PROJECT CHARTER

Biomedical Waste Management

Developed in collaboration with:
Dr. Syed Ali Akbar Abbass and Ivy Lam, St. Joseph's Health Centre
Dr. John Vecchio, London Health Sciences Centre
Allen Bridge, Provincial Lead, Alberta Health Services

Team members: Operating Room teams and Administrators

Executive Sponsor:

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Due to the complexity of this issue, this charter is a working version.

A modifiable PPT version of this project charter can be downloaded to be applied to your own healthcare setting. To access all downloadable project charters featured in this playbook, click here.

Please contact CASCADES@utoronto.ca if you have any questions or suggestions to improve the contents of this charter.

NAVIGATION

Goal & Scope

1 What do you want to achieve?

Reduce volume of biomedical waste from the perioperative care areas by ___% in the next ___ months to reduce the amount of waste unnecessarily sent for carbon-intensive incineration or sterilization.

2 Define the limits of what you want to be included in the project and consider the environmental impacts you are targeting for change.

Project Scope: All waste generated within the perioperative care areas.

Emission Scope: Scope 3; these emissions arise from activities or products that are related to health sector activities, but not owned or controlled by the organization, such as pharmaceuticals and other medical products and devices

Problem/Opportunity Statement

3 Briefly state the problem you want to solve or the opportunity you want to realize.

Waste generated in healthcare facilities in Canada is commonly misclassified or incorrectly disposed of as biomedical waste; this type of waste must be treated using incineration or sterilization. Incineration is only required for the treatment of certain biomedical wastes, such as pharmaceutical, cytotoxic and pathological waste. Sterilization, most commonly autoclave steam sterilization, may be used to dispose of all other biomedical waste (1). Improper waste segregation results in the overutilization of these carbon intensive processes. Moreover, the mixing of general waste into biomedical waste unnecessarily increases waste hauling fees (2).

This is an issue with particular significance for ORs, which generate up to 30% of all hospital waste. Within the OR, waste must be segregated into waste streams for appropriate disposal (2, 3). Unfortunately, a large volume of OR non–hazardous waste is unnecessarily discarded into the biomedical waste stream (4). For example, a team of perioperative nurses in a large urban hospital in the United States conducted a "Red Bag Receptacle" content evaluation following one day of surgery for abdominal aortic aneurysm endograft procedures and found that, by weight, up to 92% of discarded biomedical waste was non–hazardous (4).

The environmental consequences of biomedical waste treatment via incineration or sterilization are significant. Incineration involves burning waste at high temperatures to produce residual ash, which can then be disposed of in a municipal solid waste landfill (5). Although incineration decreases the volume of waste and ensures sterilization, it can also release toxins such as dioxins, furans, and mercury, in addition to carbon dioxide, into the atmosphere (5,6). These atmospheric toxins are harmful to human health and the environment. For example, atmospheric mercury, which is released from incineration, poses a risk to the health of human nervous, excretory, and reproductive systems, as well as posing environmental risks (5).

Problem/Opportunity Statement

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Autoclaving refers to the sterilization of biomedical waste using dry heat or steam to kill microbial contamination. After sterilization, waste can be disposed of in a municipal solid waste landfill (5,7). Compared to incineration, autoclaving does not release dioxins, furans, or mercury into the atmosphere, making it a more suitable method to decrease emissions (8). However, unlike incineration, autoclaving does not reduce the volume of waste or alter the appearance of the waste, which can lead to waste being re-treated through incineration as some communities are reluctant to allow non-incinerated biomedical waste to be landfilled (5).

The large volume of waste that is incorrectly disposed of in the biomedical waste stream in healthcare facilities has been attributed to several factors, including poorly understood definitions of waste categories, improper segregation of waste, and inadequate staff training on how to handle and dispose of biomedical waste (2). Disposing of biomedical waste is an expensive and polluting process (1,5,9,10). Therefore, implementing proper waste segregation measures can reduce both the fiscal and environmental impacts of hospital waste.

NOTE: In some regions, landfills do not accept healthcare waste, including shredded autoclaved waste. Health authorities have no alternative but to resort to incineration for general waste disposal. This highlights the critical importance of establishing appropriate waste management facilities and strategies tailored to the unique needs of each locality.

Current State of the System/Process

4 What do things look like today?

- Waste is generated during the course of a surgery and disposed of in the bags or bins provided within the OR (e.g., landfill, recycling, biomedical, sharps, cytotoxic, pharmaceutical)
- Biomedical waste includes:
  - Countables: these are items that go into a patient and need to be removed before the patient is closed
  - Single use items soaked in blood
    - *Note: Public Health Ontario's guidelines state that materials such as dressings, empty intravenous (IV) bags, tubings, and personal protective equipment (PPE) that will not release liquid or semi-liquid blood, if compressed, can be sent to general waste streams, while any materials that will release liquid blood if compressed, as well as needles that have come into contact with blood, must be sent to the biomedical waste disposal stream (1).*
- Most healthcare facilities have waste disposal guidelines/policies that dictate all biomedical waste should go in specific colored bags or bins.
  - *Note: Biomedical waste in Ontario is generally collected in yellow coloured plastic bags or reusable bins.*
- Once the procedure is over and the final count of the countables is completed, the bag or bin containing the biomedical waste is removed from the OR.
  - Any biomedical waste disposed of in the non-hazardous waste bag or bins ends up contaminating that waste stream (e.g., landfill or recycling)

Current State of the System/Process

4 What do things look like today?

- If the healthcare facility produces enough waste, biomedical waste is stored in freezers on site, otherwise it is stored in a centralized location until pick-up
- Biomedical waste is picked up by a waste management company for treatment
  - In Canada, third-party waste management companies are contracted by hospitals to collect, handle, and transport biomedical waste to centralized provincial facilities (11,12, 13). At these provincial facilities, waste is either sterilized using methods such as autoclaving, or incinerated, depending on the facility (14).
  - Any non-hazardous waste disposed of in the biomedical waste bags or bins is also incinerated or sterilized.

Root Cause Analysis

5 What gets in your way?

Education & Awareness

- There are inconsistent definitions of what constitutes biomedical waste requiring incineration or sterilization (5).
- There is a lack of awareness of the cost and environmental implications of incorrect waste segregation.

Clinical Workflow

- Usually due to a lack of time, staff put waste in the bag closest to them.
  - Large waste bags can lead to inappropriate waste disposal by making it easy to dump everything into one easily accessible bag.
- Regulations and guidance for biomedical waste management are variable across Canadian jurisdictions, and many do not maximize opportunities for environmental sustainability (e.g., blood–saturated items) (1).
  - Internal waste disposal guidelines are not always consistent with provincial guidelines, resulting in non–hazardous waste being added to the biomedical bins.
  - Creating new guidelines around biomedical waste management is a multidisciplinary decision that affects multiple areas of the hospital outside the OR; it can be difficult to engage all the necessary stakeholders.

Root Cause Analysis

5 What gets in your way?

Infrastructure

- Many hospitals use colored plastic bags (e.g., yellow) instead of biomedical waste bins, which are more effective at promoting proper waste segregation. According to the Ontario biomedical waste guidelines, these bins should be hard, rigid, and sealed (17).
    - Bins are only one size, which can be too large for some institutions.
    - Bins are only offered in one color, which can cause confusion if they are similar to existing waste bins
    - Policies requiring biomedical waste bins containing countables to be removed after each surgical case is a barrier to the replacement of bags with reusable bins.
        - Requires bins to be stored outside of ORs, which is not always viable due to lack of space.

Finances & Procurement

- The cost of reusable bins is higher than plastic bags/bin liners (e.g., M64 bins). These bins are not owned by the hospital. They are provided by the vendor, used and replaced.

Design the Improvement & Define Change Ideas

6 What are your ideas to achieve your goals, address your root causes and close the gap from your problem statement?

Education & Awareness

- Conduct a **waste audit** to determine (and raise awareness of) the extent of inappropriate waste disposal (by weight &/or by item type)
- Incorporate education on proper waste segregation into onboarding and ongoing staff education
- Put posters on or close to the receptacle that show which items should go in the biomedical waste bags or bins **(Resource: St. Michael's Hospital Biohazardous Waste Poster)**

Clinical Workflow

- Involve occupational health and infection prevention and control as primary stakeholders from the beginning to gain their support for any changes to biomedical waste handling policies
  - Create green teams that include occupational health and infection prevention and control
- Counting policies will need to be revisited if bins are to be kept in the room between cases (involves incorporating OR nursing educator/manager, all team members)
  - Bins can always be stored outside of ORs and brought in during changeovers if counting policies cannot be changed
- Create an organizational policy that clearly defines biomedical waste and supports environmental sustainability (e.g., specifying that only items soaked in blood are considered biomedical waste). **(Resources: Legal brief on Hazardous Medical Waste Regulations in Canada; CASCADES Hazardous Medical Waste Primer)**

Design the Improvement & Define Change Ideas

6 What are your ideas to achieve your goals, address your root causes and close the gap from your problem statement?

Infrastructure

- Implement visually distinctive biomedical waste bins that encourage staff to actively consider where to put their waste.
- Standardize bins across ORs, units, and clinical areas.

Finances & Procurement

- Cost benefit analysis for the expense of reusable linerless bins instead of plastic bags.
  - Measure over time as upfront cost will be greater than the purchasing of bags.
  - Include cost savings due to reduced waste hauling fees.

Measure & Test Impact

7 How will you estimate the environmental impact of your changes?

Activity/Outcome Metric

1. **Weight of biomedical waste (in kg) generated per month**
2. **Difference in weight from previous month**

Source(s):
- Waste-audit
- Waste hauler data
- Financial data (waste hauling fees)

Considerations:
- For 1. A monthly count of the number of bags/bins of biomedical waste will also be sufficient if you can obtain an average weight per bag/bin from the waste hauler or your own waste audit
- For 2. It is assumed that this waste is still being generated, but is now being disposed of in the regular waste stream
- Monthly counts are recommended to observe progress, but data can be processed for any given time frame.

Related Environmental Metric

1. **1.833 kgCO2e/kg for hazardous waste (incineration)**
2. **1.190 kgCO2e/kg for regular waste (incineration)**

OR

0.461 kgCO2e/kg for regular waste (autoclaving then landfilling)

Source(s):
- 1. MacNeill, Lillywhite, and Brown, 2017(15)
- 2. Zhao, Wei, et al., 2009 (16)
- All metrics adapted from kg CO2e/tonne

Considerations:
- The above metrics may have limited applicability to any one site (especially given the variability in distance from site to waste treatment facility)

ENVIRONMENTAL IMPACT

- Calculation 1 should give you an estimate of the environmental impacts associated with your biomedical waste generation
- However, the waste you have removed from the biomedical waste stream will still produce emissions when it is treated as regular waste. Therefore, in order to get a sense of actual environmental savings associated with improved biomedical waste management practices, you should subtract your result for #2 from your result from #1

Considerations:
- There should be a REDUCTION in both numbers over time as biomedical waste management practices improve
- Use the Natural Resources Canada Greenhouse Gas Equivalencies Calculator to translate your results to stakeholders.

Embed & Spread

8 What steps have been taken to ensure lasting change? How could it be spread to other contexts?

Micro (What can you do?)
- Create educational materials, such as a waste disposal chart, for clinical areas.
- Embed education in all OR new staff orientation and onboarding (nursing, surgery, anesthesia, and care attendants).
- Identify environmental champions within the OR that can educate staff in the moment on correct waste segregation.

Meso (What can you do within your organization?)
- Advocate to create a hospital wide waste segregation policy.
- Obtain buy-in from executive/senior leadership for accountability on an organizational level.

Macro (What can your organization do?)
- Lobby for vendors to make hard-sided biomedical bins more affordable and customizable for individual organizations (e.g., having smaller sizes and more colour options).
- Lobby government to better understand what is considered biomedical vs pharmaceutical waste.
- Advocate for Accreditation Canada to have a sustainability section to audit hospitals.

References

(1) Walkinshaw E. Too much of a good thing? Canadian Medical Association Journal. 2011 Nov 21;183(18):E1309–10.

(2) Kagoma Y, Stall N, Rubinstein E, Naudie D. People, planet and profits: the case for greening operating rooms. Canadian Medical Association Journal. 2012 Jun 4;184(17):1905–11.

(3) Tieszen ME, Gruenberg JC. A quantitative, qualitative, and critical assessment of surgical waste. Surgeons venture through the trash can. JAMA. 1992 May 27;267(20):2765–8.

(4) Laustsen G. Reduce–Recycle–Reuse: Guidelines for Promoting Perioperative Waste Management. AORN journal. 2007;85(4):717–28.

(5) Windfeld ES, Brooks MS–L. Medical waste management – A review. Journal of Environmental Management. 2015 Nov;163:98–108.

(6) Weiss A, Hollandsworth HM, Alseidi A, Scovel L, French C, Derrick EL, et al. Environmentalism in surgical practice. Current Problems in Surgery. 2016 Apr;53(4):165–205.

(7) Klangsin P, Harding AK. Medical Waste Treatment and Disposal Methods Used by Hospitals in Oregon, Washington, and Idaho. Journal of the Air & Waste Management Association. 1998 Jun 01; 48(6): 516–526.

(8) Lee BK, Ellenbecker MJ, Moure–Ersaso R. Alternatives for treatment and disposal cost reduction of regulated medical wastes. Waste Management. 2004; 24(2): 143–151.

(9) Glauser W, Petch J, Pendharkar S. Are disposable hospital supplies trashing the environment? [Internet]. Healthy Debate. 2016. Available from: https://healthydebate.ca/2016/08/topic/hospital–medical–waste/

References

(10) Xia YF. The Natural History of Medical Waste. McMaster University Medical Journal. 2020 Dec 26;17(1).

(11) Birchard K. Out of sight, out of mind … the medical waste problem. The Lancet. 2002 Jan;359(9300):56.

(12) Walkinshaw E. Medical waste-management practices vary across Canada. Canadian Medical Association Journal. 2011 Nov 21;183(18):E1307–8.

(13) National Research Council. Waste Incineration and Public Health [Internet]. nap.nationalacademies.org. The National Academies Press; 1999. Available from: https://nap.nationalacademies.org/catalog/5803/waste-incineration-and-public-health.

(14) National Research Council (US) Committee on Health Effects of Waste Incineration. Waste Incineration & Public Health. Washington (DC): National Academies Press; 2000.

(15) MacNeill AJ, Lillywhite R, Brown CJ. The impact of surgery on global climate: a carbon footprinting study of operating theatres in three health systems. The Lancet Planetary Health. 2017;1(9):e381–8.

(16) Zhao W, van der Voet E, Huppes G, Zhang Y. Comparative life cycle assessments of incineration and non-incineration treatments for medical waste. The international journal of life cycle assessment. 2009;14(2):114–21.

(17) Government of Ontario. (2021). C-4: The Management Of Biomedical Waste In Ontario. Available from: https://www.ontario.ca/page/c-4-management-biomedical-waste-Ontario. Last accessed April 13, 2023.