

NAVIGATING BIOMEDICAL WASTE MANAGEMENT POLICIES FOR SUSTAINABILITY

Why • The Case for Change
What • The Tools for Change
How • The Strategy for Change

This project was undertaken with the financial support
of the Government of Canada.

Ce projet a été réalisé avec l'appui financier
du gouvernement du Canada.

Canada

CASCADES

UNITY HEALTH
TORONTO





NAVIGATION



Click on a topic on the table found on the right to navigate the document

<u>Introduction</u>	3
<hr/>	
<u>Why: The Case for Change</u>	5
<ul style="list-style-type: none">• Sustainable waste management• The environmental impact of biomedical waste management• The regulatory landscape	
<hr/>	
<u>What: The Tools for Change</u>	10
<ul style="list-style-type: none">• Updating internal policies: Understand the federal and provincial context• Waste segregation• Reduce overall waste	
<hr/>	
<u>How: The Strategy for Change</u>	25
<ul style="list-style-type: none">• Build relationships with landfills, waste haulers and other vendors• Re-think the culture of overpreparedness• Education-mobilization campaigns	
<hr/>	



INTRODUCTION

This playbook focuses on strategies to work effectively with biomedical waste management policies in order to reduce the environmental impact of both the waste itself and the processes required to manage it.

It is intended for healthcare policymakers looking for opportunities to improve the environmental sustainability of biomedical waste management and individual changemakers wishing to work in compliance with their local, provincial, or national regulations in organized care settings such as hospitals, primary care clinics or long term care centres.

The content of this playbook has been compiled from across a range of CASCADES and partner guidance documents and resources.



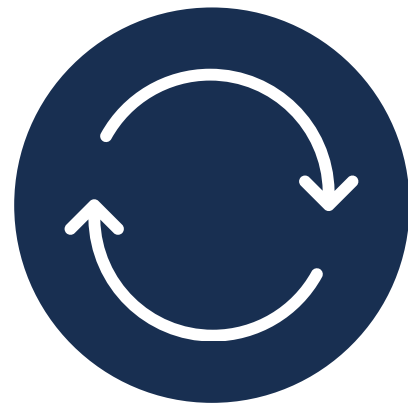
Suggested citation

Machane S, MacLeod C, Lam I. Navigating Biomedical waste management policies for sustainability version 1.1 (2024) [Internet]. CASCADES (Creating a Sustainable Canadian Health System in a Climate Crisis). [Cited DATE]. Available from <https://cascadescanada.ca/resources/waste-policy-playbook/>





PLAYBOOK STRUCTURE



WHY

The Case for Change



WHAT

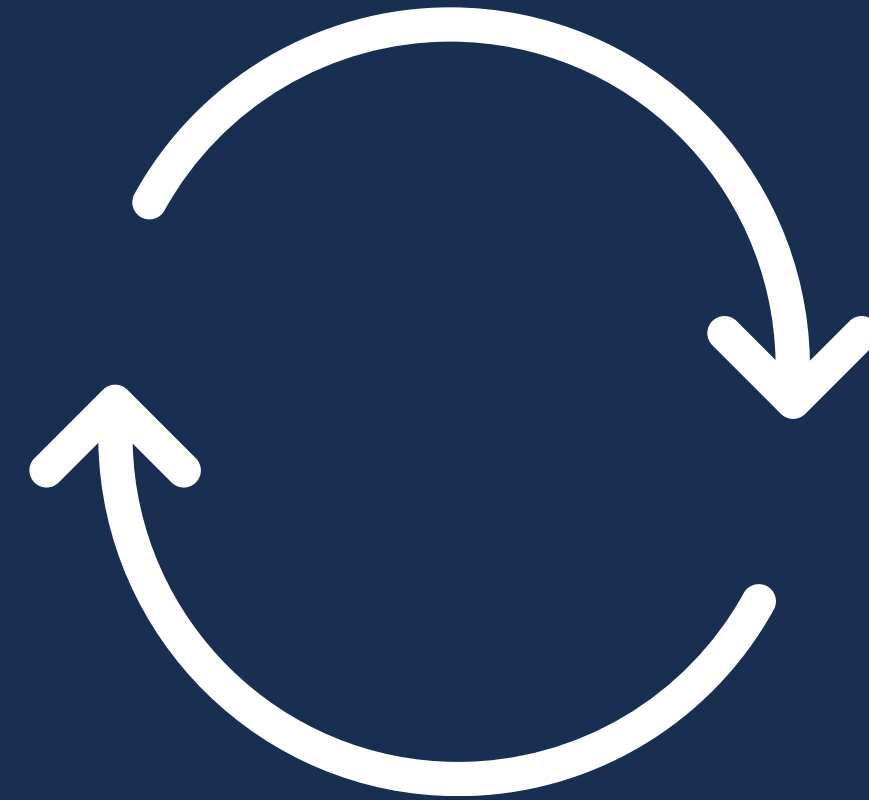
The Tools for Change



HOW

The Strategy for Change





WHY

The Case for Change

- 1 Sustainable waste management
- 2 The environmental impact of biomedical waste management
- 3 The regulatory landscape





Sustainable waste management



KEY DEFINITIONS

Key definitions from the Canadian Standards Association, [CSA Z317.10:21 Handling of Healthcare Waste Materials](#) (2021):

Biomedical Waste: “waste that requires special handling and disposal because it presents a particular risk of disease transmission (pg. 17)”

- Note:
 - “1) Biomedical waste can include used needles and syringes due to the possibility of there being blood-borne pathogens (such as HIV, Hepatitis B or C) present, and the risk of transmission if the used needle is not properly contained and disposed of.
 - 2) ‘Biohazard’ and ‘biomedical waste’ are often used interchangeably (pg. 17).”

General Waste: “material that does not pose a disease-related risk or threat to people or the environment when managed in accordance with appropriate practices and applicable regulations (pg. 17).”

Hazardous Waste: “a material or substance that, if handled improperly, has the potential to harm people, property, or the environment (pg.18).”

Sharps: “items used in medical care diagnosis or research that can be contaminated with biohazardous or cytotoxic agents and that are capable of causing punctures, cuts, or tears in skin or mucous membranes (pg. 20)”

- Note: “Sharps include hypodermic, surgical, suture, or intravenous (IV) needles, syringes with needles, Pasteur pipettes, lancets, scalpels, blades, and laboratory glass (pg. 20).”

Pharmaceutical Waste: “includes drugs and medicinal chemicals that a) are no longer usable; b) have become outdated or contaminated; c) have been stored improperly; or d) are no longer required (pg. 34).”

- Note: “Empty vials, etc., are considered as general waste. If they are not empty, they are considered as pharmaceutical waste (pg. 34).”

Cytotoxic waste: “waste associated with cytotoxic agents. There are two types of cytotoxic waste:
1. pharmaceutical cytotoxic waste, which consists of waste cytotoxic agents or any material that has been in direct contact with or is contaminated with cytotoxic agents.
2. biomedical cytotoxic waste, which consists of biomedical waste (including sharps) that have also been in contact or is contaminated with cytotoxic agents.”

- Note: “It includes waste generated from patients, outer packaging, sharps, personal protective equipment, tubing, etc. that has been in contact with cytotoxic agents.” (pg. 17)

Sustainable waste management is a broad and complex issue, with much interest and much debate (1).

Practices that reduce, manage, treat, and dispose of waste in more sustainable ways are among the changes that can be made in specific areas of care (for example, [perioperative care](#), [inhalers prescribing](#), [kidney care](#) and [pharmacy](#)). There are numerous categories of materials, like plastic waste and pharmaceutical waste, where the research, policy, and current practices are complex and evolving.

In recognition of the need for robust guidance, CASCADES is taking a focused approach, prioritizing sufficient depth in one area rather than exhaustive coverage of all. In this playbook, the term biomedical waste is used to describe any biomedical, infectious, anatomical, or microbiological waste requiring incineration or sterilization before disposal. As pharmaceutical waste can also require incineration, we have included some opportunities related to pharmaceutical waste as well.

We look forward to continuing to share robust resources as our range of coverage expands.





The environmental impact of biomedical waste management



The Canadian Healthcare system is major contributor of environmental pollutants, and places among the highest per capita carbon footprints of health systems around the world (2).

A 2019 report from the Canadian Coalition for Green Healthcare found 83 Canadian hospitals self-reported generating 101,898 metric tonnes of waste (3). Extrapolated to all 1280 (4) hospitals across Canada, the amount of waste created would be approximately 4.3 million kg of waste created per day. While most provinces have guidance documents directing the disposal of biomedical waste, few have taken the additional step of regulating such activities or penalties for non-compliance.

An estimated 85% (5,6) of medical waste generated by healthcare facilities can be disposed of in general waste streams such as landfill, recycling or composting without requiring special treatments. General waste includes products that could also be found in household waste, such as packaging, personal protective equipment and IV tubing that has not been contaminated with a high risk infectious or cytotoxic substance.

By contrast, high-risk biomedical and pharmaceutical waste requires special handling, treatment, and disposal due to environmental, health and safety concerns. This type of waste represents a small proportion of the total volume of waste generated by health care facilities but requires disproportionately high costs and enormous amounts of energy to manage (8). If untreated, the disposal of this type of healthcare waste can lead to contamination of landfills and water.

CARBON-INTENSIVE WASTE STREAMS

A study compared the carbon footprint of waste streams in a UK hospital. They compared recycling, low temperature incineration, autoclave decontamination and high temperature incineration. High temperature incineration was found to have 16 to 50 times larger carbon footprint than recycling, while autoclaving was found to have a carbon footprint 9 to 27 times greater than recycling (7).





In Canada, healthcare facilities have on-site sterilizing equipment and/or contract third-party vendors to collect, handle, and transport their biomedical waste to centralized, off-site facilities (9,10). Waste is mostly sterilized using methods such as incineration, autoclaving, hydroclaving and microwaving (11,12).

Incineration

Incineration involves burning waste at high temperatures to produce residual ash, which can then be disposed of in a municipal solid waste landfill (13). Although incineration decreases the volume of waste and ensures sterilization it releases carbon dioxide and toxins such as dioxins, furans, and mercury into the atmosphere (13,14). These atmospheric toxins are harmful to human health and the environment; for example, atmospheric mercury poses a risk to the health of human nervous, excretory, and reproductive systems and the environment. (13).

Autoclaving

Autoclaving refers to the sterilization of hazardous medical waste using dry heat or steam to kill microbial contamination. After sterilization, waste can be disposed of in a municipal solid waste landfill (15,13). Compared to incineration, autoclaving does not release dioxins, furans, and mercury into the atmosphere, making it a more suitable method to decrease emissions (16). However, unlike incineration, autoclaving does not reduce the volume or alter the appearance of the waste. Once placed into a municipal landfill, the environmental risk of leachate remains. Due to this risk, some communities do not permit autoclaved waste to be landfill and this means previously autoclaved hazardous waste must be shipped to a second facility to then be incinerated prior to end of life disposal in a landfill. It is also not an acceptable means of sterilization for Creutzfeldt-Jacob Disease infected waste or cytotoxic material (13,17).

Hydroclaving

Hydroclaving refers to the use of pressurized steam and a shredding system (121–138°C and 5 bar steam pressure) to destroy microorganisms and reduce the volume of waste. After treatment, the steam is vented through a condenser while maintaining high temperatures to dry the waste. This method is generally considered reliable for destroying pathogens and rendering biohazardous waste safe for subsequent disposal in compliance with regulations and safety standards. (18)

Microwaving

Microwaving refers to the sterilization of waste using microwave technology to heat the waste to high temperatures. It is considered an efficient and relatively rapid method for treating biohazardous waste. It can reduce the volume of waste and deactivate harmful microorganisms, making the waste safer for disposal in certain settings. (18)





The regulatory landscape



“In Canada, the responsibility for managing and reducing waste is shared among federal, provincial/territorial, and municipal governments.

Municipalities and private waste management firms

- Manage the collection, diversion, and disposal of residential and non-residential solid waste.

Provincial and territorial authorities

- Establish waste reduction policies and programs
- Approve and monitor waste management facilities and operations.

The federal government

- Controls the international and interprovincial movement of hazardous recyclables and waste
- Identifies approaches and best practices to reduce pollutant releases and greenhouse gas emissions from the waste management sector”
- Environment Climate Change Canada

To complete the picture, the Canadian Council of Ministers of the Environment (CCME) proposes environmental guidelines applicable from a pan-Canadian perspective (19) and the Transportation of Dangerous Goods Act sets the standard for means of containment of waste.

Adding further complexity to the waste management landscape is the inter-provincial inconsistency in commended waste treatment guidelines, regulations and available technologies that address biomedical medical waste management in Canada.

As a result of this ambiguity, incineration and sterilization processes are overutilized, contributing to increased environmental pollution and high waste disposal costs for healthcare institutions. There is a need for robust and clear guidance on biomedical medical waste generated in healthcare facilities in Canada that reduces unnecessary incineration and sterilization.

For example, depending on the institutions, waste from operating rooms (ORs) is estimated to contribute to over 30% of all hospital waste (20,21,22,23), of which a large volume is unnecessarily discarded as hazardous medical waste requiring incineration or sterilization before disposal in municipal solid waste landfills (24). Incineration and sterilization are expensive and polluting processes that increase both the disposal costs for healthcare institutions and greenhouse gas emissions and toxins (24).





WHAT

The Tools for Change

- 1 Updating internal policies: Understand the Canadian and provincial context
- 2 Waste segregation
- 3 Reduce overall waste





Updating internal policies: Understand the canadian and provincial context

In order to write and update high-quality biomedical waste policy documents and draw inspiration from existing places, it is important to be familiar with the regulations and reference documents available.

The following pages present an overview of the actual Canadian regulations and guidance documents issued to support healthcare workers with hazardous waste management.

MUNICIPALITIES AND PRIVATE WASTE MANAGEMENT FIRMS

Waste haulers and vendors vary in their practices and the types of waste they accept.

Before implementing staff education or any waste management program, it is important to both to review the waste management regulations and guidelines for your jurisdiction and to identify what the waste hauler serving your facility accepts.

Also ensure that any waste handling practices are aligned with federal and provincial regulations and guidelines for occupational health and safety such as the [Canadian Centre for Occupational Health and Safety](#).





CANADIAN REGULATIONS AND GUIDANCE



The Canadian federal government does not take a prescriptive role in its regulatory approach toward biomedical waste management. Most provinces rely on umbrella legislation governing all waste material to regulate the handling of biomedical waste. In this playbook, ‘regulation’ is used to express a requirement, while ‘guidance’ is used to express a recommendation.

REGULATIONS

[Transportation of Dangerous Goods Act \(1992\)](#): regulates the transportation of biohazardous materials, including the means of containment, placarding, packaging material specifications for biomedical waste.

GUIDANCE

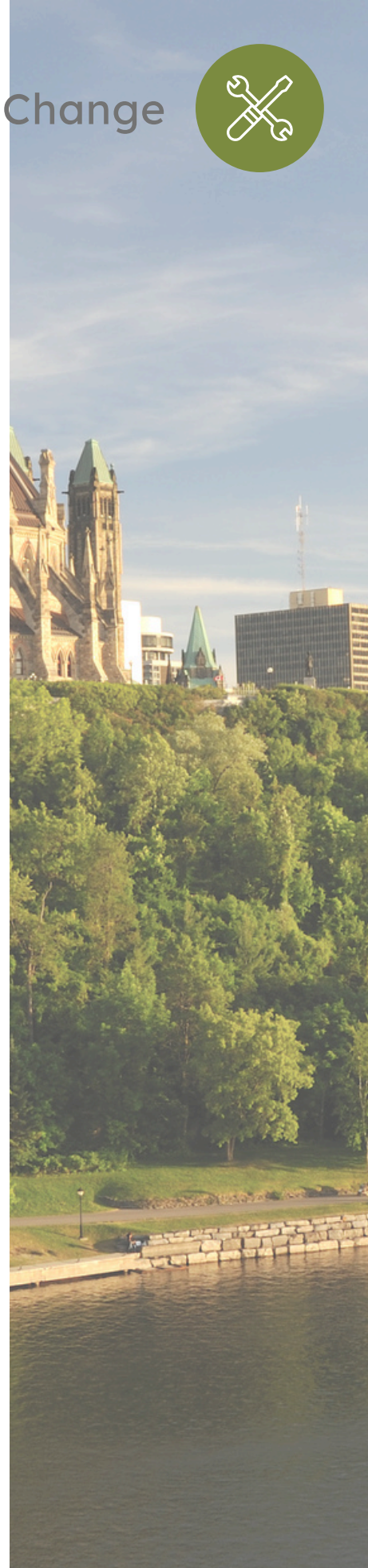
[Guidelines for the Management of Biomedical Waste in Canada \(1992\)](#): created by the Canadian Council of Ministers of the Environment (CCME) provides guidance to provinces on the definition, treatment, and disposal of biomedical waste in an effort to standardize the process. The guidelines outline the minimum practices to be followed by hospitals, long-term care facilities, public health units, and dentists for the management of biomedical waste. These guidelines are meant to act as a framework for the provinces when creating their own policies, therefore provincial regulatory agencies may specify more stringent regulations. The guidelines do not specifically address pharmaceutical waste in hospital settings; however, pharmacies and pharmaceutical suppliers are encouraged to use these guidelines.

[Destruction of narcotic, controlled and restricted substances by licensed dealers \(2018\)](#): provides guidance specifically applying to licensed dealers intending to destroy controlled substances in their possession. Informs generally on the method of destruction required, including requirement for incineration, when chemical destruction (denaturation) can be used and acceptable methods of denaturation.

[Guidance Document for Pharmacists, Practitioners and Persons in Charge of Hospitals: Handling and Destruction of Unserviceable Stock, Containing Narcotics, Controlled Drugs or Targeted Substances \(2018\)](#): provides guidance for practitioners, pharmacists, and persons in charge of a hospital involved in the handling and destruction of unserviceable stock (drug product containing a narcotic, controlled drug or targeted substance that is unusable, expired and/or that cannot be dispensed).

[Canadian Biosafety Handbook, Second Edition \(2016\)](#): provides national guidance for the safe handling and storing of human and terrestrial animal pathogens and toxins in Canada.

[Canadian Standards Association: CSA Z317.10:21 \(2021\)](#): provides guidance for handling health care waste materials, including requirements for the packaging, collection, storage, handling, treatment, and disposal of waste materials within health care facilities and veterinary health care facilities.





PROVINCIAL/TERRITORIAL REGULATIONS AND GUIDANCE

Provinces establish their own regulatory framework for handling and transporting biomedical materials, which must be based on the Transportation of Dangerous Goods Act and Guidelines for Biomedical Waste Management in Canada set by the CCME. Because the provincial regulations are based on these federal guidelines, there is consistency amongst the guidelines set across the provinces.

BRITISH COLUMBIA

REGULATIONS

[Environmental Management Act- Hazardous Waste Regulation \(B.C. Reg. 63/88\) \(1988\)](#)

GUIDANCE

N/A

ALBERTA

REGULATIONS

Biomedical waste is managed according to regional infection control procedures developed by institutions responsible for the waste and in compliance with the requirements of Alberta Health Services (AHS).

GUIDANCE

[Disposal of Biomedical Waste: Acceptable Industry Practices \(2019\)](#): describes acceptable industry practices for the disposal of biomedical waste in Alberta, in alignment with the CCME Guidelines for the Management of Biomedical Waste.

[AHS Procedure on Biomedical Waste \(2015\)](#): outlines AHS procedures for handling, transporting, and disposing biomedical waste.





SASKATCHEWAN

REGULATIONS

N/A

GUIDANCE

[Saskatchewan Biomedical Waste Management Guidelines \(2008\)](#): outlines procedures for the classifying, handling, storage, transportation, and disposal of biomedical waste in Saskatchewan.

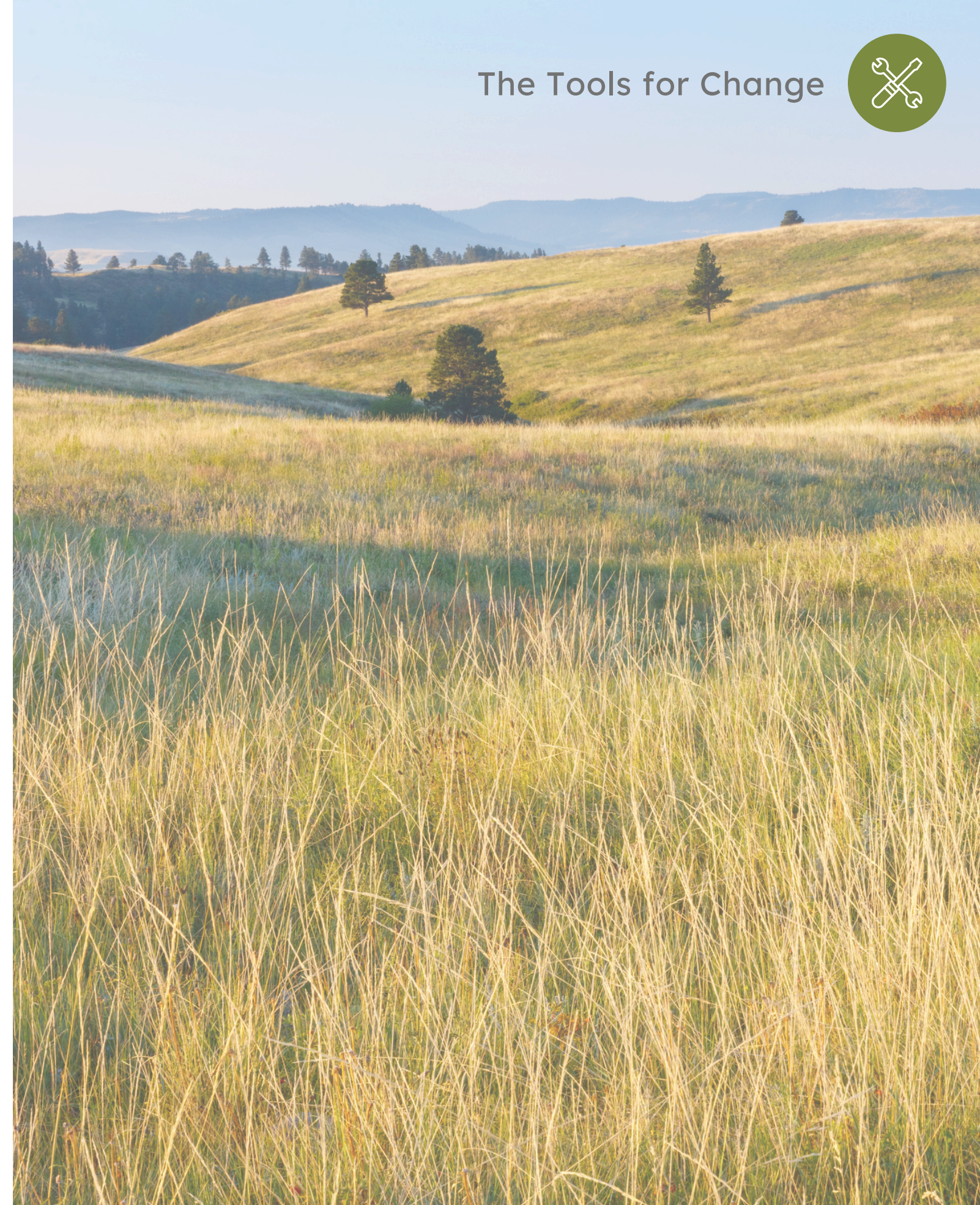
MANITOBA

REGULATIONS

[The Dangerous Goods Handling and Transportation Act- Hazardous Waste Regulation \(R. 195/2015\)](#): regulates biomedical waste from hospitals.

GUIDANCE

N/A





ONTARIO

REGULATIONS

The Ontario Ministry of the Environment and Climate Change regulates biomedical waste through the Environmental Protection Act and C-4. [Environmental Protection Act \(EPA\)](#) (1990): The EPA is the Ontario regulation for the management of industrial waste. Part V governs waste management generally, but does not provide much guidance on the disposal of biomedical waste specifically.

[Regulation 347 – General Waste Management](#): defines types of waste, but it does not define biomedical waste. It includes schedules to categorize specific substances as types of waste and lists land disposal treatment requirements for specific substances, and describes treatment methods. While a few hazardous waste chemicals exist as pharmaceuticals, most medications are not on these schedules.

[Regulation 298 – Collection of Pharmaceuticals and Sharps – Responsibilities of Producers](#): outlines responsibilities of producers and defines “pharmaceutical” and “sharp”.

[C-4: The Management of Biomedical Waste in Ontario](#) (2016): C-4 describes best management practices to be followed to minimize the impact of biomedical waste on the environment through appropriate packaging, segregation, treatment, storage and disposal methods with the aim of preserving the integrity of the environment and reducing potential public health risk through proper management of biomedical waste.

- The guideline is primarily directed at two main audiences: (1) generators of biomedical waste; and (2) carriers and receivers who are responsible for treatment, transportation and disposal of biomedical waste. Although not specifically listed, other generators and handlers of biomedical waste, such as police, fire, and ambulance services, and pharmacies are encouraged to use these guidelines when formulating their best management practices.
- The recommendations set out in this guideline are in addition to any requirements under Part V of the EPA, Regulation 347 General - Waste Management, and any other statutory or legal requirements.

GUIDANCE

Public Health Ontario, [Best Practices for Environmental Cleaning for Prevention and Control of Infections in All Health Care Settings](#) (2018): includes guidelines on the management of biomedical and pharmaceutical waste (pg. 72-78).





QUEBEC

REGULATIONS

[Règlement sur les déchets biomédicaux](#) (2021): under the Loi sur la qualité de l'environnement, this regulation defines the categories and sub-categories of biomedical waste, management methods, external storage, shipping and management requirements. It also details the record keeping requirements and preparation of annual reports. Once disinfected, biomedical waste can be taken to the landfill or incinerated under the [Règlement sur l'enfouissement et l'incinération des matières résiduelles](#)(2006).

[Règlement sur les matières dangereuses](#) (2021): defines and describes the management methods of hazardous materials that are not managed by the [Règlement sur les déchets biomédicaux](#) (ex: residues of drugs and expired drugs that are toxic or cytotoxic, including toxic products and drugs containing mineral oils or fats, containers or residual materials that contain or have come into contact with a hazardous drug product during preparation or administration).

GUIDANCE

[Guide de gestion des déchets du Réseau de la santé et des services sociaux](#) (2017):

Document from the Ministry of Health and Social Services, defines the different types of waste created in the health network. For each type, this guide details the actors, risks, management principles and occupational health and safety rules related to it and offers summary sheets.

NEW BRUNSWICK

REGULATIONS

Clean Environment Act - [Water Quality Regulation \(NB 82-126\)](#) (2018): The New Brunswick Department of Environment and Local Government manages hazardous waste (including biomedical waste) through the Clean Environment Act.

GUIDANCE

N/A





NOVA SCOTIA

REGULATIONS

[Nova Scotia health Waste Management Policy](#) provides the overall framework for general waste management in health care facilities. In general, hazardous biomedical waste is taken to a third-party vendor or disposed of at a centralized facility.

GUIDANCE

N/A

PRINCE EDWARD ISLAND

REGULATIONS

Environmental Protection Act - [Waste Resource Management Regulations \(2019\)](#): biomedical waste is classified as a 'special waste' under the Waste Resource Management Regulations.

GUIDANCE

N/A

NEWFOUNDLAND AND LABRADOR

REGULATIONS

N/A

GUIDANCE

[Management of Biomedical and Pharmaceutical Waste \(2016\)](#): provides guidance and describes best management practices for the disposal of biomedical and pharmaceutical waste.





YUKON REGULATIONS

N/A

GUIDANCE

[Guidelines for the Management of Biomedical Waste in Yukon \(2018\)](#): provides guidance for the disposal of biomedical waste.

[Biomedical Waste Facts Sheet \(2011\)](#): provides a brief overview of how to dispose biomedical waste.

NORTHWEST TERRITORIES REGULATIONS

N/A

GUIDANCE

[Guidelines for the Management of Biomedical Waste in the Northwest Territories \(2005\)](#): provides guidelines for the reduction, segregation, packaging, and treatment of biomedical waste.

NUNAVUT REGULATIONS

N/A

GUIDANCE

[Environmental guidelines for Biomedical and pharmaceutical waste \(2014\)](#): defines and explains the management of both biomedical and pharmaceutical waste in healthcare settings. Defines biomedical waste as “any solid or liquid waste that may present a threat of infection to humans”.





Waste segregation

Colour-coded waste segregation matrixes (e.g. waste sorting posters) are used in hospitals and clinical wards to indicate the correct containers for proper disposal of biomedical waste

In theory, waste segregation matrixes in hospitals offer a systematic way to ensure waste is being properly managed. However, a waste audit done by University Health Network in Ontario in 2011 demonstrated that it is not standard practice to have recycling bins available in inpatient rooms (20). Thus, potentially recyclable items end up in landfills. In addition, the literature demonstrates that locations with high patient turnover and poor processes for segregating waste ultimately results in improper waste disposal. The geography of wards is therefore an important consideration to ensure proper waste segregation (21)(22)(9).

Even when matrixes are present, there must be accountability from organization leaders to evaluate these processes.

In 2019, a pilot program to reduce waste in an emergency department in Australia found that efforts to improve waste segregation were met with poor compliance as healthcare staff

found these practices time consuming when faced with a high acuity patient workload and environmental staff were mixing different waste bins together to shorten the process (18).

Completing waste audits on individual clinical wards is an opportunity to assess the supply and source of waste, and to find opportunities to facilitate change toward more sustainable practices (9).

In addition to tools like waste matrixes and waste audits, an important component of proper waste segregation is the education of frontline staff who are present on clinical wards on a daily basis (17)(9). Providing education and creating a culture where waste segregation is seen as a priority can help develop sustainable practices (9)(11). Education on clinical wards can take place through daily huddles, in-services, emails, and through daily informal communication.

The Tools for Change



RESOURCES:

- Daniels Health waste segregation matrix
- St. Michael's Hospital Biohazardous Waste Poster (St. Mike's)
- CASCADES Project Charter: Perioperative pharmaceutical waste
- Waste and Recycling Segregation Guide (SickKids)



VIDEO: Waste Segregation with Dr. Ali Abbass

ADDITIONAL RESOURCES

- [Clinical Recycling Trainer Program Guide](#) (BC GreenCare)
- [Performing Hospital Waste Audits](#) (Waste Management Healthcare Solutions)
- [PVC 123 Program Details](#) (The Vinyl Institute of Canada)
- [PVC Recycling Vinyl Council of Australia](#)
- [Recycling Streams in Theatre](#) (Green Theatres Network)





Reduce overall waste



One way to address the environmental impact of biomedical waste treatment is by addressing the overall volume of waste generated in contexts where the waste generated may be considered biomedical.

In some cases, this may mean that materials still require special handling but are diverted from the waste stream entirely, for example by reprocessing reusable devices rather than discarding single-use products.

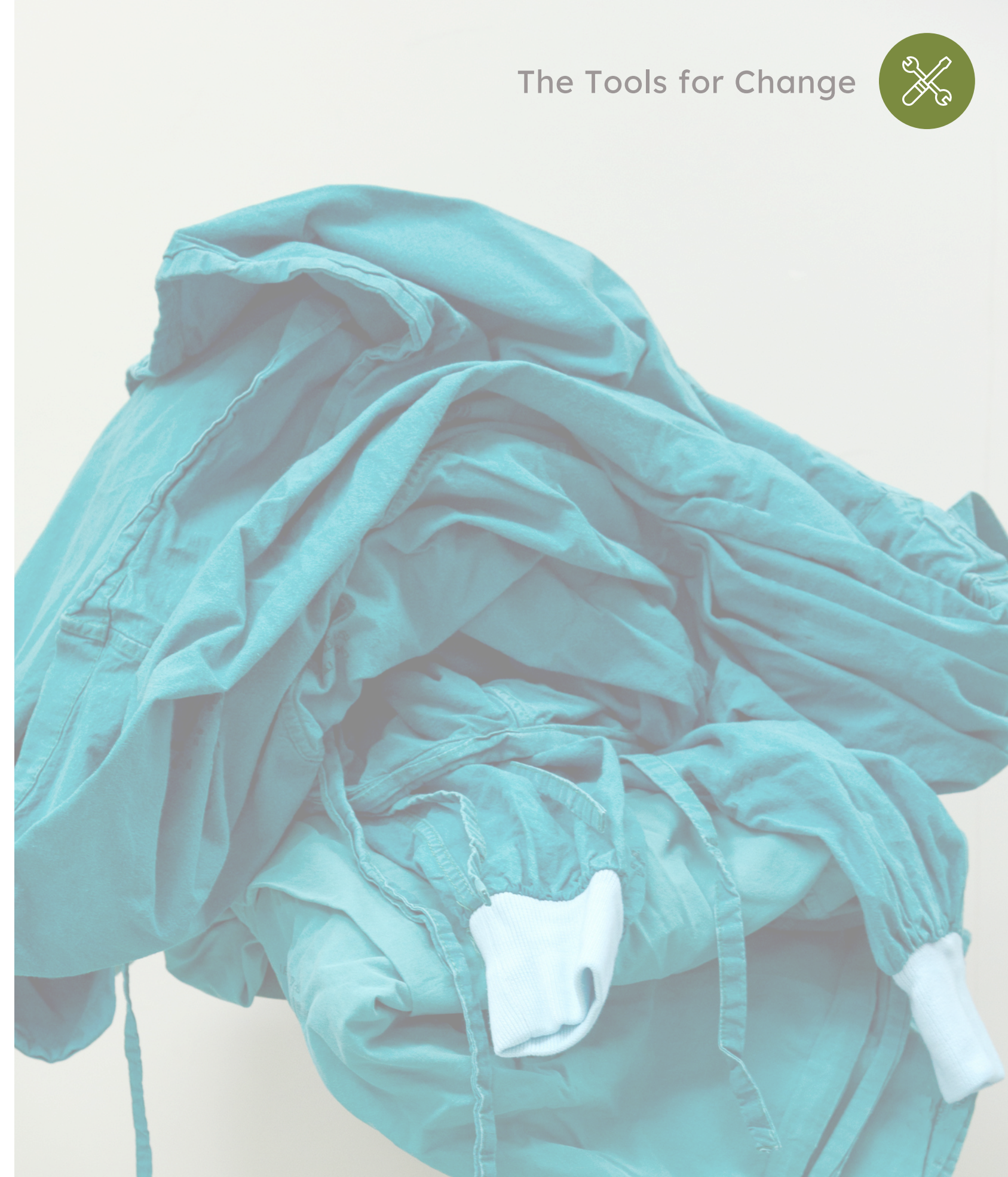
In other cases, these strategies reduce the overall volume of waste, including both biomedical and non-biomedical waste, which risks becoming contaminated or misclassified as biomedical.

In all cases, it is always important to work with clinical staff to identify opportunities, make sure they are realistic and feasible and implement them.

The strategies in this section apply to multiple types of waste, but we have selected examples that can be applied to biomedical waste.

THE 10 Rs

Institutions can implement the well-known 10Rs: Refuse, Reduce, Resell/Reuse, Repair, Reprocess, Refurbish, Remanufacture, Repurpose, Recycle and Recover. Smarter product development and use can reduce the number of products we use unnecessarily, and increase the sustainability of those we do need, thereby reducing the amount of waste generated overall.





Strategy	Explanation	Resources
Reduce unnecessary care	Reducing activity by ensuring appropriateness of care is a core component of environmentally sustainable healthcare. Insofar as each test and treatment comes at a carbon cost, finding ways to reduce their unnecessary implementation results in immediate environmental savings.	<ul style="list-style-type: none"> • Sustainable Perioperative Care playbook • Planetary Health for Primary Care toolkit • Seven Tests and Treatments to Question (Choosing Wisely Canada) • Video: The Environmental Impacts of Unnecessary Blood Tests with Dr. Karina Spoyalo • Using Blood Wisely (Choosing Wisely Canada)
Custom pack optimization	Custom packs are industry-prepared, pre-packaged, sterile bundles used for surgeries that often contain items that are not routinely used due to surgeon preference or change in practice. This leads to equipment/supplies that remain unused but are discarded due to their potential exposure to biohazardous materials. (79)	<ul style="list-style-type: none"> • Sustainable Perioperative Care playbook • Custom pack optimization project charter • Video: Optimizing Custom Packs



Choosing Wisely Canada

The [Choosing Wisely](#) initiative reconsiders the need for certain procedures to allow for more appropriate use of resources and reduce waste at the source. Clinicians and patients alike are encouraged to assess the value of using certain tests and care.





Strategy	Explanation	Resources
Switching from single-use to reusables	Studies comparing SUDs and reusables identify opportunity for both environmental and cost savings by using reusable devices. (59) For some products, options exist to use a reusable device rather than a single use device (e.g., laryngoscopes). However, reusable devices require reprocessing to ensure adequate infection control. (60) Reprocessing can also enable products labeled as single-use devices to be reused multiple times, either for the same or a different purpose.	<ul style="list-style-type: none">• Sustainable Perioperative Care playbook• Planetary Health for Primary Care toolkit

Synergie Santé Environnement

Further examples of waste reduction strategies can be found at [Synergie Santé Environnement](#), who created a micro-website dedicated to waste management in institutions. The information sheets for biomedical and pharmaceutical waste (2019) raise awareness on waste management practices in accordance with the 3RV-E principles (source reduction, reuse, recycling, valorisation, and elimination).





Strategy	Explanation	Resources
Sustainable Kidney Care	One facility audit reported 2.5 kg of total clinical waste generated per hemodialysis treatment and 1.69 kg of total clinical waste generated per 24 hour of peritoneal dialysis therapy (7), and cumulative waste production per patient per year is 390kg (7).	<ul style="list-style-type: none"> • Sustainable Kidney Care playbook
Waste reduction in inpatient inhalers	Efforts have been made to increase the number of times a single-use device can be used, thereby keeping products in circulation for as long as possible. Through a highly regulated process called device reprocessing (or “remanufacturing”), single-use devices that have been used are taken apart, rebuilt, then used again. As of September 2017, Health Canada approves commercially remanufactured devices according to the same standards by which it assesses virgin devices.(85)	<ul style="list-style-type: none"> • Climate Conscious Inhaler Practices in Inpatient Care Playbook





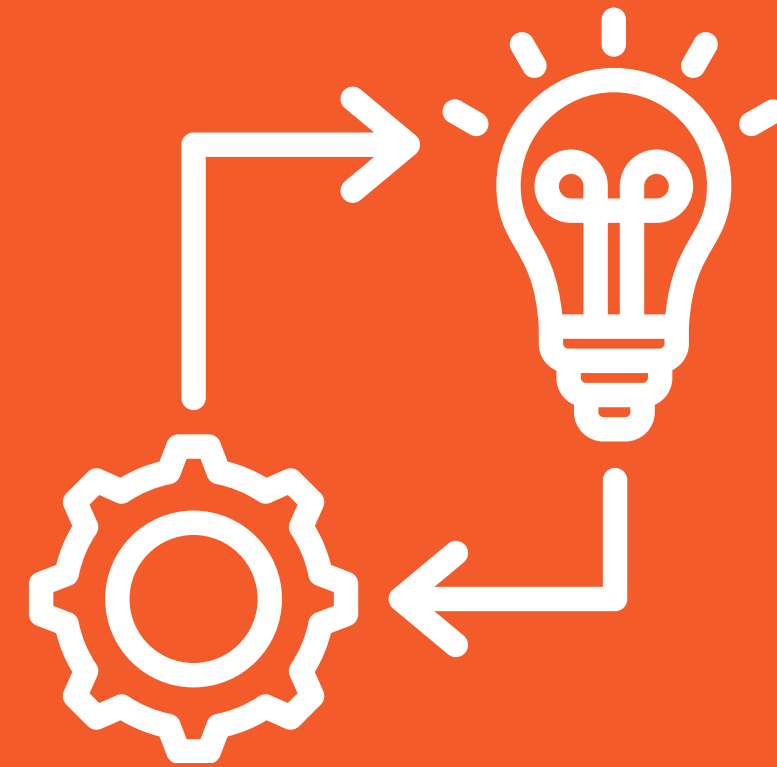
Strategy	Explanation	Resources
Device remanufacturing	Even seemingly small changes in how things are done can result in meaningful, large-scale reductions in inhaler waste and associated greenhouse gas emissions	<ul style="list-style-type: none"> • Sustainable Perioperative Care playbook • Device remanufacturing project charter • Video: Device Remanufacturing with Laurie Thomas • Video: Device remanufacturing with Dr Laura Donahoe
Extended producer responsibility	In some provinces, regulations require producers to take responsibility for end-of-life products, particularly pharmaceuticals and sharps.	<p>British Columbia</p> <ul style="list-style-type: none"> • Environmental Management Act Recycling Regulation: Part 2: Extended producer Responsibility Plans and Part 3: Extended Producer Responsibility Program Requirements if No Extended Producer Responsibility Plan <p>Ontario</p> <ul style="list-style-type: none"> • O.Reg 298/12 Collection of pharmaceuticals and sharps – responsibilities of producers <p>Quebec</p> <ul style="list-style-type: none"> • Regulation: Règlement sur la récupération et la valorisation de produits par les entreprises • Recyc-Quebec related page: Responsabilité élargie des producteurs <p>New Brunswick</p> <ul style="list-style-type: none"> • Regulation: Responsabilité élargie des producteurs • Recycle NB related page: Pharmaceutical Products and Medical Sharps - Overview <p>Prince Edward Island</p> <ul style="list-style-type: none"> • Environmental protection act materials stewardship and recycling regulations

Recycling

For general waste, when purchasing items, preference should be given to those products that are reusable, contain recycled material, or are themselves recyclable. Considerations should be given to the cost of the disposal (25). Paper and packaging should be segregated from biomedical and cytotoxic waste to avoid contamination and requirement of more intensive waste treatments.

Recycling programs such as the medical PVC recycling initiative [PVC 123](#) can be available. For example, IV bags can be recycled through this program.





HOW

The Strategy for Change

- 1 Build relationships with landfills, waste haulers and other vendors
- 2 Re-think the culture of overpreparedness
- 3 Education-mobilization campaigns





Build relationships with landfills, waste haulers and other vendors

While optimal waste segregation ideally will limit intensive disposal methods like incineration to only what waste is truly biomedical according to applicable policies and regulations, in practice, success depends in part on what will be accepted by landfills and other waste management vendors.

For example, some operators may refuse materials that appear to have blood on them, even if these materials are permissible by regulations. Others may interpret regulations as saying that all waste generated in healthcare settings is biomedical. Given the serious implications of being banned entirely from the local landfill, building and maintaining mutual understanding is key.

STRATEGIES

- Set up meetings, training, and site visits.
- Check ahead; agreements with landfills sometimes need to be formalized in written documents specifying what is accepted and what is not.



RESOURCES:

- List of provincial contacts for waste policy (coming soon!)
- [Building Partnerships with Stakeholders](#) (Government of Northwest Territories)
- [Building Partnerships with Stakeholders](#) (BC Public Service)
- [Government of the Future Series: Working Collaboratively with Stakeholders](#) (Canada School of Public Service)



VIDEO: Follow the Waste with Dr. Ali Abbass





Re-think the culture of overpreparedness

A culture of over-preparedness, although well intentioned, can be a large contributor to waste (38). Over-preparedness occurs because healthcare professionals such as nurses, physicians, and respiratory therapists are often trained and expected to be prepared in case of an emergency.

This is apparent in high acuity settings, such as Intensive Care Units (ICUs) and Emergency Departments (EDs), where most decisions are anticipatory, and supplies and equipment must be readily available in the event of a deteriorating patient (38). Some practitioners may adopt the habit of opening supplies at the bedside to have easy access.

However, this over-preparative practice comes at a cost: the infection control regulations from Infection Prevention and Control Canada state that all opened items—even those that have gone unused—must be disposed of when the patient is discharged or transferred and before a new patient enters the room (29,38). These regulations, which are aligned with other international regulations, help to inform hospital policies and can further drive needless waste production (39).

Adapted from CASCADES' [Ward Waste primer](#)
(Navisha Weerashinge, 2022)





Education-mobilization campaigns

Practice change can start by educating staff involved in every stage, from procurement to waste supplies, that certain items can be disposed of in general waste and recycling.

Waste management should be a part of employee training and regularly reinforced. Education should include facility procedures for reduction, segregation, collection, packaging, colour coding, labelling, storage and in house movement of waste (40).

In particular, education on sorting hazardous waste is required to efficiently manage waste in healthcare settings (13). According to Canadian hospital administrators, the increased volume of medical waste that is disposed of as biomedical is due to poorly understood definitions of hazardous waste categories; improper segregation of biomedical waste from non-biomedical waste; and inadequate staff training on how to handle and dispose of biomedical and pharmaceutical waste (24). For these reasons, healthcare providers tend to err on the side of caution when deciding how to dispose of hospital waste, which increases the volume of general waste disposed of as biomedical (41).

Effective sorting is advantageous for both cost savings and emissions reduction associated with incineration and sterilization processes.

Waste audits should be completed regularly, with review from all departments on waste generation and assessments of where waste reductions can occur. Employees should be educated and engaged to generate ideas in this area.

Adapted from CASCADES' [Ward Waste primer](#) (Navisha Weerashinge, 2022)



RESOURCES:

- [Safe management of wastes from health-care activities: Second edition \(WHO 2014\)](#)
- [Daniels Biomedical Waste Poster](#)
- [Biomedical Waste posters \(BCGreenCare in collaboration with Stericycle\)](#)
- [Performing Hospital Waste Audits \(Waste Management Healthcare Solutions\)](#)
- [Clinical Recycling Trainer Program Guide \(BC GreenCare\)](#)
- [Performing Hospital Waste Audits \(Waste Management Healthcare Solutions\)](#)





References

1. Rutala WA, Mayhall CG. Medical waste. *Infection Control and Hospital Epidemiology*. 1992 Jan; 13(1): 38-48.
2. Romanelli M, Napoli C, Green C. The 2023 report of the Lancet Countdown on health and climate change: the imperative for a health-centred response in a world facing irreversible harms. *The Lancet*. 2023 Dec 16; 402(10419): 2346-2394.
3. Canadian Coalition for Green Health Care. Green Hospital Scorecard 2019 Report. Canadian Coalition for Green Health Care; 2021.
4. Innovation and Economic Development Canada. Canadian Industry Statistic - Summary. ; 2022.
5. Canadian Standards Association. Guidelines for the management of biomedical waste in Canada. Guidelines. Canadian Council of Ministers of the Environment; 1992.
6. World Health Organization. Health-care waste fact sheet. [Online].; 2018 [cited 2023 11 25]
7. Rizan C, Bhutta M, Reed M, Lillywhite R. The carbon footprint of waste streams in a UK hospital. *Journal of Cleaner Production*. 2021 Mar 01; 286: 125446.
8. Zikhatile T, Atagana H, Bwapwa J, Sawtell D. A Review of the Impact That Healthcare Risk Waste Treatment Technologies Have on the Environment. *International Journal of Environmental Research and Public Health*. 2022 Sep 22; 19(19): 11967.
9. Birchard K. Out of sight, out of mind. the medical waste problem. *The Lancet*. 2002 Jan 05.
10. Walkinshaw E. Medical waste management vary across Canada. *CMAJ*. 2011 Dec 03; 183(18): 1307-1308.
11. National Research Council (US) committee on Health Effects of Waste incineration. *Waste Incineration and Public Health*. National Academies Press. 2000;: 336.
12. Singh N, Ogunseitan OA, Tang Y. Medical Waste: Current challenges and future opportunities for sustainable management. *Critical reviews in Environmental Science and Technology*. 2022 Jun 03; 11(52): 2000-2022.
13. Windfeld ES, Brooks MSL. Medical waste management - A Review. *Journal of Environmental Management*. 2015 Nov 01; 163: 98-108.
14. Weiss A, Hollandwirth HM, Alseidi A, Scoval L, French C, Derrick EL. Environmentalism in surgical practice. *Current Problems in Surgery*. 2016 Apr 01; 1(17): 165-205.
15. Klansin P, Harding AK. Medical Waste Treatment and Disposal Methods Used by Hospitals in Oregon, Washington and Idaho. *Journal of the Air and Waste Management Association*. 06 Jan; 6(48): 516-526.
16. Lee BK, Ellenbecker MJ, Moure-Ersaso R. Alternatives for treatment and disposal cost reduction of regulated medical Wastes. *Waste Management*. 2004; 2(24): 143-151.
17. Health Canada. Infection Control Guidelines: Classic Creutzfeldt-Jakob Disease in Canada. *Canada Communicable Disease Report*. 2002;(1188-4169).
18. Health Care without Harm Europe. Non-incineration medical waste treatment technologies in Europe. A resource for hospital administrators, facility managers, health care professionals, environmental advocates, and community members [Internet].; 2013.
19. Canadian Council of Ministers of the Environment. About-. [Online].; 2024 [cited 2024 01 01].
20. Braschi C, Tung C, Chen KT. The impact of waste reduction in general surgery operating rooms. *American Journal of Surgery*. 2022 Dec; 224(6): 1370-1373.
21. Wyssusek KH, Keys M, Van Zundert AAJ. Operating room greening initiatives - the old, the new, and the way forward: A narrative review. *Waste management & research: the journal of the International Solid Wastes and Public Cleansing Association, ISWA*. 2019 Jan; 37(1): 3-19.
22. Goldberg ME, Vekeman D, Torjman MC. Medical waste in the environment: do anesthesia personnel have a role to play? *Journal of Clinical Anesthesia*. 1996 Sep;: 475-479.
23. Kagoma Y, Stall N, Rubinstein E, Naudie D. People, planet and profits: the case for greening operating rooms. *CMAJ : Canadian Medical Association Journal*. 2012 Nov 20; 184(17): 1905-1911.
24. Walkinshaw E. Too much of a good thing? *CMAJ*. 2011 Dec 13; 183(18).
25. Chamberlain M. Healthcare waste segregation. [Online].; 2018 [cited https://www.danielshhealth.com/knowledge-center/healthcare-waste-segregation.
26. Gobardhan R. Investigating waste diversion opportunities during the terminal cleaning of vacated patient rooms at the Toronto Western hospital. *University Health Network*; 2011.
27. Bdour A, Altrabsheh B, Hadadin N, Al-Shareif M. Assessment of medical wastes management practice: A case study of the northern part of Jordan. *Waste Management (Elmsford)*. 2007; 6(27): 746-759.
28. Grose J, Bennallick M, Nichols A, Pahl S, Richardson J. How can behaviour change theory contribute to a reduce, re-use and recycle approach to waste management in the NHS: a feasibility study. *Sustainability*. 2011;: 1-8.
29. Hsu S, Theil C, Mello M, Slutzman J. Dumpster diving in the Emergency Department: Quantity and Characteristics of Waste at a Level I Trauma Center. *The Western Journal of emergency medicine*. 2020; 5(21).
30. Church R, Briggs D, Tran V. Climate emergency: Towards a greener emergency department. *Emergency medicine Australasia*. 2019; 2(31): 274-275. *of Surgery*. 2013 Apr;(94): 46-55.





31. Grundy Q, Krasik O, Meleca N, Mills N, Nour S, Whalem E. Beyond engagement: Realizing Nurses' Capacity to Lead Sustainable Health Systems. *Healthcare Paper*. 2020; 3(19): 67-73.
32. Johnston L. Reducing Patient Supply Waste Through Nurse Education to Improve Quality of Patient Care in the Clinical Microsystem. *Master's Projects and Capstone*. 2017 May;(25).
33. Stall N, Kagoma Y, Bondy J, Naudie D. Surgical waste audit of 5 total knee arthroplasties. *Canadian Journal*
34. Stigant C, Nour S, Finkle N, Devitt K. Sustainable Kidney Care. *CASCADES (Creating a Sustainable Canadian Health System in a Climate Crisis)*.
35. McGain F, Story D, Lim T, McAlister S. Financial and environmental costs of reusable and single-use anaesthetic equipment. *Br J Anaesth*. 2017 Jun; 6(118): 862-869.
36. Rizan C, Mortimer F, Stancliffe R, Bhutta M. Plastics in healthcare: time for a re-evaluation. *J R Soc Med*. 2020 Feb; 2(113): 49-53.
38. Ghersin ZJ, Flaherty MR, Yager P, Cummings BM. Going green: decreasing medical waste in a paediatric intensive care unit in the United States. *The New Bioethics*. 2020; 2(26): 98-110.
39. Aljabre SHM. Hospital generate waste: A plan for its proper management. *Journal of family and Community Medicine*. 2002; 5(61).
40. Garcia R. Effective cost-reduction strategies in the management of regulated medical waste. *American Journal of Infection Control*. 1999; 27(2): 165-175.
41. Almuneef M, Memish Z. Effective medical waste manadement: it can be done. *American journal of Infection Control*. 2003 May;; 188-192.



About this playbook

LEAD AUTHORS

- Sarah Machane, Innovation Lead (Quebec) - CASCADES
- Cate MacLeod, Communications and Events Lead - CASCADES
- Ivy Lam, Pharmacy Innovation Lead - CASCADES; University of Toronto Leslie Dan Faculty of Pharmacy; Unity Health Toronto

WORKING GROUP MEMBERS

- Allen Bridge, Provincial Lead, Waste Management and Sustainability - Alberta Health Services
- Ali Abbass, Anesthesiologist, St Joseph's Health Centre (SJHC), Unity Health Toronto
- Victoria Brzozowski, Environmental Management Lead - Hamilton Health Sciences

GRAPHIC DESIGN by Luz A. Paczka Giorgi

Version 1.1. Published Oct 1, 2024.

This document will be reviewed for future updates and we welcome your feedback. Please send any comments or recommendations to cascades@utoronto.ca or opt-in to our knowledge product surveys.

Materials created by CASCADES are shared under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International Public License (CC BY-NC-SA 4.0) and you may use these materials according to the terms and conditions of the CC BY-NC-SA 4.0 license. Read more about CASCADES' intellectual property policies.

While it is not a requirement under the license, we would be grateful if you would let us know where and how you share or adapt our materials so we can see and learn from how they are used.

This playbook, or the associated resources, may reference services and/or product offerings from specific suppliers. The inclusion of such mentions or links should not be interpreted as an endorsement by CASCADES of any product or service.

