

THE ECO-HEALTH FOOTPRINT GUIDE

Measuring Your Organization's Impact on Public Health and the Environment

(Version 1.2)

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About the Global Health and Safety Initiative

The Global Health and Safety Initiative (GHSI) is a sector-wide collaboration to transform the way that healthcare designs, builds and operates its facilities, the products used in healthcare and research and public policy that supports healthier and safer hospitals, communities and society.

GHSI aims to build a learning community and leverage the expertise of its partners to support evidence-based improvements at the intersection of patient safety, worker safety and environmental sustainability. www.globalhealthsafety.org.

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Foreword

The GHSI promotes best practice, collaboration and the harmonization of tools, resources, and methodologies to promote environmental, patient and worker safety in the health care sector. As part of this effort, healthcare organizations have undertaken footprinting both on their own and with the help of footprinting assistance providers. The GHSI aims to move the healthcare sector towards making Eco-Health Footprinting a standard sector practice.

The GHSI is currently working to further harmonize protocols for measuring the components of the Eco-Health Footprint. To date, the most recognized Eco-Health Footprint measurement standard addresses greenhouse gas (GHG) emissions, often using carbon dioxide as the proxy. Standards for energy and waste are also becoming harmonized within the healthcare sector. The GHSI and its Eco-Health Footprint Task Group have worked with Dartmouth-Hitchcock Medical Center to enhance and make their tool available as a standardized approach for the sector, reflecting current best practice in the field.

The GHSI recommends that health systems use the Dartmouth-Hitchcock Medical Center's tool to create a comprehensive footprint across seven categories. Additionally, the GHSI recommends the following tools for deeper analysis and tracking of waste and energy:

- Practice Greenhealth's **Greenhealth Tracker** (waste) and Energy Impact Calculator (energy) and
- EPA's **Portfolio Manager** (energy).

Information on these tools is provided below and in the **Additional Resources** section.

This *Guide* is one of several publications created by the GHSI to assist our industry in advancing safety, health and environmental stewardship. The GHSI also has several working groups and initiatives in place. We welcome your comments and participation in our shared mission.

The Eco-Health Footprint Guide:

Measuring your Organization's Impact on Public Health and the Environment

These days, it's hard not to notice a growing emphasis on the environment. In recent years, a series of new terminology – such as “green”, “sustainability”, “climate change” and “carbon footprint” – have become commonplace in the media, corporate communications and policy discussions.

Increased environmental stewardship by the healthcare sector aligns with its intrinsic mission to protect human health, and to the public's growing interest in knowing how all organizations are implementing their environmental commitments. In addition, increased environmental stewardship is linked to improved operational efficiency and fiscal responsibility, and can be integrated into existing continuous improvement processes. Thus, healthcare, like other sectors, is increasingly seeking ways to advance its environmental stewardship by greening its facilities, services, and the products that are used by its workers and patients.

A widely-used indicator of an organization's environmental stewardship is its footprint. For many, the idea of footprinting seems daunting, but it is an essential and valuable tool in managing resources and impacts. The Global Health and Safety Initiative (GHSI) has created this Guide to serve as a resource to help healthcare organizations get started with the process of collecting data and measuring their footprints. It is the GHSI's intent to establish a sector-endorsed common protocol and toolkit for Eco-Health Footprinting within healthcare.

This *Guide* is a basic introduction to the Eco-Health Footprint — a footprinting methodology customized for the healthcare sector that tailors existing standard methodologies and best practices. We provide the reader with key footprinting concepts, terminology and resources. We also highlight issues specific to the healthcare industry and cite leading examples of footprinting among healthcare institutions.

What is a footprint? What is the “Eco-Health Footprint”?

The Eco-Health Footprint represents an important construct through which the healthcare industry can measurably advance its environmental stewardship goals and address characteristics unique to the healthcare sector, such as:

- High energy use, estimated at more than twice the energy intensity of commercial office buildings (In fact, the healthcare industry has the second highest energy intensity of any building type in the U.S.¹),
- High water use (about 70% of hospital's total water use is for process water uses ²),
- Distinct operations resulting in a unique toxic profile compared to other building types, and
- A core mission to promote human health and well-being expressed through environmental stewardship.

You might be asking yourself: How would we go about the enormous task of substantially reducing our environmental impact at the facility, system, and industry levels? An important first step is to create an awareness of the scope of our impact by measuring it. A best practice for healthcare organization is to measure its “footprint”, which implies obtaining a calculation that describes a high-level view of an organization's environmental and health impacts.

¹ Energy Information Administration's Commercial Buildings Energy Consumption Survey (CBECS) Database

² Source: Robert Loranger, PE

These days, everybody’s talking about “footprinting”, but what does it really mean?

An Introduction to the Eco-Health Footprint

The Eco-Health Footprint, as conceived by the GHSI in collaboration with its partner organizations, is a methodology to measure the environmental and health impacts of healthcare. Healthcare organizations have undertaken footprinting both on their own and with the help of footprinting assistance providers. Additionally, governmental agencies and organizations, such as the GHSI, provide tools and resources to healthcare organizations seeking to footprint and improve overall environmental stewardship. The GHSI aims to move the healthcare sector towards making Eco-Health Footprinting a standardized sector practice as part of the GHSI’s mission to promote environmental and safety leadership, and provide resources for collaborative sectoral change.

The Eco-Health Footprint takes advantage of existing tools and best practices to measure the health care industry’s contribution to a number of environmental issues. Drawing from impact categories of other Ecological Footprint studies, the Eco-Health Footprint is structured to address the following impacts from the operations, built environment, transportation and supply chain associated with healthcare:

- Greenhouse gases including anesthetic and medical gases,
- Water including process and domestic (potable) and waste water,
- Waste (municipal solid waste, regulated medical waste, hazardous waste, electronic waste, construction & demolition waste, and recyclable waste,
- Toxic chemicals,
- Criteria air pollutants, and
- Built land.

The supply chain is an integral part of a healthcare facility’s overall Eco-Health Footprint. The boundaries of the Eco-Health Footprint should extend beyond your operations and buildings use: What you purchase and how your purchases are manufactured and delivered is a significant part of your Eco-Health Footprint.

We will describe the Eco-Health Footprint in further detail in the following section: **What makes up an “Eco-Health Footprint”?**

Two Approaches: Carbon Footprinting and Ecological Footprinting

All footprints — including carbon and ecological footprints — measure environmental impacts in relation to an identified baseline, such as tons or acres. A comprehensive footprint assessment takes into account environmental impacts from both the supply chain and operations.

Carbon Footprint

The term “carbon footprint” is somewhat of a misnomer in that it does not measure solely carbon dioxide. A carbon footprint instead measures the output of numerous greenhouse gases in relation to the global warming potential of carbon dioxide. Carbon dioxide is used as a baseline for the measurement of all greenhouse gases, because carbon dioxide is the most abundant greenhouse gas. However, other greenhouse gases, such as methane, are less abundant but actually have higher global warming potentials. Within carbon footprinting, the emissions of gases other than CO2 are translated into CO2 equivalents using global warming potentials:

Greenhouse Gas	Global Warming Potential ³
Carbon dioxide (CO2)	1
Methane (CH4)	21
Nitrous Oxide (N2O)	310
Hydrofluorocarbon (HFC) (used in mobile source air conditioning)	1300

Within carbon footprinting, the international standard for measuring relevant greenhouse gas outputs is in million metric tons of carbon dioxide equivalent (MMT_{CO2Eq}). The carbon footprint measures the amount in tons of the greenhouse gases that an organization produces directly and indirectly to support its activities and consumption.

Currently, there is a great deal of focus on carbon footprints given the current policy discussions on greenhouse gas reductions. However, carbon footprints (a measurement of tons) do not consider resource scarcity as directly as an ecological footprint (a measurement of acres) does. Organizations may choose to solely measure their carbon footprint, or nest their measurement of the carbon footprint within an overall ecological footprint.

Ecological Footprint

For organizations interested in measuring impacts beyond carbon emissions, “ecological footprinting” is widely recognized as a best practice. Initially conceived in 1994 by Mathis Wackernagel and William Rees of the University of British Columbia, an ecological footprint is essentially a resource measurement and management tool.

Wackernagel’s and Rees’ methodology uses the Earth’s bio-productive capacity as the basis for measurement. This represents the physical area required to produce the resources needed to support a population, measured in “global hectares”— a calculated global land equivalent that provides a common point of reference to an international user community.

An ecological footprint measures the amount of biologically productive land and water that it takes to meet the consumption demands of a human population and assimilate their wastes. Expressed in either global hectares or acres (the average biocapacity of any bioproductive areas on the planet), an ecological footprint can be used to link a person’s or a group’s practices with demands on the finite and known carrying capacity of the Earth.

Evenly divided, 6.6 global acres are estimated to be available for each person on the planet, though this does not account for the needs of other species. Humans are believed to have claimed the entire regenerative yield of the Earth by the mid-1980’s. Since then we have been in a state of continually expanding over-consumption, drawing down the planet’s natural capital. We are now demanding resources at a rate of 40 percent faster than the planet can produce them.¹

Healthcare institutions have particularly large ecological footprints. With greater awareness, footprinting should help us to manage our ecological assets more carefully, and inspire personal and collective actions in support of a world where people live healthful lives within the means of our one planet.

³ These estimates are from the Inter-Governmental Panel on Climate Change (IPCC)’s **Second Assessment Report** (1996). These are the values used internationally for reporting greenhouse gas (GHG) emissions to the United Nations. (EPA also uses them for the **Inventory of U.S. Greenhouse Gas Emissions and Sinks**). The IPCC has since published the **Third Assessment Report** (2001) and has updated GHG potential values.

Why should you measure your footprint?

Measuring an organization's footprint is a key component of sound environmental stewardship, operational management and fiscal responsibility.

Walk the Talk: Aligning Measurement with Mission

Footprinting allows your organization to “walk the talk” reflecting your commitment to community benefit by promoting and supporting a healthy environment. Associated benefits include:

- Positive, pro-active communications to patients, staff, visitors, community-based organizations and policymakers regarding your environmental stewardship,
- A building and facility operations conducive to attracting and retaining employees, patients, and capital (such as philanthropy), and
- An improved natural environment that enhances human health and well-being.

Dollars and Sense: What Gets Measured Gets Managed

The investment in measuring an organization's footprint can yield a *quick return on the financial investment*. This is because footprinting reveals many simple ways to dramatically reduce costs—the *low hanging fruit*—and enhance your organization's reputation. Identifying the most significant contributors to your carbon footprint, for example, can reveal solutions that yield significant, short-term paybacks. For example, following the 2004 release of the United Kingdom's **National Health Service** (NHS) Ecological Footprint, NHS prioritized the following actions:

- Improve energy performance,
- Reduce waste, and
- Locate facilities to reduce staff, patient and visitor travel⁴.

Rosie Hospital, part of the NHS Foundation Trust, implemented an energy awareness program that communicated messages such as “12 lights left on for an hour could power an ultrasound machine for 60 minutes”. The energy awareness program helped staff change their behavior and saved roughly \$15,000 in energy costs in the first year.

Cap and Trade: Getting Proactive On Carbon Regulations

Undertaking an Eco-Health Footprint will prepare your organization for anticipated regulations, particularly those pertaining to carbon emissions. To prepare for a potential federal cap-and-trade system, organizations will need to measure their footprint. Organizations that already footprint will be able to take advantage of voluntary and regional carbon markets and regional registries, potentially profiting financially from early action and market entry.

Who's measuring their footprint?

Several healthcare organizations have undertaken footprinting efforts to date; we describe a few prominent examples below.

⁴ *Sustainable Healthcare Architecture*, Robin Guenther and Gail Vittori, 2008.

Lions Gate Hospital

In 2001, **Lions Gate Hospital**, in Vancouver, British Columbia, was the first healthcare facility to have its ecological footprint measured. Lions Gate's ecological footprint was found to be nearly 720 times the size of its physical footprint in acres, the baseline chosen for this analysis, illustrating the magnitude of the healthcare industry's impacts. (To provide context, the entire city of Vancouver's footprint was 180 times its physical footprint in acres – one-fourth of Lions Gate's ecological impact.) Lions Gate measured the impacts of key product inputs, such as gloves, plastic bags, and diapers. Toxics (i.e., discarded and excreted medications) were not addressed. More information on Lions Gate Hospital's footprint can be found in the book **Sustainable Healthcare Architecture** and in the study “**The Ecological Footprint of Lions Gate Hospital**”.

United Kingdom's National Health Service (NHS)

The United Kingdom's **National Health Service** (NHS), the world's largest publicly-funded health service provider, conducted its first ecological footprint assessment in 2004. NHS measured its footprint among six categories: energy, products and waste, food, transportation, water and built land. NHS's ecological footprint was nearly 5 million global hectares. NHS's footprinting results and methodology are described in detail in their **Material Health report**. As a result of this study, the NHS procurement group developed 10 key action items to reduce their ecological footprint. Additionally, reflecting the UK's emphasis on lowering their country's carbon footprint, the Treasury allocated 100 million pounds over a three-year period to replace aging NHS mechanical equipment, improve efficiency and reduce carbon emissions. In September 2008, NHS released a report entitled “**NHS England Carbon Emissions: Carbon Footprinting Report**”. This report outlines NHS-England's carbon dioxide emissions with a focus on transportation, building energy use, and procurement. Other related **documents** can be found at the NHS **Sustainable Development Unit's** website.

Dartmouth-Hitchcock Medical Center

Dartmouth-Hitchcock Medical Center (DHMC), located in Lebanon, New Hampshire, used NHS's Material Health Report as a planning resource to begin the process of measuring its ecological footprint. They initially thought they could only measure two or three of NHS's seven categories but ended up measuring all seven. In the process, they created an Excel®-based tool to manage the data and perform calculations. To assist with their footprint, DHMC took advantage of diverse existing resources to develop a consistent methodology for assessing their unique footprint:

- For **water and built land**, they used the methodology outlined in NHS's *Material Health Report*.
- For **waste**, the U.S. Environmental Protection Agency's **Waste Reduction Model** (WARM) provided the conversion factors for most materials.
- For **products**, the **Economic Input-Output Life Cycle Assessment** (EIO-LCA) model developed by Carnegie Mellon University was found to be the most comprehensive source of product and process emissions information. (Medical product categories had to be extrapolated from many other manufacturing processes.)
- For **food**, they referred to a **Sustainable Food Consumption** study and used hectares per dollar to measure food impacts.
- For **converting carbon to energy land** in most categories (including energy consumption and transportation), they relied on the factor used in a **model** provided by EPA Victoria (Australia).

⁵Ibid.

DHMC currently reports that its ecological footprint is roughly 200 times its physical footprint. DHMC's footprint is divided into the following elements:

- Products (40%),
- Transportation (31%),
- Energy (22%),
- Food (6%),
- Built Land (0.5%),
- Waste (0.2%), and
- Water (0.1%).

London Health Sciences Center

London Health Sciences Center (LHSC), located in London, Ontario Canada, reports its **current footprint** and its efforts to reduce environmental burdens on its **Ecological Stewardship** website and through its **"Elements" newsletter**. LHSC currently reports that its ecological footprint is roughly 384 times its physical footprint. LHSC's footprint is divided into the following elements:

- Capital items* (35%),
- Utilities (31%),
- Prosthetics & implants (17%),
- Short-life materials & waste (11%),
- Staff and patient transport (6%) and
- Built land (0.1%).

* The term "capital items" typically refers to any equipment, land, buildings or improvements to land.

LHSC also measured each component of its waste stream and identified **several solutions** to reduce its waste footprint. These solutions include new construction, retrofit activities, staff engagement, avoidance and co-generation.

Kaiser Permanente

Kaiser Permanente, a group practice prepayment program serving the healthcare needs of more than 8.6 million members in nine states and the District of Columbia, calculated that its direct energy carbon footprint in 2005 was 314,066 global acres, which equated to 0.049 global acres per member or 0.21% of the U.S. per capita ecological footprint.

Other attempts at footprinting have expressed Kaiser Permanente's impacts in terms of CO₂ emissions (metric tons) and water (gallons). For CO₂ emissions, Kaiser Permanente has publicly reported its emissions through the California Climate Action Registry (**CCAR**) annually since 2005, and annually through the Climate Registry beginning in 2009. Thus far, Kaiser Permanente's GHG emissions inventories have focused on the organization's CO₂ emissions but its forthcoming 2008 inventory will measure emissions of all six Kyoto gases. Kaiser Permanente's past greenhouse gas emissions reports are publicly available at: <http://www.climateregistry.org/CARROT/public/reports.aspx>.

For water consumption, Kaiser Permanente calculated that between 2006 and 2008, its hospitals in California used an average of 107,143 gallons of water per bed per year, while the average other hospital in California consumed 135,222 gallons per bed per year and the average other hospital nationally utilized 182,699 gallons per bed per year.

Spectrum Health Hospitals

Spectrum Health Hospitals, located in Grand Rapids, Michigan, established 2007 as its baseline year from which water, energy and waste data will be benchmarked. Spectrum's two largest facilities (Butterworth and Blodgett Hospitals) used the following resources for benchmarking purposes and to help determine their footprint:

- For waste tracking, Spectrum Health utilized Excel® spreadsheets and the U.S. EPA's **WasteWise Program**
- For water and energy tracking, Spectrum Health utilizes Excel® spreadsheets and U.S. EPA's **Energy Star Portfolio Manager**

Spectrum Health is currently piloting a single stream recycle program at five of its facilities. The vendor also offers a web-based reporting tool with waste, water and energy tracking, benchmarking and electronic billing/reporting (EDI) capabilities.

Cleveland Clinic

Cleveland Clinic, located in Cleveland, Ohio, is a not-for-profit multi-specialty academic medical center that integrates clinical and hospital care with research and education. U.S. News & World Report consistently names Cleveland Clinic as one of the nation's best hospitals in its annual "America's Best Hospitals" survey. Approximately 1,800 full-time salaried physicians and researchers and a total of more than 37,000 employees at Cleveland Clinic and Cleveland Clinic Florida represent more than 100 medical specialties and subspecialties. In 2007, there were 3.5 million outpatient visits to Cleveland Clinic and 50,455 hospital admissions. Patients came for treatment from every state and from more than 80 countries.

Cleveland Clinic established its Office for a Healthy Environment (OHE) in 2007, which has the responsibility of documenting the environmental impact and improvements made. The OHE oversees a network of green teams throughout the enterprise, including a team at each of Cleveland Clinic's 10 Northeast Ohio hospitals.

- For **greenhouse gases**, Cleveland Clinic follows the **Climate Registry** protocol for Tier 1 and Tier 2 emissions. This tool is used enterprise-wide.
- For water and energy tracking, Cleveland Clinic utilizes excel spreadsheets and U.S. EPA's **Energy Star Portfolio Manager**. This tool is used enterprise-wide.
- To understand the results of its **local food procurement strategy**, Cleveland Clinic Main Campus tracks the percentage of food spent within 100 and 200 mile radii on a quarterly basis.
- For **waste tracking**, Cleveland Clinic used the first generation **Practice Greenhealth** waste tracking spreadsheet, and is developing a new web-based system in conjunction with Practice Greenhealth for release in 2009. This tool is used enterprise-wide, and tracks more than 40 waste streams at Cleveland Clinic's largest sites.
- To understand **the environmental impact of waste and waste reduction**, Cleveland Clinic Main Campus uses the U.S. Environmental Protection Agency's **Waste Reduction Model (WARM)**.

In support of its membership in the United Nations Global Compact, Cleveland Clinic has completed the first phase of a comprehensive Global Reporting Initiative (GRI) Sustainability Report, which uses the G3 indicators to provide consistent language and metrics for international participants around the triple bottom line of economy, ecology and equity, an accepted international definition of sustainable business practices.

What makes up an “Eco-Health Footprint”?

The Eco-Health Footprint consists of six major impact categories:

- Greenhouse gases including anesthetic and medical gases,
- Water including process and domestic (potable) and waste water,
- Waste (municipal solid waste, regulated medical waste, hazardous waste, electronic waste, construction & demolition waste, and recyclable waste),
- Toxic chemicals,
- Criteria air pollutants, and
- Built land.

Within each component, there are varied levels of consensus on how to measure the footprint. There is a concerted effort to standardize the concept of environmental footprinting so that interested parties can effectively compare and contrast organizations’ footprints. With this in mind, many of the specific components of a footprint are in development, while expert groups are actively collaborating to create global standards for measurement and reporting. The GHSI is currently working to further harmonize protocols for measuring the components of the Eco-Health Footprint.

Carbon (GHG) Footprint

According to the U.S. EPA, healthcare organizations **spend over \$8.3 billion annually on energy** to support their operations. As with all organizations, carbon emissions generally represent a significant component of a healthcare facility’s footprint. The term “carbon” is shorthand for carbon dioxide or CO₂. CO₂ is one of six internationally-recognized greenhouse gases. The other five are:

- Methane (CH₄),
- Nitrous oxide (N₂O),
- Hydrofluorocarbons (HFCs),
- Perfluorocarbons (PFCs) and
- Sulfur hexafluoride (SF₆)

Greenhouse gases are relevant to climate change because they trap heat in the atmosphere, similar to what happens in a greenhouse or in a car with its windows closed. In the context of footprinting, carbon and greenhouse gases (or GHGs) are often used interchangeably because CO₂ is the most prevalent greenhouse gas associated with human activity. In this Guide, we will often use the term “carbon” to address the issue of greenhouse gases.

There are three levels (or “scopes”) in which a carbon footprint is measured.

- **Scope 1:** All direct GHG emissions
- **Scope 2:** Indirect GHG emissions associated with energy consumption
- **Scope 3:** All other indirect GHG emissions

Scope 1 measures all GHG emissions from sources within an organization’s boundaries that it controls. For example, fuels used and emitted onsite from the machinery and equipment that you operate are Scope 1 emissions. Within healthcare, anesthetic and medical gases are Scope 1 emissions.

Scope 2 addresses activities that take place at your organization but are emitted by others. A key example of Scope 2 is emissions at a power plant for the energy that your organization is using

Scope 3 is a broad measurement of all indirect emissions. Scope 3 includes emissions generated to create and deliver the products in your supply chain (as addressed later in **Supply Chain Matters: What you purchase contributes to your footprint?**). Scope 3 also includes employee commuting and travel and the emissions from processing waste. Based on examples to date, the greatest source of greenhouse gas emissions comes from Scopes 2 and 3.

The most widely-used international greenhouse gas accounting tool is the **Greenhouse Gas Protocol** (GHG Protocol), which was developed by **The World Resources Institute** and the **World Business Council for Sustainable Development** (WRI/WBCSD).

If you are going to measure your carbon footprint in North America, **The Climate Registry** is a recommended path to take. The Climate Registry, an offshoot and sister organization of the **California Climate Action Registry** (CCAR), is now widely used across the United States, Canada and Mexico. The Climate Registry helps organizations to report in consistent, transparent and credible manner. The Climate Registry has also developed its General Reporting Protocols, which are posted online. The Climate Registry’s Protocols build upon the GHG Protocols and other preceding GHG measurement standards, including those from:

- **International Organization for Standardization** (ISO),
- **The California Climate Action Registry**, and
- **The U.S. Environmental Protection Agency**

Hospitals, such as **Kaiser Permanente** and **Catholic Healthcare West**, have **registered** with the California Climate Action Registry. A full list of hospitals who have registered with the national Climate Registry can be found online on its **“List of Members” page**. It’s worth noting that the Climate Registry requires third-party verification and is developing industry-specific protocols for carbon intensive industries, such as electrical utilities and oil and gas. They may at some point specifically address the healthcare sector.

Dartmouth-Hitchcock’s Footprint Calculator Tool measures energy use and has undergone industry-review and pilot testing by several healthcare organizations. The Dartmouth-Hitchcock Tool displays results in terms of acres (for ecological footprinting) and metric tons of carbon equivalents (for carbon footprinting).

In addition, the U.S. EPA’s **Portfolio Manager** offers an online tool that healthcare facilities across the United States are using to:

- Benchmark their energy performance,
- Track water usage,
- Compare to similar facilities in their region and nationally, and
- Track their progress in reducing emissions with the recent addition of emissions factors from the EPA’s **Emissions & Generation Resource Integrated Database** (eGRID)*.

* *These emissions factors align with the Greenhouse Gas Protocol referenced above.*

Once you begin measuring, reporting and managing your carbon footprint, it is advised to think in terms of equivalents, such as the homes that could be powered or railroad cars worth of coal that would be powered from your organization's carbon footprint. The use of carbon equivalents helps to define, communicate and implement reduction strategies. The U.S. EPA has a **Greenhouse Gas Equivalents Calculator** online.

Water Footprint

Water, including domestic, process and wastewater, is another significant Eco-Health footprint indicator. The unique water profile of the healthcare sector – particularly its high water use, high percentage use of process water, and potential for hospital-related qualitative concerns in wastewater (i.e., pharmaceuticals) – lends itself to a specialized form of water footprinting. Seventy percent of total water use in hospitals is process water⁶ (a stark contrast to commercial office buildings). **The Green Guide for Healthcare** and **LEED for Health Care** (the latter still under development) include credits reflecting hospitals' unique water use profile.

Several globally recognized organizations are currently developing standards for water footprinting which may guide the healthcare sector. For example, **The World Business Council for Sustainable Development** recently helped launch the **Water Footprint Network** to develop standards and tools for water footprinting. Another pioneering institution on water footprinting is the **UNESCO-IHE Institute for Water Education**. In addition, a number of Fortune 100 companies including Coca-Cola, Intel and Nestlé are actively measuring and reporting their water footprints. A December 2008 conference in San Francisco was dedicated to Corporate Water Footprinting and provided many presentations, including examples of companies that have completed a water footprint; these presentations are **publicly available**.

The key indicators in water footprinting are the volume of freshwater consumed, evaporated and polluted, along with wastewater as an output. Also, since water is a limited resource, the location and time of water use is factored into the calculation of the water footprint.

The Water Footprint Network is developing a **Corporate Water Footprinting** methodology, which is intended to be applicable to all organizations. Because of healthcare's unique water profile, a generic methodology (such as the Corporate Water Footprint) may benefit from some customization. This is a common theme that has been proposed for other footprinting tools comprising the GHSI Eco-Health Footprint Toolkit.

Like carbon, water footprinting measures both direct and indirect impacts. The Corporate Water Footprint uses a two-tiered approach:

- Operational Water Footprint (direct impacts) and
- Supply Chain Water Footprint (indirect impacts).

Reflecting the Eco-Health Footprint's holistic approach—tracking key impact categories through the life cycle—wastewater will be addressed in the Water Footprint category with an approach offered to reflect the specific quantitative and qualitative considerations relevant to the healthcare sector (methodology under development as of this writing).

⁶ Source: Robert Loranger, PE

As with the carbon footprint, impacts related to the supply chain can be larger than impacts from direct operations.

Both the operational and the supply chain water footprints are divided into three categories*:

- Blue Water Footprint (i.e., freshwater evaporated from surface and ground water),
- Green Water Footprint (i.e., freshwater evaporate from rainwater stored as soil moisture), and
- Grey Water Footprint (i.e., freshwater required to dilute polluted water to reach acceptable levels).

* *The Corporate Water Footprint Categories use freshwater as a baseline.*

Waste Footprint

While waste is a contributor to the carbon footprint*, waste should be measured and managed as a separate component. Why? First of all, waste is a key area where organizations can identify cost savings and improve environmental stewardship. The **U.S. EPA** and the **American Hospital Association** have established a **goal** to reduce by 50% percent the total waste volume in all hospitals by 2010. Secondly, waste in the healthcare industry (including regulated medical waste) is garnering increased attention among the media, mission-oriented organizations and industry organizations. Waste also offers significant opportunities for cost savings, as hospitals pay high costs for landfill, red bag and autoclaved waste that could be recycled and reduced by better management practices. With paper estimated to exceed 50% of total non-regulated waste based on a **study of 10 California-based hospitals**, there are opportunities to increase the percent that is recycled, thereby reducing the hospital's waste footprint.

* *Measurement of waste is addressed in Climate Action Registry's Protocol as a Scope 3 element*

Healthcare systems should categorize waste considering the following categories, aligned with the categories established in the Practice Greenhealth's Greenhealth Tracker tool*:

- Municipal Solid Waste (MSW)
- Regulated Medical Waste (RMW)
- Hazardous Waste,
- Electronic Waste
- Construction & Demolition Waste
- Recyclable Solid Waste

* *Launched in 2009, Greenhealth Tracker tool was developed by GHSI partner organization Practice Greenhealth and piloted by Cleveland Clinic.*

Waste is generally measured and managed within the "Reduce, Reuse, Recycle" framework.

- **Reduce:** Waste footprint is usually best minimized by reducing waste at the source. (A highly effective strategy is often the reduction of packaging materials.)
- **Reuse:** The second most effective strategy is to shift to reusable products (those that are durable as opposed to disposable) and to donate waste.
- **Recycle:** Recycling, while important, is usually the third most effective waste footprint reduction strategy.

The U.S. EPA and the American Hospital Association have established a goal to reduce by 50% percent the total waste volume in all hospitals by 2010.

Several tools and resources are available to healthcare facilities seeking to measure and reduce waste, which include the following:

- **The Green Guide for Health Care's** Operations Section,
- **Practice Greenhealth's Greenhealth Tracker** (measures, categorizes and calculates waste by type).
- U.S. EPA's **Waste Reduction Model (WARM)** (provide a spreadsheet and web-based calculator with a focus on impact to greenhouse gas emissions), and
- U.S. EPA's Waste Wise Program.

Toxics Footprint

The healthcare industry is committed to avoiding toxic chemicals as part of the 1998 **Memorandum of Understanding** with the U.S. EPA and **American Hospital Association**. A great deal of progress is currently underway, with a significant focus and success on the virtual elimination of mercury. While the inclusion of toxic chemicals in the context of footprinting is still in development, it is important to identify this impact category as it has historic relevance to the healthcare industry and has direct consequences on human health. Because toxic chemicals hold relevance to several footprint indicators, including criteria air pollutants and waste, this section is focused more specifically on the supply chain of materials and products that an organization purchases.

The 1998 EPA-AHA Memorandum established several activities for the health care industry to undertake. Included in the activities are:

- "Virtual elimination of mercury waste",
- "Chemical waste minimization", and
- Pollution prevention activities associated with PBT (persistent bio-accumulative and toxic) chemicals*.

** The U.S. EPA defines PBT chemicals as "...highly toxic, long-lasting substances that can build up in the food chain to levels that are harmful to human and ecosystem health. They are associated with a range of adverse human health effects, including effects on the nervous system, reproductive and developmental problems, cancer, and genetic impacts."*

While the healthcare industry has made significant strides towards the virtual elimination of mercury in its facilities, many healthcare systems have expressed interest in minimizing reliance on other toxic chemicals and materials of concern, including, but not limited to:

- Lead,
- Dioxins and furans,
- Phthalates,
- Bisphenol-A (BPA),
- Perfluorochemicals or "perc" (for example, used as fabric treatment),
- Halogenated flame retardants, and
- Volatile organic compounds (VOCs).

Some Group Purchasing Organizations (GPOs) have begun to identify products that contain some of these chemicals to enable purchasers to assess whether alternative products are available that conform to desired performance, health and safety attributes. Similarly, many manufacturers are substituting non-toxic and less toxic chemicals in their products in an effort to shift towards a safer product line.

GHSI's **Healthy Purchasing Workgroup**, made up primarily of healthcare systems and their GPOs, are developing **Environmentally Preferable Purchasing** specifications for common healthcare products containing chemicals of concern. The specifications will be accessible through a searchable database including examples of alternative products and their vendors.

The Built Environment Workgroup and Materials Sub-Committee of GHSI have developed **Fact Sheets** with information on health concerns and alternatives to address many common building materials of concern. Searchable databases of building materials developed by GHSI's partner organizations are included in the **Additional Resources** section of this document.

Criteria Air Pollutants (CAP) Footprint

The U.S. Environmental Protection Agency classifies six common air pollutants as criteria air pollutants, or CAPs. The Eco-Health Footprint includes these pollutants because of their effects on human health, including increased respiratory symptoms, heart and lung disease, and the potential for premature death. The six CAPs are:

- Ozone*,
- Particulate matter*,
- Carbon monoxide,
- Nitrogen dioxide,
- Sulfur dioxide, and
- Lead.

Emergency energy generators, commonly installed on hospital facilities and campuses to provide energy reliability, are a commonly a significant source of CAPs for healthcare. Many generators are powered with diesel fuel, a point source of CAP emissions.

* Of the six, the EPA considers *ground level ozone* and *particulate matter* to represent the highest risks. The EPA regulates these pollutants based on permissible exposure levels, reflecting human health-based or environmentally-based criteria.

Opportunities for healthcare organizations to reduce their CAP footprint include:

- Limiting transportation for staff, visitors and patients,
- Selecting goods and services that minimize CAP emissions associated with their manufacturing and transportation practices, and
- Managing energy stand-by generators (e.g., keeping testing to a minimum, using ultra-low sulfur diesel fuel, converting to biodiesel).

Built Land Footprint

The built land component of the “Eco-Health Footprint” pertains to a healthcare facility’s physical footprint, generally measured in acres. Reducing the built land component of an Eco-Health Footprint can lead to several benefits including:

- Lower direct costs associated with land acquisition, operations and maintenance,
- Closer proximity to patients and staff enabled by smaller size facilities,
- A more human-scale user experience, benefiting patients, staff and visitor well-being can be provided by smaller size facilities,
- Reduced parking-related land area of facilities when facilities are located near public transit, and/or accessible by pedestrians and cyclists, and
- Healthier transport from providing viable alternatives to single-occupant vehicles through other transit options (e.g., public transportation, walking, cycling).

The built land footprint can be affected by several factors including: population size, local land types and uses, bio-productivity, available area, and land use efficiency. While the greatest opportunity to reduce this component of your Eco-Health Footprint is in planning new construction, considering ways to build flexibility into existing facilities can sometimes offset the need for additions and renovations. The **GHSI Built Environment Workgroup** is working to address built land impacts and to provide guidance in these areas.

Supply Chain Matters: What you purchase contributes to your footprint

Your supply chain is a critical contributor to your Eco-Health Footprint. Your true footprint comes not only from your use of goods and services but also from their manufacture and delivery. In fact, your supply chain could yield a larger impact than your actual operational footprint. For example, **59% of NHS’s 2004 carbon footprint** came from procurement. Your supply chain or purchases are often referred to as “indirect impacts”.

Measuring all impacts from one’s supply chain is a very significant undertaking. Health care facilities have found it useful to use estimates and benchmarking to manage the measurement of these indirect impacts. For example, some facilities categorize their purchases and then benchmark their performance in comparison to aggregated data (i.e., the percentage of your food purchases with less than 100 food miles in comparison to national averages). **Dartmouth Hitchcock** divided their purchases into 25 categories and used the **Carnegie Mellon Economic Input-Output Life Cycle Assessment (EIO-LCA) Model**. The Carnegie Mellon Model calculates an estimation of the associated environmental impacts for each category based on the amount spent (i.e., the environmental impacts of one million dollars of pharmaceutical purchases). Another key concept for measuring indirect supply chain impacts is the “embedded energy” for products, which is the amount of energy required to source, extract, manufacture and deliver a product. Regardless of methodology used, health care organizations should be transparent when explaining how they are measuring environmental impacts from the supply chain.

Fortunately, the supply chain often presents the easiest and most significant opportunities for reducing your footprint. It is important to understand who your key suppliers are and to work with them.

Three common supply chains that feed the healthcare sector are the following:

- Information Technology,
- Pharmaceuticals, and
- Office Supplies.

Within these sectors, there is a significant amount of footprint measurement happening within some of the most well-known brands. Below are some examples which highlight the widespread practice of footprint measurement. Some of these examples may be customers that can serve as helpful partners as you begin to measure your footprint.

Information Technology: Information technology can be energy-intensive and may pose environmental hazards during its disposal. Fortunately, information technology is an area where organizations can identify easy ways to reduce their footprint. Leading IT firms, in addition to measuring their own footprint, provide services and resources to customers seeking to reduce their IT-related footprint. As an example, Hewlett-Packard has a **Carbon Footprint Calculator** for printing equipment to help organizations assess their printer fleet and compare individual products. Microsoft offers an **Assessment and Planning Toolkit**, a free **Edison** energy monitoring application and a Virtualization suite of services. Dell has Green IT, Virtualization services and a recycling **program** for customers. IBM offers a suite of footprint-related services and resources including a recent study on **Water Footprinting**.

Pharmaceuticals: Pharmaceuticals are a significant component of a healthcare facility’s footprint. For the UK’s NHS, pharmaceuticals were overwhelmingly the largest contributor to its carbon footprint associated with purchasing. NHS’s **2008 Carbon Emissions Report** noted that the location where pharmaceuticals were manufactured had a particularly strong impact on its overall footprint. NHS’s Purchasing and Supply Agency (PASA) is now working with pharmaceutical customers to understand and reduce their footprint from pharmaceuticals. Pharmaceutical suppliers can serve as valuable resources and partners to healthcare organizations seeking to measure and reduce their indirect footprints. For example, Merck has been publishing its environmental footprint for several years and provides a detailed analysis of its footprint **online**.

Office Supplies: Major office supply retailers are now measuring their own footprints and providing resources to customers. For example, Office Depot provides customers with a **Green Office Guide** that addresses a broad range of office supplies. Office Depot also posts its **“20 Ways to Go Green at Work”** recommendations to customers. **Office Max** has a “Your Carbon Footprint: Addressing It Is Good Business” brochure and customized services to help customers reduce their carbon footprint through their purchases. GHSI’s **Healthy Purchasing Workgroup** is developing a collective buying strategy to promote the purchase of 30% minimum post-consumer recycled content office paper.

GHSI’s Healthy Purchasing and other workgroups are working with GPOs and vendors to provide resources and market-based solutions to maximize the footprint reductions possible through Environmentally Preferable Purchasing (EPP) as outlined in the **GHSI EPP Guidance Document**.

Eco-Health Footprint Tools

The GHSI is currently working to further harmonize protocols for measuring the components of the Eco-Health Footprint. To date, the most recognized Eco-Health Footprint measurement standard addresses greenhouse gas (GHG) emissions, often using carbon dioxide as the proxy. Standards for energy and waste are also becoming harmonized within the healthcare sector. The GHSI and its Eco-Health Footprint Task Group have worked with Dartmouth-Hitchcock Medical Center to enhance and make their tool available as a standardized approach for the sector, reflecting current best practice in the field.

The GHSI recommends that health systems use the Dartmouth-Hitchcock Medical Center’s tool to create a comprehensive footprint across seven categories. Additionally, GHSI recommends the following tools for deeper analysis and tracking of waste and energy:

- Practice Greenhealth’s **Greenhealth Tracker** (waste) and Energy Impact Calculator (energy) and
- EPA’s **Portfolio Manager** (energy).

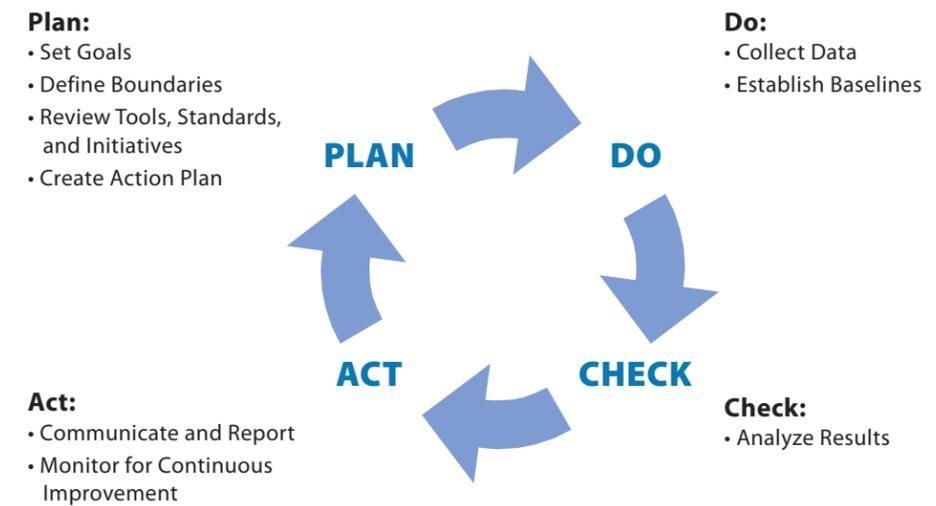
Information on these tools is provided below and in the **Additional Resources** section.

How to measure your Eco-Health Footprint: A “Step by Step” Approach

Now that you’ve been exposed to the basic footprinting concepts, you may be wondering “How do I get started?”

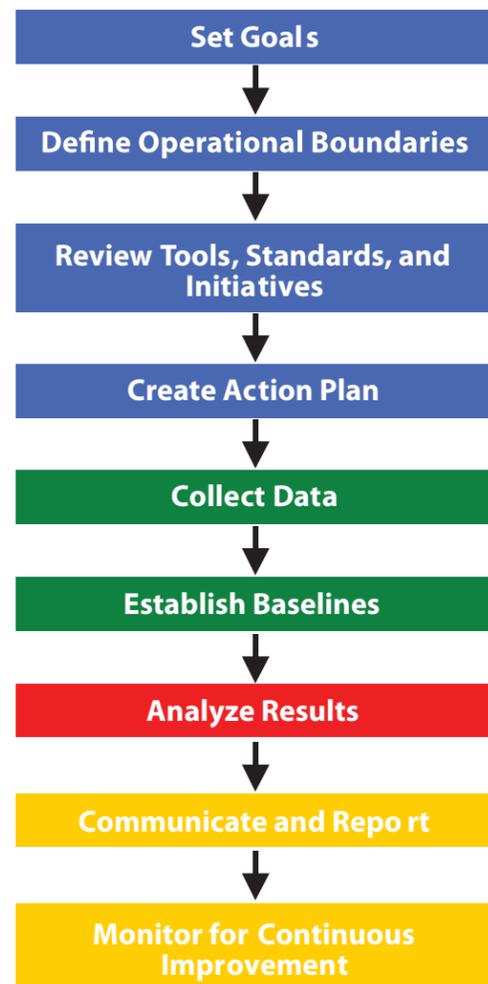
In this Section, we propose a “step by step” approach to measure your Eco-Health Footprint. You may find that a “one size fits all” approach to measuring your Eco-Health Footprint doesn’t quite work. The examples of **past footprinting efforts** by other healthcare organizations included in this Guide illuminate this point. Organizations should undertake their footprinting efforts in a manner that aligns to organizational structure, goals and capacity.

Footprinting should be the beginning of a process towards continuous improvement. You may have already “continuous improvement processes” in place, similar to the model below. We encourage you to apply your own processes and integrate footprinting in a streamlined manner.



Sample Steps to Footprinting

As you embark on footprinting, you can utilize the following steps (as identified in the Continuous Improvement Model above):



PLAN

1. Set Goals:

Define the goals of your footprinting exercise, which may include:

- Reducing carbon, water, waste, toxics, criteria air pollutants and built land impacts,
- Reducing costs,
- Promoting organizational change,
- Attracting talent or customers, and
- Enhancing reputation.

2. Define Operational Boundaries

The major decisions will include:

- Which parts of your organization or operations will be included? (E.g. Will your footprint solely focus on operations or will it extend to transportation and the supply chain? Which facilities will be tracked? You may not have the ability to separate data by specific building types.)
- Will you measure all five components of the Eco-Health Footprint?
- How will you measure each component of the Eco-Health Footprint?

In making these decisions, a good first step is to preliminarily identify your emissions sources and other key environmental and health impacts (i.e., key drivers of your Eco-Health Footprint).

At a minimum, GHSI recommends that healthcare organizations begin measuring greenhouse gas emissions with an emphasis on energy and waste. Hospitals often find significant environmental and cost savings in these two areas, and these areas have the most established tools and protocols.

Each component of the Eco-Health Footprint will require you to make a series of choices regarding boundaries. Using carbon footprinting as an example, while the GHG and Climate Registry Protocols provide guidance, an organization must make a series of choices when measuring its carbon footprint. These choices include the following:

- Do you report on Scope 3 emissions?
- Do you only report on carbon?
- Do you report on all six greenhouse gases?
- Do you report on greenhouse gases other than the six internationally-recognized greenhouse gases?
- Do you report only on operations that you can control?
- Do you also report on operations in which you have an equity share?
- What level of facility-based reporting will you do?

The Green Guide for Health Care has established the following goals for each component of the Eco-Health footprint: carbon neutral, water balanced, zero waste, and zero toxics. For built land, goals are focused on the scope and location of construction.

When making these choices, you should consider what is reasonable in light of your data collection capabilities and what is expected in the healthcare sector. For example, you may decide that your footprint should address the key issues that your peers are addressing and that your key stakeholders want you to address. Other factors may include the increase in cost and time associated with reporting and the type of data that senior management would like to see reported. You may find opportunities to lead the healthcare sector when conducting your footprint.

3. Review Tools, Standards, and Initiatives:

Several protocols, tools and initiatives are available related to the measurement of your Eco-Health Footprint. While the GHSI's mission is to harmonize these protocols, tools and initiatives for health care systems, your team will have to define and select the overall program internally for measurement. Our experience is that health care systems currently have the most established tools for energy and waste.

The GHSI recommends the Dartmouth-Hitchcock Medical Center's Footprint Calculator Tool to get a high level view of key elements of the Eco-Health Footprint from which communication, reporting and reduction opportunities can be identified. Other tools, such as the EPA Portfolio Manager for energy and Greenhealth Tracker for waste, are quite helpful to the management of environmental performance across multiple operations and provide deeper and more specific tools for these environmental impacts.

Decisions will include:

- Which protocols to use (i.e., WRI/WSBCD, The Climate Registry, etc.)?
- Which tools to use (i.e., Dartmouth-Hitchcock's Footprint Calculator Tool, EPA Portfolio Manager, Practice Greenhealth's Greenhealth Tracker, etc.)?
- Which voluntary initiatives to participate in (i.e., The Climate Registry, The Global Reporting Initiative, Regional carbon markets, etc.)?

4. Create Action Plan:

An important final step of planning is to create an action plan, in which you should:

- Determine timeframe and deadlines,
- Define processes, and
- Assess feasibility of defined goals and boundaries

Conducting a feasibility assessment will prepare you to act upon your chosen boundaries and goals. The following may be helpful to consider when assessing feasibility:

- **Data:** What information is available (such as energy bills, meter readings, transportation records, purchasing records)?
- **Resources:** What staff and departments in your organization will be responsible for collecting the necessary data for footprinting?
- **Outreach:** How you are going to engage your supply chain to provide data?

DO

5. Collect Data:

Once you feel that you have properly planned, it is time to begin collecting information. Healthcare facilities have found spreadsheets and web-based calculators to be helpful. To review, you should consider the following when collecting data for your footprint:

- **Carbon:** Direct and indirect emissions (including anesthetic and medical gases); relevant emission factors (i.e., GWPs for global warming potential)
- **Water:** Volume of potable and processed water
- **Waste:** Tons of solid, liquid, hazardous, recycled, construction and regulated medical wastes
- **Toxics:** Amount of mercury and other toxic materials
- **Criteria Air Pollutants:** Volume of emissions associated with transportation, energy supply and identified product procurement
- **Built Land:** Scope and location of construction

When collecting, you should include both quantitative and qualitative data. Qualitative data will help you understand your results and can be integrated into future communications related to your footprint and overall environmental stewardship.

6. Establish Baselines

The Eco-Health Footprint (i.e., carbon, water, waste, toxics) is best understood and managed when normalized to a baseline, typically called the "base year".

When selecting a "base year", your organization should look for:

- The earliest point in time with reliable data, and
- A year where the data is both auditable and verifiable.

Over time, your "base year" may need to be recalculated in the event of:

- Structural changes to your organization, or
- Changes in the calculation methodologies employed for your Eco-Health Footprint.

CHECK

7. Analyze Results:

Now that you have completed the task of measurement, you should analyze the results to receive the full benefits of the footprinting exercise

- Identify the major contributors to your footprint (These may present the largest opportunities for cost savings.)
- Benchmark your performance data to normalize and contextualize
- Identify strategies and opportunities for footprint reduction (Strategies should be specific, realistic and targeted. Hospitals, such as NHS, have chosen three areas to focus on for improvement.)
- Review for accuracy
- Consider data verification (Verification adds credibility to your measurement and may be required by some stakeholders.)

Understanding and analyzing your results will also prepare you to communicate them externally in a manner that is detailed and accurate.

ACT

8. Communicate and Report:

As an organization, you will need to decide the manner in which you'd like communicate the footprint result and which aspects of your footprint that you'd like to make internally or publicly available. Organizations can utilize a number of communication tools which include:

- A report on your methodology and findings,
- A press release,
- A website dedicated to your footprint and environmental stewardship, and
- Targeted communications to particular groups (such as staff, patients, financiers and industry associations).

In addition to targeted communications, your organization may decide to report to voluntary initiatives, such as the Climate Registry.

With environmental communications and reporting, transparency is critical. Communicating in an honest, detailed manner will give your organization and its footprint more credibility. In addition to transparency, organizations should consider the following principles for environmental reporting*:

- Relevance (to your audience),
- Completeness (all sources identified within selected boundaries),
- Consistency (allow for meaningful comparisons over time), and
- Accuracy (avoid understating data, reducing uncertainties in your data)

** If you decide to report to the Climate Registry, your report will be evaluated based on its transparency, relevance, completeness, consistency and accuracy.*

Goal setting and footprint reduction initiatives are also commonly included in external communications on footprinting or environmental stewardship.

Reporting to the WRI/WBSCD's GHG Protocol will require:

- Organizational and operational boundaries
- Reporting period
- Total Scope 1 and 2 emissions
- Base year and base year adjustments
- Documented calculation methodologies
- Specific exclusions of facilities, sources and/or operations

9. Monitor for Continuous Improvement:

Ideally, measuring your footprint is only the beginning of a journey towards improved financial and environmental stewardship. Monitoring the key impacts to your Eco-Health footprint will allow your organizations to:

- Engage in goal setting,
- Course correct if necessary,
- Realize cost savings, and
- Respond to requests from key stakeholders as they arise.

As your organization looks towards goals for reduction, the following are guiding principles:

- Specific and realistic targets (i.e., reduce total volume of waste that is sent to landfills by 10% next year),
- Established dates for targets (i.e., 2010, 2020, 2050),
- Consideration of both absolute impacts (i.e., total carbon tons) and relative impacts (i.e., total carbon related to scope of operations),
- Alignment with other business goals (i.e., cost savings, efficiency, reputation), and
- Actionable methods for achievement (i.e., process improvements, energy efficiency, etc.) .

Health care organizations have found executive dashboards and reports to management and operations to be valuable footprint monitoring tools. Organizations should monitor their footprint with an eye towards continued improvement and update their footprints periodically, considering the steps in this *Guide*.

Glossary

General Terms

Anthropogenic	caused or produced by humans
Built land footprint	measurement in acres or hectares of all area that an organization that built on that takes into account population size, local land types and uses, bio-productivity, how much area is available, and efficiency of land use
Direct impacts	emissions from operations
Eco-Health Footprint	methodology for measuring and communicating the public health and environmental impacts of healthcare operations
Ecological Footprint	a resource management tool that measures how much land and water area a human population requires to produce the resources it consumes and to absorb its waste under prevailing technology
Embedded energy	amount of energy required to source, extract, manufacture, and deliver a product
Global hectare	one hectare of biologically-productive space assuming average world productivity (note: a metric measurement equivalent to roughly 2.5 acres per hectare)
Greenhouse gases	gases that trap heat in the atmosphere
Indirect impacts	emissions related to operations including supply chain, transportation and waste
Sustainability	the ability to meet present needs without compromising the ability of future generations to meet their needs
Triple Bottom Line	addition of social and environmental values to the traditional economic measures for an organization's success (i.e. economy, ecology and equity)

Carbon Footprinting Terms

Carbon footprint	direct and indirect emissions of carbon dioxide, generally measured in tons
Scope 1 emissions	direct emissions from fossil fuels under your direct control, such as at your premises or in your vehicle fleet
Scope 2 emissions	indirect emissions from electricity that you consume but that is generated elsewhere.
Scope 3 emissions	other indirect emissions that you cause but that are not from emission sources that you own, including emissions from your supply chain and from business travel

Water Footprinting Terms

Water footprint	total volume of fresh water that is used directly and indirectly to run and support the business or organization
Blue water footprint	volume of freshwater that evaporated from the global blue water resources (surface water and ground water)
Green water footprint	volume of freshwater evaporated from the global green water resources (rainwater stored in the soil as soil moisture)
Gray water footprint	volume of polluted water, calculated as the volume of water that is required to dilute pollutants to such an extent that the quality of the water remains above agreed water quality standards.

Additional Resources

Below is a consolidated list of resources, many of which are referenced in this Guide. The resources listed below are only a subset of the wealth of organizations, tools and resources that are available to organizations seeking to measure their footprint and improve environmental stewardship.

Ecological Footprinting

Organizations

- Global Footprint Network (Leading organization focused on advancing the practice of Ecological Footprinting)

Tools

- Dartmouth-Hitchcock's Footprint Calculator Tool (Available through the GHSI website www.globalhealthsafety.org)
- Australia's EPA Victoria's Ecological Footprint Calculator (Used by Dartmouth-Hitchcock to convert carbon to energy land)
- U.S. EPA's Greenhouse Gas Equivalents Calculator (Calculates greenhouse gas equivalent metrics, such as the homes that could be powered or railroad cars worth of coal; Aimed to help define and communicate reduction strategies)

Publications

- Sustainable Healthcare Architecture (2007 book that details ecological footprints and sustainable design for healthcare)
- Determining the Ecological Footprint of a Hospital (Study by Dr. Susan Germain on Lions Gate Hospital's 2001 footprint)

Carbon (GHG) Footprinting

Organizations

- Best Foot Forward (Provider of footprinting services for several leading hospitals)
- The California Climate Action Registry (Resource for credible, voluntary reporting)
- The Carbon Trust (U.K.-based group that works with organizations to reduce carbon emissions)
- The Climate Registry (North American resource for credible, voluntary reporting)
- International Organization for Standardization (ISO) (Organization with a series of widely-used standards, some of which address carbon accounting and management)
- The World Resources Institute and the World Business Council for Sustainable Development (WRI/WBCSD) (Organization which developed the GHG Protocol)
- The U.S. Environmental Protection Agency (Organization with several resources to help organizations address greenhouse gases)

Tools

- CARROT Climate Action Registry Reporting Online Tool (California Climate Action Registry's greenhouse gas emission calculation and reporting software)
- U.S. EPA Portfolio Manager (Online tool that healthcare facilities across the United States are using to benchmark their energy performance)
- U.S. EPA SmartWay Tool (Helps organizations address impacts from transportation)

- U.S. EPA's Greenhouse Gas Equivalent Calculator (Calculates greenhouse gas equivalent metrics, such as the homes that could be powered or railroad cars worth of coal; Aimed to help define and communicate reduction strategies)
- Practice Greenhealth's Energy Impact Calculator (Calculates the public health and financial impacts of conventional power purchases)

Publications

- Climate Registry's General Reporting Protocols (228 page, detailed document on carbon footprint reporting)
- The Greenhouse Gas Protocol (Description of leading standard for measuring GHG emissions)
- NHS's 2004 Material Health Report (Describes NHS's initial footprint)
- NHS's 2008 Carbon Reduction Strategy Report -- "Saving Carbon, Improving Health" (Describes current footprint reduction strategies)
- NHS's 2008 NHS England Carbon Emissions: Carbon Footprinting Report (Describes current footprint reduction strategies)
- London Health Sciences Center's Ecological Stewardship website (Describes LHSC's footprint and subsequent footprint reduction strategies)
- Energy Information Administration's Commercial Buildings Energy Consumption Survey (CBECS) Database (2007 data on energy usage for all buildings)
- U.S. EPA's Emissions & Generation Resource Integrated Database (eGRID) (Allows organizations to track progress in reducing emissions)

Water Footprinting

Organizations

- UNESCO-IHE Institute for Water Education (International organization that works to advance water stewardship)
- Water Footprint Network (Launched by WRI/WBCSD to promote standards for water footprinting)

Tools

- Water Footprint Network's Water Footprint Calculator (Provides quick and extended calculations of individual water use)

Publications

- The Green Guide for Health Care (Addresses unique water profile for hospitals)- LEED for Health Care (Still in development, Plans to address credits for reducing processed water)
- Presentations from 2008 Corporate Water Footprinting Conference (Series of detailed presentations from leading organizations describing water management strategies)
- Water Footprint Network's Corporate Water Footprint website (Description of footprinting methodology)

Waste Footprinting

Organizations

- American Hospital Association
- Environmental Protection Agency (WasteWise Program)
- Practice Greenhealth

Tools

- U.S. EPA Waste Reduction Model (WARM) (Helps organizations track and voluntarily report greenhouse gas emissions reductions from several different waste management practices)
- Practice Greenhealth's Greenhealth Tracker (Helps facilities understand waste disposal dollars are being spent and organizes information by each type of waste)

Publications

- 1998 Memorandum of Understanding between U.S. EPA and American Hospital Association (Agreement that identifies goals to reduce the impact of healthcare facilities on the environment)
- California Integrated Waste Management Board's "Waste Reduction Activities for Hospitals" Website
- Practice Greenhealth's Managing Pharmaceutical Waste: A 10-Step Blueprint for Healthcare Facilities In the United States (Comprehensive overview and best practices for managing pharmaceutical waste in healthcare facilities)

Toxic Footprinting

Organizations

- American Hospital Association
- Clean Production Action
- Environmental Protection Agency

Tools

- Center for Health Design's RIPPLE database (Provides best practices for sustainable and evidence-based design in healthcare design and construction, with scientific studies and examples from leading healthcare facilities).
- Healthy Building Network's Pharos database (Allows users to choose from over 500 products and building materials used in the built environment, Covers a broad spectrum of building materials and rates products on safety and sustainability criteria throughout their lifecycle)

Publications

- 1998 Memorandum of Understanding between U.S. EPA and American Hospital Association (Agreement that identifies goals to reduce the impact of healthcare facilities on the environment.)

Criteria Air Pollutant Footprinting

Publications

- EPA's "What Are the Six Common Air Pollutants?" Website

Other Footprinting Resources

- The Footprint Calculator Review (A matrix that provides an overview of leading footprinting tools)
- Carnegie Mellon University's Economic Input-Output Life Cycle Assessment (EIOCLA) (Used by Dartmouth Hitchcock Medical Center to measure impacts from products)
- Sustainable Food Consumption study (Used by Dartmouth Hitchcock Medical Center to measure impacts from food consumption)
- Introduction to Cap-and-Trade Carbon Policy Using Musical Chairs: An Illustration of Managed Scarcity (A widely-used explanation of the cap-and-trade system using the analogy of musical chairs)