Chemicals

GGHH guidance document series

Provides guidance for hospitals and others working on the GGHH safer chemicals goal

GGHH guidance document series

Global Green and Healthy Hospitals (GGHH) is creating guidance documents for each of the 10 GGHH goal areas. These documents are intended to assist member hospitals and health systems in reducing their environmental footprint and promoting environmental health. This document provides guidance for hospitals and others working on the GGHH safer chemicals goal.

Guidance documents are designed as interconnected pieces of a larger framework that includes action items in the GGHH agenda, self-assessment checklists, benchmarking tools, associated case studies and resources, and tools (still in development) to help members measure progress over time.

These documents are available to members via GGHH Connect and downloadable in PDF format. They are meant to be participatory, living documents. GGHH seeks feedback and suggestions for actions, examples, case studies, and links so guidance evolves based on the experience and input of our members.

About the safer chemicals guidance document

The health care sector is one of the largest consumers of chemicals and materials, some of which are well documented to pose serious threats to health and the environment. Although the sector's mission is to protect human health, these harmful chemicals and materials can contribute to the burden of disease and threaten ecological systems on which we depend for life and health.

Products used in health care have the potential to harm human health and the environment during production, use, and disposal. Toxic chemicals generated during the life cycle of products have contaminated humans and the environment worldwide. Nearly all nations suffer an epidemic of chronic diseases with strong links to environmental factors. The manufacture, use, and disposal of hazardous chemicals has created a crisis that poses a global threat to human rights. Inequities in the distribution of these hazards can be exacerbated by socio-economic factors. Coupled with climate change, chemical contamination can exacerbate and accelerate impacts to the ecosystem and human health that threaten the basis of all life.

Even before birth, people encounter a barrage of toxic chemicals that can impact normal childhood development and health later in life. The health consequences of exposure to toxic chemicals are disproportionately borne by people with low incomes. Populations vulnerable to hazardous chemicals and materials used in health care include patients, clinicians, environmental services workers and other employees in the health care setting, factory workers that manufacture products, workers in waste disposal facilities, and people who live near mining, manufacturing, or waste disposal sites. Research has shown that health sector employees may be more at risk than the general public, reporting one of the highest rates of adult asthma relative to all major occupational groups and showing a greater risk of developing chronic respiratory illnesses. Health care clinicians and technicians are at risk.

The safer chemicals guidance document includes a brief overview of each priority area along with a set of tools to reduce the use of hazardous chemicals and materials and improve the health and safety of patients, workers, visitors, and the community.

This is not intended to be a systematic evidence review nor a comprehensive treatment of all potential sustainability challenges, but rather a toolkit focused on some of the most important and widely recognized sustainability issues in health care.

GGHH guidance document series

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Important concepts

Some important concepts to consider when working toward safe chemical substitution and management in the health care setting include chemical identification and labeling, a hierarchy of controls approach to hazards, and complementary substitution and alternatives assessment.

Chemical identification, labeling, and communication

Identifying and labeling chemicals is a fundamental building block of health, safety and sustainability. This practice supports the development of a safety culture at your facility, helps assure patient and employee health and safety, and facilitates proper disposal of products to protect the community. Identifying and labeling chemicals also helps with the prioritization of hazards. Many countries require labeling using the Globally Harmonized System (GHS) of classifying and labeling chemicals, but it may not be consistently practiced or communicated. Any program to ensure the safe use of chemicals should include identifying hazards (including classification according to a credible classification system); clearly labeling chemical and material hazards (including safe handling instructions); communicating pertinent information consistently and clearly at point of use and in storage; and eliminating and reducing hazards wherever possible. Leaders should institutionalize and prioritize these practices throughout the organization.

Tools and resources

Database | International Labor Organization/WHO International chemical safety cards provide essential safety and health information on chemicals.

Guidance | OSHA Guide to the globally harmonized system of classification and labeling of chemicals (GHS)

Website | GHS Globally harmonized system of classification and labeling of chemicals

Website | GHS Globally harmonized system implementation by country

Substitution and alternatives assessment

Substitution or informed substitution means replacing hazardous chemicals with demonstrated safer alternatives to protect public health and the environment. In 2010, the U.S. Environmental Protection Agency defined informed substitution as:

> *A considered transition from a chemical of particular concern to safer chemicals or non-chemical alternatives. The goals of informed substitution are to minimize the likelihood of unintended consequences, which can result from a precautionary switch away from a chemical of concern without fully understanding the profile of potential alternatives, and to enable a course of action based on the best information – on the environment and human health – that is available or can be estimated.*

Functional substitution emphasizes the need to substitute a particular function or service that the chemical or material provides rather than finding a drop-in chemical replacement. This process involves exploring a range of molecular, material, design, and systems changes that can meet a particular function, creating opportunities for innovation in product and building design. For example, rather than substituting one flame retardant for another, a functional substitution approach would look at alternative options to achieve the function of flame retardancy. These options might include using alternative designs that eliminate flammable materials; separating flammable materials from ignition sources; using barrier materials between flammable materials and an ignition source; reevaluating the need for the function (ie not all products need a flame retardant); installing sprinklers in a building to eliminate the need for a flame retardant; or evaluating the level of performance based on the evidence.

An **alternatives assessment** is a step-defined process that occupational health specialists, manufacturers, product designers, businesses, governments, health care purchasers, supply chain managers, and others can use to make more informed decisions about the substitution of toxic chemicals in products, processes, or institutions. An alternatives assessment decreases risk by reducing hazards, avoiding regrettable substitutions, and integrating occupational safety and health and environmental considerations into product selection. Key principles include a focus on function first instead of a particular chemical; a central focus on hazard reduction; and consideration of the necessity of a chemical.

Alternatives may include drop-in substitutes; changes in production processes; changes in product design; changes in how functions are performed; non-chemical solutions; or new systems of consumption.

Tools and resources

Guidance | Interstate Chemicals Clearinghouse Alternatives assessment guide (2017)

Guidance | National Academies Framework to guide selection of chemical alternatives (2014)

Training syllabus | SAICM-KEMI Chemical safety, substitution, and management training for health workers

Website | European Chemicals Agency How to substitute: A step-by-step guide to substitution

Website | OECD Substitution and alternatives assessment toolbox

Website | Interstate Chemicals Clearinghouse Chemical hazard assessment database enables users to search for GreenScreen and quick chemical assessment tools.

Website | Clean Production Action GreenScreen is a method for comparative chemical hazard assessment that can be used for identifying chemicals of high concern and safer alternatives.

Website | Health and Safety Executive of UK Substitution basics

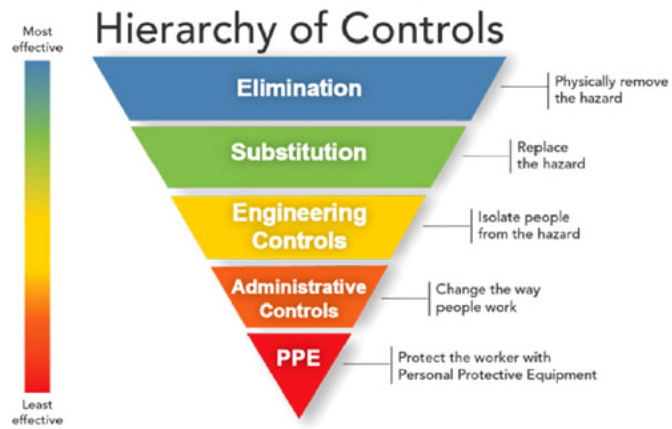
Website | German Federal Institute for Occupational Safety and Health Subsport is a free, multilingual platform for information exchange on alternative substances and technologies.

For product-specific information on alternatives, see the chapters below.

Hierarchy of controls

Occupational safety and health professionals use a framework called the hierarchy of controls to reduce workplace hazards. It is a widely accepted system promoted by most safety organizations. **The hierarchy places the highest value on completely eliminating a hazard rather than relying on workers to reduce their exposure**.

The hazard controls in the hierarchy are, in order of decreasing effectiveness:



Source: The National Institute for Occupational Safety and Health (NIOSH)

Elimination: Eliminating the hazard by physically removing it is the most effective hazard control. Hazards can be eliminated by redesigning an activity so hazardous chemicals are not required or eliminating the need for chemicals through prevention as with Integrated Pest Management.

Substitution: Substitution refers to the replacement of a hazardous material or process with one that is less hazardous. Substitution can be a drop-in replacement or include product redesign so the hazard isn't required. Minimization involves the reduction of a hazard rather than complete elimination.

Engineering controls: Engineering controls involve making changes to the work environment to reduce exposure to chemical hazards. A common example is fume hoods. This approach is preferred when it is impossible to eliminate the hazard completely because engineering changes can be institutionalized and made permanent and do not rely on employee behavior.

Administrative and work practice controls: Administrative controls are policies and procedures that modify workers' schedules and tasks in ways that minimize exposure to hazards. Examples include developing a chemical hygiene plan or standard operating procedures such as pouring instead of spraying cleaning chemicals on surfaces (in order to reduce inhaled exposures). This intervention relies on worker behavior change, making it less robust.

Personal protective equipment (PPE): PPE is the least effective method for protecting workers from hazards. PPE includes masks, gloves, or other protective equipment to reduce exposure. PPE should be used in addition to other methods or if there are no other effective ways to control the hazard. This intervention relies on worker behavior change and should be the last line of defense.

Tools and resources

Website I CDC NIOSH hierarchy of controls

Priority chemicals and materials of concern in health care

Mercury-containing medical products

Rationale

Mercury is widely used in health care, and the World Health Organization has identified it as one of the top 10 chemicals of major public health concern. The United Nations Environment Programme (UNEP) has identified the adverse effects of mercury pollution as a serious global environmental and human health problem. The UNEP Governing Council has targeted reducing methylmercury accumulation in the global environment as a major global priority.

Mercury can be manufactured or occur in different forms that vary in toxicity and bioavailability. In metal form, mercury can rapidly vaporize at ambient temperatures and be dispersed and inhaled when released indoors. When released to the environment, mercury persists and circulates between air, water, sediments, soil, and biota. Mercury can be deposited locally or transported long distances. When metallic mercury ends up in water bodies and wetlands, naturally occurring bacteria in the sediment transform it into methylmercury, a more toxic compound that can build up in fish tissue. Fish and shellfish are the main sources of methylmercury in the human diet.

Methylmercury is highly toxic to humans and wildlife, with impacts on the brain, nervous system, kidneys, digestive and immune systems, lungs, skin, and eyes. It is readily absorbed from the intestinal tract and in pregnant women easily crosses the placenta, where impacts on fetal brain development are a particular concern. Chronic, low-dose prenatal exposure to methylmercury as a result of maternal consumption of fish has been shown to cause neurotoxicity in children. Neurotoxic impacts include poor performance on neurobehavioral tests, particularly attention, fine-motor function, language, visual-spatial abilities like drawing, and verbal memory. Among certain subsistence fishing populations, between 1.5 per 1,000 and 17 per 1,000 children have shown cognitive impacts caused by consumption of fish containing mercury.

Mercury has been detected in human blood, urine, milk, and hair. Biomonitoring data routinely collected by the U.S. Centers for Disease Control and Prevention (CDC) show that approximately 6 percent of women of reproductive age are exposed to mercury at or above the reference dose, representing a public health threat.

Mercury is present in a wide variety of health care products, including thermometers, sphygmomanometers, dental amalgam, laboratory chemicals and preservatives, cleaning agents, and various electronic devices such as fluorescent lamps and computer equipment. Some of these devices can break or leak, exposing health care workers to the metal and potentially contaminating the environment. Costs of spills have ranged from several thousand dollars to hundreds of thousands of dollars. Mercury spills also can pose a threat to workers. In one Ohio study, mercury from three broken thermometers in an office approximately 10 square feet in size led to vapors three times the limit permitted by the U.S. Occupational Safety and Health Administration.

Dental amalgam is used to fill cavities caused by tooth decay. Approximately half of dental amalgam is elemental mercury by weight. In 2016, the United Nations Environment Programme and the World Alliance urged governments around the world to phase down the use of dental amalgam. Norway and Sweden have completely prohibited its use. Since July 2018, dental amalgam cannot be used in any EU country to treat milk teeth and is prohibited for children younger than 15 and pregnant or breastfeeding women, except when deemed strictly necessary. In 2020, the U.S. FDA recommended against using mercury dental amalgam in certain high-risk groups.

International treaty on mercury elimination

The Minamata Convention on Mercury of 2013 is a global treaty to protect human health and the environment from anthropogenic emissions and releases of mercury. The major highlights of the convention include restrictions on the manufacture, import, or export of mercury-added products; a ban on new mercury mines; the phase out of existing mines; the phase out and phase down of mercury use in a number of products and processes; control measures on emissions to air and releases to land and water; and regulation of the informal sector of artisanal and small-scale gold mining. The convention also addresses interim storage of mercury, disposal once it becomes waste, and contaminated sites.

WHO and Health Care Without Harm global mercury-free health care initiative

The World Health Organization and Health Care Without Harm global initiative was a component of the UNEP mercury products partnership led by the United States Environmental Protection Agency. The objective of the initiative was to reduce the use of mercury-containing fever thermometers and sphygmomanometers by at least 70% and shift to accurate, affordable, and safer non-mercury alternatives. See the initiative for more information.

Other uses

Mercury is also used in industrial processes that produce chlorine and sodium hydroxide (mercury chlor-alkali plants), vinyl chloride monomer for polyvinyl chloride production, and polyurethane elastomers. It is extensively used to extract gold from ore in artisanal and small-scale gold mining. It is contained in products such as electrical switches (including thermostats), relays, measuring and control equipment, energy-efficient fluorescent light bulbs, and some batteries. It is used in laboratories, cosmetics, pharmaceuticals (including vaccines as a preservative), paints, and jewelry. Mercury is also released from some industrial processes, such as coal-fired power and heat generation, cement production, mining, and other metallurgic activities such as non-ferrous metals production, as well as incineration of many types of waste.

Key considerations

- It is important to inventory all mercury sources at your facility and prioritize elimination of the most important ones (see chart below).
- Digital thermometers perform well but certain considerations are important:
  - Digital thermometers can be as accurate as mercury thermometers. Those that conform to international standards have the degree of precision required in medical care.
  - Standard-setting organizations like ASTM International have developed protocols to help the health care community identify accurate alternatives.
  - It is imperative that the health care sector and governments guarantee thermometers acquired from manufacturers abide by independently certified ASTM testing techniques and protocols (or other internationally recognized procedures) to ensure accuracy.
  - Some digital thermometers must be calibrated. Some manufacturers recommend having the precision of the temperature sensor tested regularly by an authorized laboratory.
- Aneroid blood pressure devices perform well but should be periodically maintained and calibrated.

Mercury hazard summary and alternatives chart

Hazard summary	Product category	Select alternatives
Mercury is a persistent and potent neurotoxicant that can harm the brain, kidneys, and liver. Mercury is toxic to unborn children. Mercury can contaminate the food web.	Thermometers	Mainly digital or electronic, alcohol, galinstan
	Blood pressure monitors	Mainly aneroid (mechanical dial or digital) – electronic, oscillometric
	Thermostats	Electronic