>1</sup> Many concepts of green and healthy design are applicable to existing and new hospitals, and can help mitigate climate change through reducing energy use and improving the health of patients and staff through less toxic materials and better design.

- **Greener buildings promote environmental sustainability and decrease atmospheric emissions that contribute to global warming.**
  - Currently, the healthcare sector is one of the most consumptive and energy-intensive built environments (refer to graphs below).
  - There is a need for hospitals to reduce energy consumption in order to reduce greenhouse gas emissions. **Energy efficiency is the best method to reduce the “carbon footprint” of a building.**<sup>2</sup>
  - Green buildings use ~30% less energy, produce less waste, and use less water.<sup>3</sup>

Total Energy Use per Sector



Energy Use per Square Foot



- **Greener buildings promote the health of patients and staff.**
  - Studies of the relationship between worker comfort/productivity and building design/operation found significantly reduced illness symptoms, reduced absenteeism and increases in perceived productivity from workers in buildings with “smart design” features.<sup>3</sup>
  - Attributes of healthy work environment include: better lighting (including more daylight), temperature regulation, adequate ventilation, and better building material source controls.<sup>3</sup>
  - The concentration of pollutants indoors are generally 10 to 100 times higher than outdoor levels.<sup>3</sup> Green design would reduce exposure of harmful pollutants such as volatile organic compounds (VOCs).

- **Greener buildings make business sense and save hospitals money.**
  - Energy efficient buildings save money due to: reduced energy purchases and decreased peak energy demand, increased worker productivity, and lower operations and maintenance costs.<sup>3</sup>
  - Buildings constructed to Leadership in Energy and Environmental Design (LEED) standards can save more than 250% of its up-front costs over the course of its 40-year useable life cycle.<sup>4</sup>
  - According to the Energystar® website: “Healthcare organizations spend over \$8.3 billion on energy each year to meet patient needs. Every dollar a nonprofit healthcare organization saves on energy is equivalent to generating new revenues of \$20 for hospitals or \$10 for medical offices. Just a 5 percent reduction in energy costs in for-profit hospitals, medical offices, and nursing homes can boost earnings a penny per share.”<sup>5</sup>

### Ideas for your campus:

- Establish a “Green Building Task Force” on campus to learn more about green building issues:
  - Engage a broad range of people—students, faculty, nurses, physicians, maintenance workers, and administrators.
  - Develop a list of campus-specific goals to improve energy efficiency and public health in existing buildings and proposed construction projects.
  - Meet with hospital administrators and facility managers to discuss the principles of green buildings. If it’s just you don’t be afraid to ask for a meeting with the campus architect!
  - Develop a plan for reasonable implementation in your facility and for new construction projects. The Green Guide for Healthcare is a useful resource: [www.gghc.org/](http://www.gghc.org/)
- Conduct an energy audit at your institution. Use this website to get started: [www.energystar.gov/index.cfm?c=assess\\_performance.assess\\_performance\\_index](http://www.energystar.gov/index.cfm?c=assess_performance.assess_performance_index)
- Implement energy-saving and emission-reducing practices at your institution:
  - Switch to low energy lighting such as light emitting diodes (LEDs).
  - Install motion detector switching to darken un-used rooms.
  - Install local area and room air conditioners and thermostats.
  - Turn off computers overnight.
  - Purchase green energy. Call your energy provider and inquire about green energy options, or use this website: [www.green-e.org/base/re\\_products?cust=b](http://www.green-e.org/base/re_products?cust=b)
  - Invest in renewable energy sources. Local, state, and federal programs offer incentives for the use of renewable energy. The contacts within specific geographical areas may be found at: [www.dsireusa.org/](http://www.dsireusa.org/) and [www.solarelectricpower.org/index.php?page=utility](http://www.solarelectricpower.org/index.php?page=utility).
- Join the Campus Climate Challenge: <http://climatechallenge.org/>

### On-line resources

#### Green building:

Environmental Protection Agency [www.epa.gov/greenbuilding/](http://www.epa.gov/greenbuilding/)

The Green Guide for Healthcare [www.gghc.org/](http://www.gghc.org/)

Healthcare Without Harm [www.noharm.org/us/healthyBuilding/issue](http://www.noharm.org/us/healthyBuilding/issue)

Hospitals for a Healthy Environment <http://cms.h2e-online.org/ee/facilities/>

U.S. Green Building Council and LEED standards [www.usgbc.org](http://www.usgbc.org)

#### Energy Audits:

Energystar® for Healthcare [www.energystar.gov/index.cfm?c=healthcare.bus\\_healthcare](http://www.energystar.gov/index.cfm?c=healthcare.bus_healthcare)

EPA and Energystar® Facility Energy Management Guidelines

[www.energystar.gov/ia/business/guidelines/Facility\\_Energy\\_Assessment\\_Matrix.xls](http://www.energystar.gov/ia/business/guidelines/Facility_Energy_Assessment_Matrix.xls)

#### Personal carbon footprint:

Carbon Footprint™ [www.carbonfootprint.com/](http://www.carbonfootprint.com/)

Energystar® Home Energy Audit

[www.energystar.gov/index.cfm?c=home\\_improvement.hm\\_improvement\\_audits](http://www.energystar.gov/index.cfm?c=home_improvement.hm_improvement_audits)

An Inconvenient Truth [www.climatecrisis.net/takeaction/carboncalculator/](http://www.climatecrisis.net/takeaction/carboncalculator/)

#### Global Warming:

Intergovernmental Panel on Climate Change (IPCC) [www.ipcc.ch/](http://www.ipcc.ch/)

Medical Alliance to Stop Global Warming

[www.psr.org/site/PageServer?pagename=MedicalAlliance\\_to\\_StopGlobalWarming](http://www.psr.org/site/PageServer?pagename=MedicalAlliance_to_StopGlobalWarming)

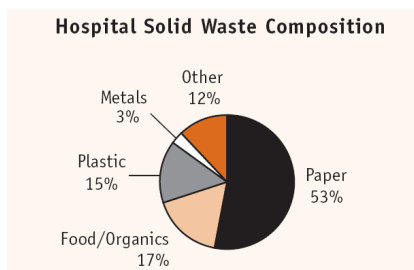
Physicians for Social Responsibility [www.psr.org](http://www.psr.org)

World Health Organization [www.who.int/globalchange/climate/en/](http://www.who.int/globalchange/climate/en/)

## Medical Waste, Incinerators, and Recycling

### Issue

American hospitals generate 20 million pounds of solid waste every year. A traditional method of disposal involves dumping all hospital waste into on-site incinerators, which burn the waste at a high temperature and release various pollutants into the air including mercury and dioxin.<sup>6</sup> However, most of waste generated in hospitals is non-hazardous solid waste such as paper and cardboard. Common waste reduction and recycling programs can be used to better manage this part of a hospital's waste stream. With hospital waste disposal costs ranging from \$44 to \$68 per ton, reducing waste volume and implementing recycling programs can also save money in the long run.<sup>7</sup>



Source: Healthcare Without Harm<sup>8</sup>

### Hospital Waste: Items to Recycle

Newspapers	Aluminum & Steel Cans	Glass	Magazines
Corrugated Boxes	Office Paper	Batteries	Plastics
Ink Cartridges	Xylene & Formalin (solvents)	Overhead Film	Fluorescent Lamps

Source: Health Care Without Harm<sup>9</sup>

Here are some important definitions regarding hospital waste:

**Regulated Medical Waste:** portion of the waste stream that may be contaminated by blood, body fluids or other potentially infectious materials, thus posing a significant risk of transmitting infection (it is also known as “biohazardous” waste or ‘infectious medical’ waste). It is regulated on a state level, and standards diverge widely. The Occupational Safety and Health Administration (OSHA) regulates some aspects of medical waste handling to protect worker health.<sup>10</sup>

**Hazardous Material:** certain raw materials or products, purchased from outside suppliers that are stored and used at a facility. Examples include pharmaceuticals, mercury, disinfectants, laboratory chemicals, and pesticides. OSHA, and its counterpart state agency, are responsible for developing and enforcing the rules for hazardous materials regarding worker health and safety. The Department of Transportation (DOT) sets rules to determine if a material is hazardous from a transportation safety standpoint.<sup>11</sup>

**Hazardous Waste:** materials generated at a facility that meet very specific criteria spelled out in the federal Resource Conservation and Recovery Act (RCRA). Regulations are developed and enforced by the Environmental Protection Agency (EPA), and by state and local environmental agencies.<sup>11</sup>

### Ideas for your campus

- Healthcare Without Harm recommends the following steps to improve medical waste disposal:
  1. Establish a Task Force with those involved in the waste process.
  2. Conduct a “Waste Audit” to determine the amounts and types of waste. A useful place to start: <http://cms.h2e-online.org/ee/waste-reduction/getting-started/assessments/>
  3. Establish a “Waste Segregation and Minimization” program. Some useful tips provided at: <http://cms.h2e-online.org/ee/waste-reduction/>
  4. Educate staff about separating and minimizing wastes.
  5. Establish a recycling program for glass, plastics, paper, cardboard, etc.
  6. Work with the purchasing team to create a more sustainable purchasing policy (reusable, recyclable, sustainable, healthy products).
- Work with community activists to help shut down a local medical incinerator. [www.noharm.org/us/tools/communitieswithincinerators](http://www.noharm.org/us/tools/communitieswithincinerators)

### On-line resources

California Integrated Waste Management Board [www.ciwmb.ca.gov/BIZWASTE/factsheets/hospital.htm](http://www.ciwmb.ca.gov/BIZWASTE/factsheets/hospital.htm)

Healthcare Without Harm [www.noharm.org/us/medicalwaste/issue](http://www.noharm.org/us/medicalwaste/issue)

Hospitals for a Healthy Environment <http://cms.h2e-online.org/ee/waste-reduction/>

## Electronic Waste

### Issue:

Electronic equipment is a fact of modern healthcare; but, disposal of electronics can be a risk to health and the environment. The average electronic product contains many chemicals such as chlorinated plastics, brominated flame retardants, and heavy metals—all linked to negative health effects. When disposed of improperly in landfills or incinerators, electronic products can release these toxins into the environment. An estimated 70% of heavy metal in landfills comes from discarded electronics.<sup>12</sup>

### Ideas for your campus:

- Meet with environmental and purchasing administrators at your institution and encourage the following:
  - Negotiate contracts that require products and practices to meet specific environmental criteria.
  - Extend the life of electronic equipment through upgrades and reuse.
  - Establish manufacturer take-back requirements for electronic equipment at the end of life.
  - Establish recycling programs with vendors who have signed the Electronic Recycler's Pledge of True Stewardship: [www.ban.org/pledge1.html](http://www.ban.org/pledge1.html)

### On-line resources:

Healthcare Without Harm [www.noharm.org/us/electronics/issue](http://www.noharm.org/us/electronics/issue)  
10 Step Guide—*Healthier Choices for Electronic Equipment: From Procurement to End-of-Life*  
[www.noharm.org/details.cfm?ID=895&type=document](http://www.noharm.org/details.cfm?ID=895&type=document)

## Cleaning Products and Pesticides

### Issue:

There are many products used inside hospitals, including pesticides and cleaning products, which can pose a health risk to patients. Many cleaning products contain chemicals called volatile organic compounds (VOCs). VOC's are also found in products such as paints, building materials and furnishings, and office equipment. The concentration of VOCs in indoor air is consistently up to 10x higher than concentrations in outdoor air, and inhalation accounts for more than 99% of exposure to many VOCs.<sup>13,14</sup> VOCs may have short- and long-term adverse health effects such as eye, nose, and throat irritation; headaches, loss of coordination, nausea; damage to liver, kidney, and central nervous system.<sup>13</sup> VOCs may induce acute asthma attacks in sensitive individuals, due to nonspecific irritation of the airways. A common VOC, formaldehyde, has been linked to upper respiratory tract irritation, and also to asthma exacerbation in infants and children, and is classified as a probable human carcinogen.<sup>14,15</sup> Pesticides are also used extensively throughout hospitals. A national survey of hospitals found that 100% of the responding institutions used chemical pesticide products, with 91% using them indoors. Further, 36% of the hospitals used a pesticide that is no longer registered by the EPA, and 18% use products with an active ingredient being phased out by the EPA due to unacceptable health risks.<sup>16</sup> Common pesticides used in hospitals include organophosphates (OP), pyrethrin/pyrethroids, and carbamates—all of which have been linked to neurological and respiratory health effects.<sup>14,17</sup>

### Ideas for your campus:

- Encourage the hospital to implement a cost-effective Integrated Pest Management (IPM) program for pesticide use, and encourage the use of "least toxic" pesticides. For more information on IPM: <http://cms.h2e-online.org/ee/hazmat/hazmatconcern/pesticides/>
- Encourage your hospital to contact their vendors and express a preference for cleaning products that do not contain volatile organic compounds, or other toxic chemicals. Refer to this INFORM report for more detailed information and healthy alternative products: [www.informinc.org/reportpdfs/chp/CleaningForHealth.pdf](http://www.informinc.org/reportpdfs/chp/CleaningForHealth.pdf)

### On-line resources:

Beyond Pesticides' Healthy Hospitals Report [www.noharm.org/details.cfm?ID=864&type=document](http://www.noharm.org/details.cfm?ID=864&type=document)  
Healthcare Without Harm [www.noharm.org/us/pesticidesCleaners/issue](http://www.noharm.org/us/pesticidesCleaners/issue)  
New York State Report on Pesticide Use in Hospitals [www.oag.state.ny.us/environment/hospital95.html](http://www.oag.state.ny.us/environment/hospital95.html)  
Pesticide Action Network [www.panna.org](http://www.panna.org)

## Mercury Free Healthcare

### Issue:

Mercury is a heavy metal found in various products, and is an environmental contaminant and human health threat. In the healthcare industry, mercury is found in devices such as blood pressure cuffs, thermometers, and esophageal dilators. Hospitals must dispose of mercury-containing waste, meet water discharge standards for mercury, and also deal with mercury spills. **Medical waste incinerators are the 4<sup>th</sup> largest producer of mercury emissions in the United States.** In addition, mercury-containing products disposed in landfill can contaminate the environment.<sup>18</sup> Mercury released into the environment can deposit into water, get converted into organic methyl mercury by bacteria, and bioaccumulate in the food chain (especially in fish).<sup>19</sup> This is an important environmental health issue because mercury is a neurodevelopmental toxin and a reproductive toxin. Children, pregnant women, and women of childbearing age are at particular risk. It is estimated that between 300,000 and 650,000 American children each year have cord blood mercury levels high enough to cause loss of IQ. This loss of intelligence and associated loss in economic productivity persist throughout the lives of children exposed to mercury.<sup>20</sup>

### Ideas for your campus:

- Contact local representatives of Health Care Without Harm or Hospitals for a Healthy Environment and get involved with local efforts.
- Educate students, faculty, staff, and hospital employees about uses of mercury and health effects.
- Distribute information to patients about healthy fish consumption. Check local Fish Consumption Advisories for mercury. Physicians for Social Responsibility has excellent patient and physician fish consumption guides: [www.mercuryaction.org/fish/](http://www.mercuryaction.org/fish/)
- Conduct a mercury audit at your institution to determine which products contain mercury. Identify specific items at your hospital that are reasonable targets for a phase-out, and engage the administration in developing a plan and timetable. Use Section 5A and 5B of this document to help you get started: [www.h2e-online.org/pubs/selfasmt.pdf](http://www.h2e-online.org/pubs/selfasmt.pdf)
- Talk to your dean about the creation of a mercury-free purchasing policy. For a sample policy: [www.noharm.org/details.cfm?ID=748&type=document](http://www.noharm.org/details.cfm?ID=748&type=document). For a list of mercury free medical devices: [www.sustainablehospitals.org](http://www.sustainablehospitals.org)
- Organize a mercury thermometer exchange. To get started, read this helpful guide: [www.noharm.org/library/docs/Going\\_Green\\_How\\_to\\_Hold\\_a\\_Mercury\\_Thermometer\\_.pdf](http://www.noharm.org/library/docs/Going_Green_How_to_Hold_a_Mercury_Thermometer_.pdf)
- Apply for a Making Medicine Mercury Free (MMMf) award: a one-time award given to facilities that have made the significant and noteworthy step of becoming virtually "mercury free." For more information and an application: <http://cms.h2e-online.org/awards/apply/#mmmf>

### On-line Resources:

American Academy of Pediatrics Policy Statement on Mercury:

<http://aappolicy.aappublications.org/cgi/content/full/pediatrics;108/1/197>

Health Care Without Harm: [www.noharm.org/us/mercury/issue](http://www.noharm.org/us/mercury/issue)

Hospitals for a Healthy Environment: [www.h2e-online.org/index.cfm](http://www.h2e-online.org/index.cfm)

Mercury Free Healthcare: [www.mercuryfreehealthcare.org/](http://www.mercuryfreehealthcare.org/)

NIH Mercury Free Campaign: [http://nems.nih.gov/outreach/mad\\_hatter.cfm?tab=hatter](http://nems.nih.gov/outreach/mad_hatter.cfm?tab=hatter)

## **Brominated Flame Retardants**

### **Issue:**

Brominated flame retardants (BFR) are added to many plastic, foam, and fabric products to prevent fires. The most common BFRs are Polybrominated Diphenyl Ethers (PBDEs). Common hospital products that contain PBDEs include furniture cushions, curtains, electronic equipment (televisions, pulse oximeters, ventilators, monitors), and computers.<sup>21</sup> PBDEs are persistent environmental pollutants and bioaccumulate in the food chain. Humans are exposed to PBDE's through consumption of contaminated food (fish, meats, dairy) because the chemical accumulates in fatty tissues. Exposure can also occur through ingestion or inhalation of contaminated dust, because the chemicals are released from the products over time.<sup>22,23</sup> In addition, exposure can occur through the placenta or breast milk.<sup>24</sup> Although human health effects have not been studied extensively, animal studies associated PBDE exposure with adverse brain development, cancer, endocrine disruption, and immune suppression.<sup>24</sup> Recent testing of PBDE levels in Americans have reported levels 10-100 times higher than levels found in Europeans.<sup>22</sup>

### **Ideas for your campus:**

- Encourage the hospital to purchase products with no halogenated flame retardants, but still meet flame retardancy standards.
- Encourage your hospital to require disclosure of the name and CAS number (the chemical abstracts service registry number) of all added flame retardants used in the products purchased.
- Encourage your hospital to contact their vendors and express a preference for products that do not contain toxic, persistent, bioaccumulative toxicants.

### **On-line resources:**

Brominated Flame Retardants: Rising Levels of Concern [www.noharm.org/details.cfm?ID=1095&type=document](http://www.noharm.org/details.cfm?ID=1095&type=document)  
Health Care Without Harm: [www.noharm.org/us/bfr/issue](http://www.noharm.org/us/bfr/issue)

## **Polyvinylchloride (PVC)**

### **Issue:**

Polyvinylchloride (PVC) is used to make many plastic products found in hospitals including IV bags and tubing, disposable gloves, pipes, flooring, plastic wrap, and furniture. PVC differs from other types of plastic because its production requires chlorine, metallic heat stabilizers, and plasticizers. These additives make PVC a particularly dangerous product throughout its entire lifecycle.<sup>25</sup> During PVC production, vinyl chloride and dioxin are released. Vinyl chloride is a known human carcinogen, and exposure has been linked to liver changes, nerve damage, and immune dysfunction.<sup>26</sup> Dioxin compounds are linked to chloracne (skin lesion), liver damage, nerve damage, and several cancers.<sup>27</sup> During the use and disposal of PVC, plasticizers (such as di-2-ethylhexylphthalate-DHEP) and metals (such as lead) can leach out. According to the FDA, some patients can be exposed to high levels of DHEP through medical procedures. Plasticizers have been linked to adverse development of the male reproductive system and reduced production of normal sperm in animal studies.<sup>28</sup>

### **Ideas for your campus:**

- Establish an institution-wide PVC reduction policy
- Perform an audit to identify PVC medical devices and building materials. Healthcare Without Harm has useful guidelines: [www.noharm.org/details.cfm?type=document&id=741](http://www.noharm.org/details.cfm?type=document&id=741)
- Identify PVC-free alternatives for medical devices and building materials that can be used at your institution. HealthCare Without Harm provides several documents about alternatives: [www.noharm.org/us/pvcDehp/pvcFree](http://www.noharm.org/us/pvcDehp/pvcFree). Sustainable Hospitals has a PVC alternative database: [www.noharm.org/details.cfm?type=document&id=741](http://www.noharm.org/details.cfm?type=document&id=741)

### **On-line resources:**

Health Care Without Harm: [www.noharm.org/us/pvcDehp/issue](http://www.noharm.org/us/pvcDehp/issue)

## Healthy Food at Hospitals

### Issue:

The average hospital in the United States serves more than 1 million meals per year. In 2001, hospitals spent \$5 billion on food services.<sup>29</sup> The following are some of the important food issues that should be addressed by hospitals in order to promote healthy and sustainable food consumption:

- **Fast food:** A study done with the American Medical Student Association (AMSA) found that 42% of hospitals surveyed sold fast food on campus.<sup>30</sup> Fast food is not a healthy option for patients. Adults and children who eat fast food consume more calories, fat, saturated fat and sodium, and less vitamin A, vitamin C, milk, fruits or vegetables than those who do not.<sup>31</sup>
- **Antibiotic Resistance:** Most of the antibiotics used in the United States are not used to treat humans. Most antibiotics are instead used as food additives in poultry, swine, and beef cattle. Half of these antibiotics are in classes used to treat human diseases, contributing to antibiotic resistance in bacteria.<sup>32</sup> Antibiotic resistance is a critical problem in today's hospitals, as 70% of hospital-acquired bacterial infections are resistant to at least one of the common drug treatments.<sup>33</sup>
- **Pesticide Residues:** Widespread agricultural use of pesticides on crops results in exposures to agricultural workers, rural communities, and farmers and causes widespread ground and water contamination. Pesticide residues left on produce may expose consumers. Pesticides have been linked to a variety of health impacts including neurological impairment, birth defects, impaired reproduction and cancer.<sup>34</sup>
- **Recombinant Bovine Growth Hormone (rBGH):** This is a synthetic hormone given to cows to increase milk production, and it has been linked to various health effects in animals. Recent evidence suggests a link with human health effects.<sup>35</sup>
- **Our Changing Food System:** In the United States, the typical food item travels from 1,500 to 2,400 miles from source to plate, resulting in enormous use of fossil fuels for transportation. And, while farm total acreage has decreased in the United States, individual farm size has increased and is more likely to produce a single crop or animal, contributing to the decline in production of diverse food crops.<sup>36</sup>

### Ideas for your campus:

- Contract with food distributors, food providers, or group purchasing organization (GPO) that support healthy food.
- Implement purchasing policies for:
  - Organic food to limit pesticide exposure.
  - Meat and poultry from animals that were raised without antibiotics.
  - Milk without recombinant bovine growth hormone.
  - Local products. This will reduce energy used for transportation, reduce packaging waste, and also support the local economy.
- Have a "good food" lunch to raise money and awareness.
- Get rid of fast food and soda on campus!
- Have healthy foods available for meetings and conferences at your institution.
- Phase out the use of trans-fats. AMSA has published a booklet on how to accomplish this: [www.amsa.org/cph/RemovingTransFats.doc](http://www.amsa.org/cph/RemovingTransFats.doc)
- Campaign for healthier foods in vending machines.
- Organize a local farmers market at or near the hospital.
- Implement an overarching healthy foods policy. For an example, refer to the City and County of San Francisco Department of Public Health Sustainable Food Policy (for all County Hospitals) [www.noharm.org/details.cfm?ID=1609&type=document](http://www.noharm.org/details.cfm?ID=1609&type=document)
- Car pool to the local farmer's market to buy groceries.
- Join a local food co-op.

### On-line Resources:

Healthcare Without Harm [www.noharm.org/us/food/issue](http://www.noharm.org/us/food/issue)

Healthy Food, Healthy Hospitals, Healthy Communities [www.healthobservatory.org/library.cfm?refid=72927](http://www.healthobservatory.org/library.cfm?refid=72927)

## References

- 1 - Healthcare Without Harm and Rocky Mountain Institute. 2003. Design for Health: Summit for Massachusetts Health Care Decision Makers. [www.noharm.org/details.cfm?ID=1120&type=document](http://www.noharm.org/details.cfm?ID=1120&type=document)
- 2 - Energystar®. Did you know? [www.energystar.gov/index.cfm?c=learn\\_more.did\\_you\\_know](http://www.energystar.gov/index.cfm?c=learn_more.did_you_know); accessed August 5, 2007.
- 3 - Kats, G. 2003. Green Building Financial Costs and Benefits. *Capital E*; <http://www.cap-e.com/ewebeditpro/items/O59F3481.pdf>
- 4 - von Paumgarten, Paul. 2003. The Business Case for High Performance Green Buildings: Sustainability and its Financial Impact. *Journal of Facilities Management*; 2(1); 26-34.
- 5 - Energystar®. Energystar for Health Care. [www.energystar.gov/index.cfm?c=healthcare.bus\\_healthcare](http://www.energystar.gov/index.cfm?c=healthcare.bus_healthcare); accessed August 3, 2007.
- 6 - Healthcare Without Harm. 2002. What's Wrong with Incineration? [www.noharm.org/library/docs/Going\\_Green\\_3-2\\_Whats\\_Wrong\\_with\\_Incineration.pdf](http://www.noharm.org/library/docs/Going_Green_3-2_Whats_Wrong_with_Incineration.pdf)
- 7 - Hospitals for a Healthy Environment. Waste Reduction. <http://cms.h2e-online.org/ee/waste-reduction/>; accessed July 29, 2007.
- 8 - Healthcare Without Harm. 2001. Waste Minimization, Segregation and Recycling in Hospitals. [www.noharm.org/library/docs/Going\\_Green\\_4-1\\_Waste\\_Minimization\\_Segregation.pdf](http://www.noharm.org/library/docs/Going_Green_4-1_Waste_Minimization_Segregation.pdf)
- 9 - Healthcare Without Harm. 2001. Recycling Fact Sheet. [www.noharm.org/library/docs/Going\\_Green\\_4-6\\_Recycling\\_Fact\\_Sheet.pdf](http://www.noharm.org/library/docs/Going_Green_4-6_Recycling_Fact_Sheet.pdf)
- 10 - Hospitals for a Healthy Environment. Regulated Medical Waste-Overview. <http://cms.h2e-online.org/ee/rmw/>; accessed July 29, 2007.
- 11 - Hospitals for a Healthy Environment. Hazardous Materials-Overview. <http://cms.h2e-online.org/ee/hazmat/>; accessed July 29, 2007.
- 12 - Healthcare Without Harm. 2004. Environmentally Preferable Procurement Guidelines for Information Technology (IT) Equipment in Health Care Part I: The Issue. [www.noharm.org/details.cfm?ID=877&type=document](http://www.noharm.org/details.cfm?ID=877&type=document)
- 13 - United States Environmental Protection Agency (EPA). 2007. Introduction to Indoor Air Quality: Organic Gases. <http://www.epa.gov/iaq/voc.html>; accessed July 24, 2007.
- 14 - American Academy of Pediatrics (AAP). Pediatric Environmental Health - 2nd Edition, 2003.
- 15 - Environmental Protection Agency (EPA). Indoor Air Pollution- An Introduction for Health Professionals. [www.epa.gov/iaq/pubs/hpguide.html#VOCs](http://www.epa.gov/iaq/pubs/hpguide.html#VOCs); accessed July 29, 2007.
- 16 - Healthy Hospitals: Controlling Pests Without Harmful Pesticides. A Report by Beyond Pesticides and Healthcare Without Harm. <http://www.noharm.org/details.cfm?ID=864&type=document>
- 17 - Hoppin, J., D.M. Umbach, S.J. London, M.C.R. Alavanja, and D.P. Sandler. 2002. Chemical Predictors of Wheeze among Farmer Pesticide Applicators in the Agricultural Health Study. *American Journal of Respiratory and Critical Care Medicine*; 165:683–689.
- 18 - Healthcare Without Harm. 2002. Making Medicine Mercury-Free A Resource Guide for Mercury-Free Medicine. [www.noharm.org/library/docs/Going\\_Green\\_Making\\_Medicine\\_Mercury\\_Free.pdf](http://www.noharm.org/library/docs/Going_Green_Making_Medicine_Mercury_Free.pdf)
- 19 - Greater Boston Physicians for Social Responsibility (GBPSR). In Harm's Way: Toxic Threats to Child Development. May, 2000.
- 20 - Trasande, L. P. Landrigan, and C. Schechter, 2005. Public Health and Economic Consequences of Methyl Mercury Toxicity to the Developing Brain. *Environmental Health Perspectives*, 113:590–596.
- 21 - Healthcare Without Harm. 2006. What Health Care Purchasers Can Do to Reduce Flame Retardants. [www.noharm.org/details.cfm?ID=1108&type=document](http://www.noharm.org/details.cfm?ID=1108&type=document)
- 22 - Schechter, A., M. Pavuk, O.Papke, J.J. Ryan, L. Birnbaum, and R. Rosen. 2003. Polybrominated Diphenyl Ethers (PBDEs) in U.S. Mothers' Milk. *Environmental Health Perspectives*; 111:1723–1729.
- 23 - Jones-Otazo, H., J. Clarke, M. Diamond, J. Archbold, G. Ferguson, T. Harner, G. Richardson, J.J. Ryan, and B. Wilford. 2005. Is House Dust the Missing Exposure Pathway for PBDEs? An Analysis of the Urban Fate and Human Exposure to PBDEs. *Environmental Science & Technology*; 39: 5121-5130.
- 24 - Agency for Toxic Substances & Disease Registry (ATSDR). 2004. Public Health Statement for PBDEs. <http://www.atsdr.cdc.gov/toxprofiles/phs68-pbde.html#bookmark06>
- 25 - Healthcare Without Harm. 2006. Why Health Care is Moving Away from the Hazardous Plastic Polyvinyl Chloride (PVC). [www.noharm.org/details.cfm?ID=1277&type=document](http://www.noharm.org/details.cfm?ID=1277&type=document)
- 26 - Agency for Toxic Substances & Disease Registry (ATSDR). 2006. Public Health Statement for Vinyl Chloride. [www.atsdr.cdc.gov/toxprofiles/phs20.html](http://www.atsdr.cdc.gov/toxprofiles/phs20.html)
- 27 - Agency for Toxic Substances & Disease Registry (ATSDR). 2006. Chemical Agent Briefing Sheet: Dioxins. [www.atsdr.cdc.gov/cabs/dioxins/index.html](http://www.atsdr.cdc.gov/cabs/dioxins/index.html)
- 28 - Food and Drug Administration (FDA). 2002. FDA Public Health Notification: PVC Devices Containing the Plasticizer DEHP. <http://www.fda.gov/cdrh/safety/dehp.html>
- 29 - Institute for Agriculture and Trade Policy. 2005. Healthy Food, Healthy Hospitals, Healthy Communities. [www.healthobservatory.org/library.cfm?refid=72927](http://www.healthobservatory.org/library.cfm?refid=72927)
- 30 - Lesser, L. 2006. Prevalence and Type of Brand Name Fast Food at Academic-affiliated Hospitals. *Journal of the American Board of Family Medicine*; 19:526-527.
- 31 - Paeratakul, S., D.P. Ferdinand, C.M. Champagne, D.H. Ryan, and G.A. Bray. 2003. Fast-food consumption among US adults and children: Dietary and nutrient intake profile. *J Am Dietetic Assoc*; 103(10):1332-8.
- 32 - Healthcare Without Harm. 2005. Antibiotic Resistance and Agricultural Overuse of Antibiotics What Health Care Food Systems Can Do. [www.noharm.org/details.cfm?ID=938&type=document](http://www.noharm.org/details.cfm?ID=938&type=document)
- 33 - Centers for Disease Control and Prevention. Campaign to Prevent Antimicrobial Resistance in Healthcare Settings [www.cdc.gov/drugresistance/healthcare/problem.htm](http://www.cdc.gov/drugresistance/healthcare/problem.htm); accessed July 30, 2007.
- 34 - Healthcare Without Harm. 2007. Healthy Food in Health Care: A Menu of Options. [www.noharm.org/details.cfm?ID=1133&type=document](http://www.noharm.org/details.cfm?ID=1133&type=document)
- 35 - Healthcare Without Harm. Position Statement of rGBH. [www.noharm.org/details.cfm?ID=1104&type=document](http://www.noharm.org/details.cfm?ID=1104&type=document)
- 36 - Healthcare Without Harm. 2006. Food and Food Purchasing: A Role for Health Care. [www.noharm.org/details.cfm?ID=1052&type=document](http://www.noharm.org/details.cfm?ID=1052&type=document)