BOSTON MEDICAL CENTER

Waste Audit Guide for Pharmacy Settings

Prepared by: Anna Goldman,[1] Cassandra Thiel,[2] and Stephanie Tsacogianis,[1]
[1] Boston Medical Center
[2] Clinically Sustainable Consulting

Waste Audit Guide for Pharmacy Settings

Introduction

Waste audits provide data to support waste reduction efforts, regulatory compliance, financial and sustainability improvements, and emissions reporting. This guide is designed to support the implementation of detailed, manual audits of pharmaceutical products and associated waste. The guide was developed in 2025, the first year of Boston Medical Center's Pharmacy Waste Reduction Initiative, a collaboration with Takeda Pharmaceuticals. The guide outlines the key steps, vendor coordination tips, and data collection protocols to capture accurate and actionable waste data, including emissions modeling and pharmaceutical packaging insights. The guide reflects learnings from real-world audits conducted at BMC in 2025.

STEP 1 Specify the Goals of Your Pharmacy Waste Audit

A pharmacy waste audit can be conducted with varying levels of intensity (Figure 1), ranging from observational to quantitative, and from high-level summaries using existing data to detailed, manually collected data. This document provides guidance on conducting a comprehensive manual audit: approach #6 in Figure

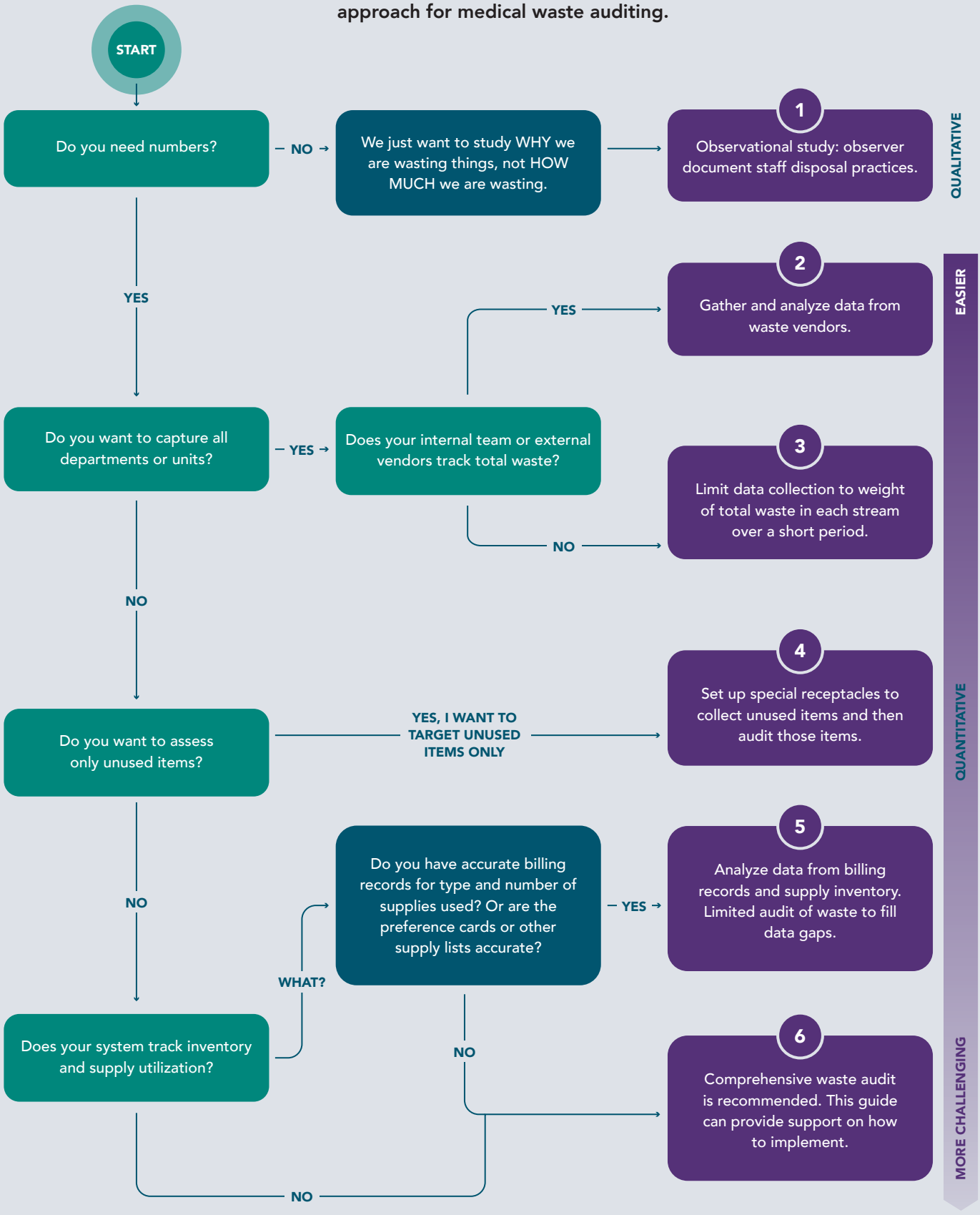
The first step when considering a pharmacy waste audit is to clarify your purpose and goals (see Figure 1). Relevant questions that can be answered with an audit include:

- Where are the hotspots of waste generation at your site?
- Are you recycling as much as you could be?
- How much waste (and from which waste stream) is correctly vs. incorrectly sorted?
- Are there safety or compliance concerns with current disposal patterns?
- What are the greenhouse gas emissions associated with the waste at your site?
- Are specific procurement or operational practices leading to inefficiencies and higher waste generation?
- How much product is unused and/or expired?
- To what extent is shipping waste a concern in addition to the waste generated in the pharmacy?
- Why and where is certain waste generated (this may require an observational approach in addition to manual audits)?
- Where are the opportunities to reduce waste and greenhouse gas generation?

The remainder of this guide details the steps in conducting a comprehensive audit. A comprehensive audit can answer all of the above questions, but you may choose to narrow your scope, which allows for a less resource and time-intensive audit.

Waste Audit Guide (Figure 1)

Use this guide to help identify your goal, scope, and approach for medical waste auditing.



STEP 2 Plan the Pharmacy Waste Audit

1. **Determine the audit site(s):** Strategically select the departments, units, and/or waste streams that will be audited. Ensure the site(s) you select generate all waste streams which you desire to audit. One approach to selection is to start with areas that generate high volumes of packaging and other waste. Another approach is to focus on areas that generate high waste expenses. A third approach is to select a site where product stocking/handling/use inefficiencies are suspected.
2. **Select an appropriate timeframe for the audit:** Select a defined amount of time during which waste is collected for auditing. This may be one hour, one day, or one week depending on the volume of waste generated at the audit site and the goal of the audit. The timeframe should be selected to create a snapshot of average or 'typical' waste generation patterns. For example, a holiday week may not be representative of a non-holiday week and may be avoided for auditing purposes.

STEP 3 Staff Roles, Space, and Tools

1. Identify relevant teams. In many settings, different teams are responsible for individual waste streams. For example, housekeeping staff may be responsible for municipal solid waste and recycling. Environmental Health and Safety teams may be responsible for hazardous and non-hazardous drug waste. Outside vendors may be responsible for sharps, regulated medical waste, items containing Protected Health Information, or take-back streams like single-use device reprocessing or expired drugs.
2. Decide if waste sorting and waste data collection will be outsourced or performed in-house. In most cases, engaging an outside vendor simplifies the process but adds cost. However, you should check with your contracted waste vendors to ascertain whether auditing of the waste streams they manage is included in your contract.
   - If outsourcing, engage a licensed waste vendor to do the sorting and data collection. Ensure the vendor can safely sort and weigh multiple waste streams, document pharmaceutical packaging layers, and supply calibrated scales that measure to 0.1 grams. Confirm vendor scope and cost in writing. Before commencing, align on deliverables; exact services to be provided (sorting, weighing, documentation, analysis); timelines; and cost estimates.
   - If conducting audits in-house, designate clear roles. See Table 1.
3. If conducting audits in-house, identify a location with adequate space to sort significant volumes of waste. Ensure the space is ventilated, as pharmaceutical waste can have associated odors.
4. For in-house audits, the following materials are required: PPE gowns; protective eyewear; puncture-proof gloves; tongs for handling waste, and a scale that scale that measures to at least 0.1 grams.

Table 1: Key Roles and Training Requirements

KEY ROLES TO ASSIGN	TRAINING REQUIREMENTS
• Waste sorters • Data recorders • Pharmacy liaisons (coordinating with pharmacy staff) • Project manager (overseeing the entire audit process, ensuring safety)	• Hands-on practice with sample materials • Waste classification training • Data entry protocols • Safety procedures and emergency protocols • Equipment operation (scales, documentation tools)

STEP 4 Understand Types of Waste

Understand the relevant waste streams (Table 2) and packaging types (Table 3). For the audits conducted at BMC, collaboration included regulated medical waste, municipal solid waste (MSW)/recycling, chemo waste, non-hazardous and hazardous pharmaceuticals, and Personal or Private Health Information (PHI) Prescription Bottles Secure Destruction.

Table 2: Waste Streams Found in a Typical Pharmacy Setting

REGULATED MEDICAL WASTE (RMW)	MUNICIPAL SOLID WASTE (MSW)	RECYCLING	SPECIAL WASTE STREAMS
• Red bag waste (biohazardous materials) • Sharps containers (needles, scalpels)	General non-hazardous waste/ regular trash	Materials that are recyclable by a municipal recycling facility	• Chemotherapy waste • Non-hazardous pharmaceuticals • Hazardous pharmaceuticals (RCRA) • Personal Health Information (PHI) destruction

Table 3: Packaging Types

PRIMARY PACKAGING	SECONDARY PACKAGING	TERTIARY PACKAGING
Materials that directly touch the product, such as blister packs, vials, syringes, or immediate containers.	Materials that group product units together, such as cartons, boxes, or trays. Secondary packaging often contains branding, instructions, and product information.	Materials used for shipping and distribution, such as pallets, shrink wrap, or corrugated cardboard boxes. Ice packs and insulation for cold chain shipping can also be included in this category.

STEP 5 Design the Database/Spreadsheet for Data Entry

Create a standardized spreadsheet for data entry and, later, for data analysis. See Table 4 for recommended data collection fields. It is recommended to collect photographic data for each waste item, and the database should be designed to store this information or be linked to images of the item.

Table 4: Data Fields

CATEGORY	DATA FIELD	DATA FORMAT
Item Identification	Description of item/drug name	Free Text
	Device category	Dropdown: Med/Surg, Pharma, Other
	Photo of item	Unique ID tied to audit photo
	Vendor or Brand	Free Text
Weight & Quantity	Weight	Numeric
	Quantity/count of item	Numeric
	Empty Item Weight (for medication, to capture packaging weight) (g)	Numeric
	Packaging Type	Dropdown (primary, secondary, or tertiary)
Drug Waste-Specific Information	Labeled Volume	For liquids: enter printed volume (e.g., 500)
	Volume Unit	Dropdown (e.g., mL, grams)
	Drug packaging category	Dropdown (e.g., syringe, IV bag, vial, prescription bottle) **See Table 5 for recommended dropdown list**
	Sharp present?	Checkbox
	Estimated Drug Weight (g)	Numeric
	Use status	Dropdown (unopened, partially-used, empty)
	Expired?	Dropdown: expired/ not expired/ expiring in 1 month
	If not expired, Expiration Date	Date
Sorting & Stream Check	Item in the correct waste stream?	Checkbox
	If no, in which waste stream should the item have been discarded?	Dropdown (MSW, RMW, etc.)
	Patient Info Visible?	Checkbox
Material Composition	Material 1	Dropdown (glass, metal, polypropylene, thin film plastic, hard plastic, etc.) **See Table 6 for recommended dropdown list**
	Material 1 Weight (g)	Numeric
	Material 2	Dropdown (glass, metal, polypropylene, thin film plastic, hard plastic, etc.)
	Material 2 Weight (g)	Numeric
	Material 3	Dropdown (glass, metal, polypropylene, thin film plastic, hard plastic, etc.)
	Material 3 Weight (g)	Numeric
Notes	Notes	Free text: add clarifications, issues, labels removed, etc.

Packaging classification (Table 5) allows auditors to analyze materials, recyclability, and emissions impact without linking to purchasing data. It also supports vendor-neutral benchmarking and simplifies product identification during waste sorting.

Table 5: Drug packaging category

☐ White plastic bottle	☐ IV bag	☐ Plastic ampoule
☐ Orange plastic prescription bottle	☐ IV tubing	☐ Plastic vial
☐ Syringe with needle	☐ IV bag plus tubing	☐ Peel pack
☐ Syringe without needle	☐ IV bag with vial attachment	☐ Blister pack
☐ Liquid medication bottle	☐ IV bag with syringe	☐ Peel cup
☐ Peel cup	☐ Needle (with or without cap)	☐ Paperboard box
☐ Caps	☐ Glass vial	☐ Insulative packaging
☐ Thin plastic	☐ IV spike adapter	☐ Corrugated cardboard
☐ Pen injector	☐ Inhaler	☐ Not drug packaging

Table 6: Suggested Material Types (for database dropdown menu) and conversion list for material-level life cycle analysis

DROPDOWN MENU FOR MATERIAL TYPE IN DATABASE	MATERIAL TYPE
Plastic – IV bag or tubing	Polyvinyl Chloride
Plastic – thin film	Low Density Polyethylene
Plastic – syringe	Polypropylene
Plastic – hard plastic	Low Density Polyethylene or Polypropylene
Plastic – rubber	Variable
Plastic – soft foam	Expanded Polyurethane
Plastic – stiff Styrofoam	Expanded Polystyrene
Plastic – gowns and drapes	Polypropylene Fabric
Nitrile Gloves	Nitrile Butadiene
Paper	Paper
Paper towel	Paper towel
Paperboard	Paperboard
Corrugated cardboard	Corrugated cardboard
Aluminum	Aluminum
Steel (needles)	Steel (needles)
Other metal	Other metal
Glass	Glass
Ice pack	Ice pack
Cotton/fabric	Cotton/fabric
Electronics	Electronics
Other	Not applicable

STEP 6 Coordinate Waste Collection Procedure

- Ensure all pharmacy managers and staff at audit site are aware of the planned audit.
  - Designate a clinical point person on staff at the audit site who can address questions or concerns.
- Coordinate with all relevant teams (housekeeping, Environmental Health and Safety, etc.) for timing of empty bin drop off at the start of the audit, waste pick up, and transport to sorting location.
- Ensure that everyone involved understands the exact start and end time of the audit.
- We recommend placing signs on all waste receptacles involved in the audit to denote that this waste is being collected for an audit and to note the start and end time of collection.
  - BMC used different colored can liners (silver instead of transparent) for MSW receptacles to denote MSW waste that was being collected for the audit.
- Ensure team managers (i.e. housekeeping managers) are communicating with on-the-ground staff, especially regarding the start and end time and the need for diversion of waste (instead of the usual workflow) to a new location during the defined audit period.
- Ensure that this information is propagated to on-the-ground staff through changes of shift.
- Audit leader should exchange contact information with all on-the-ground staff for easy communication and trouble shooting.

Site Specific Example: For a one-day audit of an outpatient pharmacy, empty receptacles are placed prior to opening. All receptacles containing collected waste are removed after closing to sorting location. For any receptacles that become full during the course of the day, housekeeping staff should remove these receptacles and transport to the sorting location.

STEP 7 Audit "Dry Run"

Before the official audit period, we recommend conducting a dry run with all teams to confirm that everything works as planned. Goals include:

- Test waste collection logistics: empty receptacle drop-off, pickup, and waste transport to sorting location
- Make sure team roles, receptacles, and signage are clear
- Waste sorters and data recorders practice data entry into database. Staff or vendors doing the waste sorting and data entry can use waste collected during the dry run for training and practice.
- Troubleshoot photo documentation of waste items

Use this dry run to:

- Adjust audit period if too much or too little waste was collected
- Improve communication channels, if needed
- Adjust team roles if needed
- Determine adequacy of the sorting location
- Refine the database's fields, specifically item and materials classification systems, if real-world waste items don't reflect the existing options

STEP 8 Run the Audit!

If all preparation has been conducted, this should run smoothly.

STEP 9 Post-Audit Data Analysis and Reporting

Estimating Greenhouse Gas Emissions: Consider partnering with expert in life cycle analysis (LCA) to estimate greenhouse gas emissions associated with audited waste. In brief, greenhouse gas emissions can be estimated using a material-level LCA aligned with ISO 14040/14044 standards. Emissions data can be modeled using programs such as SimaPro or OpenLCA with databases such as Ecoinvent and the TRACI 2.1 V1.09 / US 2008 impact assessment method. Information on waste handling practices for each waste stream should be gathered from stream-specific waste vendors and included in the modeling to accurately estimate emissions associated with the transportation and treatment of waste. Resulting GHG data can then be analyzed to estimate GHG emissions by individual waste item, packaging category, material type, site, and waste stream.

Extracting insights from the data: There are many ways to utilize the data gathered to produce meaningful insights. Below are suggested directions for data analysis.

1. **First, make sure all data points are appropriately normalized.** For example, if one waste stream was audited for three days and others for one day, make appropriate adjustments so they represent the same baseline.
2. **Break down results** by waste stream (RMW, MSW, pharmaceutical) to identify stream-specific opportunities
3. **Analyze data** by location to recognize department-specific challenges and successes
4. **Highlight** common waste sorting errors that may be addressed through education, infrastructure adjustments (like bin placements), or policy shifts
5. **Identify** avoidable waste (ex: unused or expired items) that could be eliminated through process changes
6. **Quantify** key opportunities in terms of both environmental and financial impact

Findings from pharmacy waste audits can be used to inform operational changes, procurement decisions, staff education, and broader sustainability strategies across healthcare systems.