Guide 2.A1 Waste audit at school - Procedure

A waste audit consists in collecting waste on a daily basis, over a week, and each day: weigh the waste, characterize the waste (i.e. separate the collected waste in different waste fractions, weigh each fraction separately), and report the gathered information on a document. At the end of the week, an average of waste production per day can be obtained.

Depending on the goal you want to achieve and what you want to use the data for, the waste audit can be performed at different level (from general to specific):

1) **Overall amount** - If you want to just know the overall amounts of waste generated, you can collect all the trash bins together and characterize them;
2) **Cluster by generation source** - If you want to come up with concrete actions to be taken by the different waste generators, you can cluster the school waste generators by their activity and characterize them separately (e.g. school canteen/kitchen; classrooms; offices; etc.);
3) **Cluster per classroom** - If you want to create a "group awareness" and allow to make "competition" inside the school to motivate students to adopt better waste management practices, you can do waste characterization study per classrooms.
4) **Individual waste audit** - If you want to raise awareness of students regarding their own waste generation, you could ask them to put all their waste in a specific bag and ask them to conduct a waste characterization study with their own waste.

A step-by-step approach is defined hereafter.

Steps	
STEP 1.	Adapt waste audit process to school settings and priorities
STEP 2.	Define time and location of waste audit
STEP 3.	Prepare the team and the logistics (waste audit team and period, schedule and location of the measurements) (2 days)
STEP 4.	Get the necessary equipment (1-2 days)
STEP 5.	Train people who will conduct the waste audit (1 day)
STEP 6.	Conduct the waste audit (6-8 days)
STEP 7.	Complete the data and analyze the results (3 days)

STEP 1 - Adapt waste audit process

As a first step, take time to evaluate the school characteristic and adapt the waste audit process accordingly.

Make sure to consider in particular:

- The audit approach (overall amounts, cluster by generation source, cluster by classrooms, amounts per students)
    - In case of cluster by generation source, make sure all relevant generation source are considered (e.g. kitchen, classrooms, offices, open spaces).
    - Number of cluster that can be analyzed depends on time and people availability for waste audit
- Waste categories (balance between precision needed and time/resource available)
- The need of sampling/quartering for either waste quantity and/or composition. This will depend mainly on the overall amount of waste or amount per cluster is > 150 kg.
- The duration of the audit (one week or more?) and the measurements frequency (every day or at the end of the week?)

STEP 2 - Define time and location of waste audit

The waste audit should be performed on days that are representative of the normal school activity (e.g. not during holidays, school assemblies, strikes, festivities or other special activities). A minimum period of one week for monitoring the waste generation is recommended. The exact number of days during which the waste audit takes place differs if the school is open five or seven days a week. For both case, an additional day is necessary for preparing the measurements.

Choose a site where you can store waste, weigh and characterize the waste in a strategic spot closed to major waste generation sources. Ideally, this site should be flat and covered, well aerated, have enough space, be accessible by vehicle, have access to water for washing purposes and offer protection from pests [1].

STEP 3 - Prepare the team and logistics

The waste audit is done by at least two people over a minimum period of one week. Get support from school community to perform the waste audit (e.g. cleaning staff, student environmental clubs, etc.). The same people should perform the audit over the entire period of the audit. The time availability and motivation of the team is crucial to perform the waste audit successfully.

Define the logistics such as:

- The overall waste audit schedule, e.g. fix the schedule for waste collection every 24 hours

- The collection system, i.e. how the waste should be collected during the waste audit
- The exact waste categories to be considered
- Labelling of bags to identify the different waste generation source/cluster
- Etc.

STEP 4 – Get the necessary equipment

Among the material needed, two categories can be distinguished:

1. Essential material or "Must have" which is a basic equipment essential to conduct the waste audit
2. Optional material or "Good to have" which is not essential but which can be useful to perform the waste audit.

Essential material (or "Must have")
• Pencils, pen, tape and marker • Thick gloves • Long-sleeved shirt, long pants and closed shoes • Hand sanitizer or at least soap and water • Form to record the data (Tool 2.A1.1 and 2.A1.2) • Labeled (or colored) liner plastics bags for the collection of waste from the generation point to waste audit site • Metal, plastic or fiber containers for sorting and weighting (washable and of different sizes in prevision to the waste quantities to be measured) • If not containers, classic trash bags • Weighting scale (mechanical or electronic weight scale, hanging scale/hook scale) • Scissors • A shovel if the waste to be characterized weights more than 150kg
Optional material (or "Good to have")
• Clipboard • Safety glasses • Dust masks • Aprons • Cap • First-aid kit • Cart (if needed for moving waste), plastic sheet or tarp (e.g. 2mx2m) • Hand brooms, rakes • Absorbent rags or sponges • Camera

STEP 5 - Train people who will conduct the waste audit

Make sure to explain the purpose of the waste audit to your team and train your team on how to perform a waste audit. You can use the YouTube video below to help you training your team. Also, you can use the first day (see STEP 6 – Conduct the waste audit, first day) as trial day to make sure everyone knows what to do.

MOOC module – Conducting a Waste Generation and Characterization Study (Eawag/Sandec)
UN-Habitat, 2021. Waste Wise Cities Tool (Step 2)

STEP 6 - Conduct the waste audit

Note that the waste audit described hereafter explains the step-by-step process needed for a waste audit clustered per waste generation source (e.g. kitchen waste, classrooms, offices, etc.).

Steps on a daily basis

First, make sure every participant of the waste audit understood the objectives, is aware of the different waste categories to be studied and read the overall procedure, and in particular knows:

- How to use the safe equipment and is aware of the presence of sharp objects such as nails, razor blades, glass etc.
- How to fill up the results in the sheets
- The planning for the next days

First day (To do the day before the day of the first measurements e.g. Friday or Sunday if starting measurements on Monday)

1. Go to the measurements site with all team and all the necessary equipment
2. Check the instruments accuracy and the quality of the equipment and start by measuring the weight of the empty containers (tare weight) that will be used. Record it in data sheet under "tare". (E.g. container type A= 2.5 kg, type B= 1kg, type C= 0.5 kg). If different containers have different weight, the weight of the empty containers may be reported before every measure in order to avoid errors.
3. Collect the waste from the waste collection points (i.e. bins, containers, etc.) at the chosen schedule and following the defined collection route, and follow Step 2 to 10 described hereafter for second day and following.

Second day and following

1. At the schedule determined initially, start collecting the waste and assemble it depending on the cluster, i.e. generation source. Label the bags of collected waste correspondingly and transport them to analyze at the chosen waste audit site.
2. Measure the total waste weight for the first cluster as well as volume and write it down on the data collection sheet (Tool 2.A1.1).
3. Calculate the waste density: fill a bucket of a defined volume X in liters (ideally a 20 L water bucket) with mixed waste and measure the weight (Y) in kg. Then empty the waste and measure the weight of the empty bucket (Z) in kg. Record all these numbers. The density of waste is (Y-Z)/X/1000 [kg/m3]. Do this a few times to obtain an average.

   If you use buckets to measure the total weight, you just need to record the volume of the bucket and number of buckets filled.
4. If the waste is more than 150 kg, use the quartering method to reduce waste sampling size for characterization:
   a. Mix the waste as thoroughly as possible
   b. Then spread out the waste on the surface so that it forms a flat layer
   c. Divide the waste layer into four parts ABCD
   d. From those four portions, discard two opposing quarters (e.g. B and D)
   e. Mix the remaining quarters
   f. Repeat the quartering process until you reach a sample of around 50-70kg
5. Spread the waste of the first cluster on the plastic sheet located on a horizontal, plane surface (e.g. a sorting table) and sort the waste in the different categories.

   Note:
   - the composite materials have to be separate as far as possible. When not possible, then sort according to the major components (fraction)
   - plastics bags of trash (if any) need to be opened and their content sorted
   - It could be useful to put the signs corresponding to the waste categories on the plastic sheet to help sorting the waste, particularly when working with students.
6. Take a picture of the overall sorted waste
7. At this stage, weigh the empty container if the container has not been pre-weighted. Record the tare weight on the waste audit document.
8. Put the sorted categories one after another in the containers and measure the total weight.
9. Write down the weight of the category as well as the container type (e.g. B) on the Tool 2.A1.2.
10. Repeat step *5 to 7* for all the waste fractions until all clusters are analyzed.

11. Once all the waste fractions are sorted and weighted, store the waste and make sure the plastic sheet and the containers are empty
12. Do step 2 to 10 for all the clusters

Once the waste of all the clusters has been measured, transport it to the final disposal site of the school or to the waste collection point.

STEP 7 - Complete the data and analyze the results

It is important to have the data well organized by using a support such as a data record sheet while performing the waste audit and put all the collected data on an electronic format (excel) on a daily basis or latest on the last day of the waste audit. Make sure to note down any comments and assumptions made to give more transparency to the results of the audit (e.g. if some students were absent because of school excursion, etc.).

It is suggested to analyze the results as soon as possible and during the waste audit if possible.

Limitation of the waste audit

Some limitations induced by a waste audit need to be taken into account, either in the design of the audit or in the interpretation of the results:

- Balance between data accuracy and logistics (reliable and representative data vs. time, costs and efforts)
- Variations of waste generation due to the time of the year (exams periods, holidays, special events) and climate. An extrapolation of the audit results over a year may be unrealistic and will not show the fluctuation of waste generation throughout a year.
- A waste audit on this timescale will usually not take into account goods that become waste on a bigger timescale (not daily or weekly basis) such as books, furniture, computers etc. The moment that goods become waste depends on the lifespan of the goods.
- The access to confidential data during the waste audit needs to be tackled accordingly.

References:

1. UN-Habitat, *Waste Wise Cities Tool - Step by step guide to assess a city's municipal solid waste management performance through SDG indicator 11.6.1 Monitoring*. 2021.