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Solid Waste Assessment Replication Model

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MnTAP

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A solid waste replication model for business owners to conduct their own assessments

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Introduction

This model was developed through the Minnesota Technical Assistance Program (MnTAP) Intern Program for the Southwest Regional Solid Waste Commission (SWRSWC). MnTAP helps Minnesota businesses implement industry-tailored solutions that maximize resource efficiency, increase energy efficiency, prevent pollution, and reduce costs to improve public health and the environment. The SWRSWC is the joint effort to develop a comprehensive solid waste management for the twelve county region that will follow the solid waste management hierarchy outlined in Minnesota Statute 115A.02.

Overview

What is a solid waste assessment?

A solid waste assessment is a way to evaluate the materials in a business or facility's solid waste stream, also known as trash and recycling. An assessment can help business owners understand what types of materials are used, how much are used, where they are used, and how they are disposed of. The process generally involves a hauling and purchasing record analysis, a facility walkthrough, a waste sort, research of options, and cost-benefit analysis.

What are the benefits?

Understanding what's in the trash allows a business owner to identify opportunities to reduce the amount of waste created. Source reduction and recycling have the potential to reduce purchasing, handling, storage, and disposal costs. Reducing the amount of waste that goes to the landfill also benefits the county as a whole because it can result in tax benefits, more affordable waste hauling for everyone, and a reduction of greenhouse gases. Dedicated solid waste management starts from the ground up, and a collaborative effort to reduce solid waste can make a large impact.

What is needed to conduct an assessment?

No special equipment or technology is needed to conduct a solid waste assessment. All that is needed is:

- **Personal Protective Equipment (PPE)**: Consider potential hazards and protect yourself with equipment such as puncture-proof gloves and protective glasses.
- **1-3 hours of time**: The time needed for an assessment is dependent on the size of the operation and how extensive the assessment is. After the initial walkthrough, it is recommended that evaluation of waste continue to get a better understanding of waste generation over time.
- **A clipboard or notepad**: This is helpful for taking notes while touring the facility.
- **Data**: Gather information that can help show the cost and quantities of purchasing and disposal, as well as what quantities of materials are kept and used in the operation. This generally includes:
    - Purchasing, inventory, maintenance, and operating logs
    - Supply, equipment, and raw material invoices
    - Equipment service contracts
    - Waste hauler invoices

  This information is not required to conduct an assessment, but it allows for a more complete understanding of the materials moving in and out of the facility, as well as for calculating cost savings based on current expenditures.

Purpose of the Model

A solid waste assessment is a practical and waste-wise procedure for a business owner or county employee to conduct. This model provides a simplified and straightforward method for conducting a waste assessment so that any business owner or county employee can do their own *at no cost*.

This model was designed to:

- Enable business owners and county employees to conduct their own waste assessments;
- Provide ideas for reducing waste, improving efficiencies, and reducing costs; and
- Improve waste reduction and recycling practices in the commercial and industrial sector of the Southwest Region.

How to Conduct a Solid Waste Assessment

The following section of the model details eight steps to conduct an assessment. This is the recommended order of steps, but they can be adjusted to fit an individual business.

Develop a team

Before planning, you may want to develop a "green team." Ideally, a team will consist of employees from all facets of the operation, from management to accounting to the general workforce (line operators, mechanics, cooks, or whoever works directly in the operation) to the janitorial crew. Although an assessment can be conducted by one person, a team offers several advantages:

- **Diversity of Perspective:** Identifying opportunities in a waste assessment requires critical thinking and innovation. A team of people maximizes the potential for generating creative ideas. For example, a janitor may see an aspect of waste handling that management may not, as they work with the waste more directly. A team that is representative of the business as a whole will yield the most practical and the widest variety of ideas.
- **Time Efficiency:** While the entire team should conduct the assessment together, research can be delegated to different members to save time.
- **Employee Involvement:** Getting employees involved in the process emphasizes their value to the operation and shows that their opinion is valued. Perhaps an employee has had ideas for reducing waste in the past and would like to see a change; getting them involved allows them to share their ideas. Employees can gain satisfaction from direct involvement in improvement and will likely be willing participants in any changes made as a result of the assessment.

Plan the assessment

Once a team has been established, it's time to plan the assessment. The first step of planning an assessment is to determine which approach to take. There are three different approaches to take, each with advantages and disadvantages. These include:

1. Record analysis
2. Facility walkthrough
3. Waste sort

The first approach, a record analysis, consists of examining all records relevant to purchasing, handling, distributing, and disposing of materials. These can include purchase orders, waste hauler invoices, recycling records (if the facility generates revenue from recyclables), and other

relevant data. Conducting a record analysis allows the team to see how resources flow through the operation and to understand the value of and costs associated with wasted materials.

The second approach, a facility walkthrough, consists of an in-depth tour of the facility to examine the flow of materials and understand how waste is generated. Facility walkthroughs are advantageous because, as opposed to a record analysis or waste sort, they allow for examination of an individual process as opposed to an end-state snapshot (e.g. waste in a dumpster), which allows for process-specific waste reduction ideas. For example, watching the process may allow a facility manager to identify opportunities to improve efficiency or unnecessary waste as it happens.

The third approach, a waste sort, is used to quantify how much of each type of waste is generated. It involves collecting, sorting, and weighing each different type of waste found in the dumpsters and determining the volume, weight, and the relative percentages of each. Waste sorts are generally time consuming, as they require multiple collections for more accurate results. However, it is the most accurate way of determining the biggest sources of waste, which allows the team to prioritize which areas to target. Waste sorts are described in more detail in the "Waste Sort" section below.

A team may choose to tackle any combination of these three approaches, depending on which is the most advantageous for the facility. Taking all three approaches will yield the best results, but commands the most time and resources. The simplest way to determine which approaches to take is to consider the variety of materials used in the facility and the complexity of its processes. If the facility generates a few specific types of waste, a simpler approach may be sufficient. If the facility generates large quantities of a wide variety of waste that demand more thorough analysis, a combination of all three approaches may be warranted. The approaches have been listed above in order of time consumption and complexity. It is recommended that most facilities do both a record analysis and walkthrough. A waste sort may be added as time and resources permit.

The final planning step is to schedule a time for the assessment. Depending on which approach(es) is taken, the assessment will take approximately:

- 30 minutes to 1 hour for a record analysis
- 1 to 3 hours for a facility walkthrough
- 30 minutes to a full day for a waste sort of one day of trash (multiple days may be more representative if operations change day to day)

Setting aside extra time is recommended, as assessment times vary from facility to facility.

Gather baseline information

Simply put, a baseline is all of the information used to describe the facility as it currently operates. While an individual recommendation may have specific baseline information, general information can be obtained at the beginning of an assessment. This information includes:

- Square footage of facility
- Number of employees
- Hours of operation
- Days of operation per year
- Frequency of garbage pickup
- Cost of garbage pickup
- Cost of raw materials
- Cost of operation/maintenance
- Revenue from selling recyclables (if applicable)

This information can be used for a cost-benefit analysis of recommendations. A table is provided in the Appendix to record this information, as well as additional information that is found to be helpful.

Conduct a waste sort (optional)

A waste sort is used to quantify how much of each type of waste is generated. It involves collecting, sorting, and weighing each different type of waste found in the dumpsters and determining the volume, weight, and the relative percentages of each. If it is determined that a waste sort would be an effective use of time and resources, it is imperative to conduct it carefully to get accurate and representative results. Here are the steps to follow when conducting a waste sort.

1. Establish a time frame to collect the waste. While a single-day waste sort can be conducted, it may not provide a representative sample. Consider how the composition of waste changes from day to day or week to week. If the composition does change, collect multiple samples (and label them to keep them straight). The time required to conduct a waste sort is facility dependent. One approach is to do a sort every day between waste pickups. For example, if waste is picked up every Friday, the sort would begin at the end of the next Monday and be conducted at the end of each work day until the next Friday. This type of sort provides data on how much of each material is picked up every time.
2. Designate an open space to conduct the waste sort. It is recommended that the space is large and in a location where it will not interfere with normal operations. Outside near the dumpsters is a good location if weather permits. Consider a visible space so that employees can see the waste sort, as they can be very eye-opening in terms of how much and what's in the trash. (However, it's best not to publicize the waste sort in

advance except to those directly involved, as knowing that waste will be examined can change behavior.)

3. Obtain the necessary tools and containers. The waste will be sorted into and weighed in containers. Wastebaskets or barrels work well for this. A container will be needed for each major component of the waste (paper, plastic, glass, metal, etc.). Determine which components you will sort into in order to gather the proper number of containers. Also, it is helpful to estimate the volume of each material that will be collected and select container sizes accordingly. Typically, an average sized barrel is used and lined with a bag. A scale will also be needed to weigh individual samples. Personal protective equipment (puncture-proof gloves, safety glasses) is essential. A pair of tongs can be used to handle waste, or it can be carefully sorted by hand.
4. Begin collecting and separating the waste sample. This can be done one of two ways. Either collect the waste directly from the dumpsters, or empty the dumpsters onto a tarp and separate from there. It may be better to collect directly from the dumpster, as fragile items could be broken from emptying the dumpster onto a tarp. If desired, the major components of waste can be separated into more specific components (e.g. different types of plastic, different sizes of plastic materials).
5. Weigh the bags as they fill. It can be helpful to label the bags by component. If applicable, they can also be labeled by their location within the facility (i.e. “Process A Plastics” or “Break Room Disposables”). Record the weight of each bag, the number of bags, the size/volume of the bags, and where the waste is generated from, if applicable.
6. Repeat this process each day for the entire time frame of the waste sort.

A table is included in the Appendix to record data from the waste sort.

Conduct a facility walkthrough

A facility walkthrough is an in-depth tour of the facility that allows waste generation to be assessed more qualitatively. While records and waste sorts provide quantitative data, a walkthrough allows the team to see exactly how materials are processed and how waste is generated. It also includes a visual waste analysis of the dumpsters, so it offers an alternative to a waste sort.

There are three major components to a facility walkthrough: observing processes, interviewing employees, and examining waste. Here is a suggested list of steps to follow when conducting a walkthrough:

- Examine dumpster contents. This differs from a waste sort because it is much quicker and it does not involve counting or weighing. Instead, percentages of each component are estimated. For example, an examination of the dumpster may show that waste by volume is 15% cardboard, 20% plastic, 50% metal, and 15% glass. These approximations should be recorded and used in a cost-benefit analysis later. A link to a table of volume-to-weight conversions established by the US EPA is provided in the Appendix.

- Determine which processes generate waste and why. If a dumpster examination was conducted first, work backwards from the materials that were found and try to determine which processes created that waste and why. Identify equipment used, materials used, and approximate daily generation based on how frequently the process occurs and how much material is used in the process.
- Take note of space. Identify where materials are stored, how they are stored, and what amount of free space is available for additional storage. This may be important if implementing a recommendation would require space.
- Interview employees. Anyone directly involved in each process can be the most valuable source of information. They can answer questions that arise during the walkthrough, give realistic estimates of generation (e.g. they produce x units in one hour on this line), and pitch suggestions for improvement. Since they are involved with the individual processes, they may have the most insight on how to make them more efficient.
- Think critically about each operation throughout the assessment. Are there any inefficiencies that stand out? Could this process be improved in any way to reduce the amount of raw materials used, the amount of waste produced, or the amount of time the process takes to complete? Active discussion amongst team members can help generate ideas and enhance critical thinking during the assessment.
- Take thorough notes. It may not be feasible to conduct another walkthrough, so it is important that thorough notes are taken. Even mundane details may prove to be useful later on. A lot of information is obtained from a walkthrough, and it i easy to forget details. This is especially true if research and discussion do not occur directly after the walkthrough. Once the walkthrough is completed, it is helpful to consolidate everyone's notes and digitize them for easier access later on.

A detailed table and general checklist are provided in the Appendix.

Research opportunities

Once the assessment has been completed, it's time to begin researching options. Research serves several purposes:

- Finding ideas for how to reduce specific materials in specific operations
- Researching existing ideas to see if other similar businesses have had success with them
- Locating people/businesses who can either offer assistance to reduce certain materials or provide a means of diverting waste for reuse or recycling

This can be a complex task, so a team can be helpful. Discuss findings from the assessment and list ideas for reduction to explore further. Remember that reduction at the source, while sometimes more challenging to implement than recycling or disposal, has the highest potential

for cost savings and environmental benefit. Avoiding purchasing, handling, and disposal costs by not using a material in the first place is the best way to improve efficiencies and reduce costs.

Once a list of potential avenues for reduction and diversion has been established, delegate the ideas to different members of the team to research. If time allows, several people can research a single item to maximize the number of ideas collected. Maintain open communications between team members to share useful resources and websites.

The team should meet periodically throughout the research process to discuss findings and offer insights. Discussion topics may include cost feasibility, ease of implementation, and potential need for employee training.

Finding good information sources is often the most difficult part of research. Included in the Appendix is a list of potentially useful websites.

Implement findings

At this stage, the team has researched reduction measures, assessed cost feasibility and reduction potentials for each, and determined which to pursue. The next step is planning and piloting. Piloting a change is a relatively low-risk way to gauge effectiveness. The pilot can be conducted on a single process or area, as opposed to facility-wide. Establish a time frame for the pilot that is long enough to be representative of how much waste is generated and allows for accurate measurement of overall reduction.

For example, a three week waste sort determined that a certain process generated 100 items of plastic waste the first day, 150 the next day, and 50 the third day. In this case, the average (125) is not necessarily representative due to daily variation. The team may then determines that a nine day time frame for the pilot would yield more consistent results.

Once a time frame has been established, it is time to implement the change. If necessary, time should be set aside for employee training. Inform employees of upcoming changes and what they can do to prepare. Consider including any additional labor costs for training in the cost-benefit analysis (however, this may be offset by reduced labor if the change results in increased efficiency).

Once employees have been trained and the pilot is underway, it is time to monitor progress. Take note of what is working well and opportunities for improvement. Solicit employee feedback and opinions. Some items to consider could include:

- Impact on efficiency: is the change improving the process?
- Simplicity: did the change make the work easier for employees involved?
- Functionality: does the change work consistently with little to no maintenance?

- Sustainability: can the change be maintained over time?

Continue to regularly record waste generation (number of components and approximate poundage). As previously mentioned, a link to a volume-to-weight conversion chart for different types of waste is included in the Appendix. This information should then be compared to the baseline data collected before the pilot.

After the pilot has ended and results have been collected, it is time to run a cost-benefit analysis. A great tool to use is a simple payback. A payback is how long it takes to make back the initial investment, and it is determined using annual savings*. The formula for simple payback is:

$$\frac{Initial\ Capital\ Investment(\$)}{Annual\ Savings\ (\$)} = Payback\ (years)$$

**Payback can also be calculated in terms of months by replacing annual savings with monthly savings.*

Initial capital investment is how much money, or capital, is initially spent to implement a change. This can include:

- Purchase price of equipment
- Installation costs
- Training costs
- One-time overhead expenses
- New utility costs

Sum the relevant expenses to determine initial capital investment. If there are no expenses, the initial capital investment is $0 and payback is immediate.

For example, a shipping company purchases a cardboard baler to collect cardboard for recycling in a space-efficient manner. The baler costs $12,000 after fees, $500 for shipping and installation, $200 for employee training, and $100 in overhead expenses. The initial capital investment would amount to $12,800.

Annual savings are how much money the business saves annually from implementing this change. If exact cost information is available, then the formula is:

$$(Initial\ Monthly\ Cost - New\ Monthly\ Cost) * 12\ Months = Annual\ Savings\ (\$)$$

Often times, a total monthly cost is not readily available, so it must be calculated first.

The formula is:

$$Cost\ per\ Unit\ (\$) * Units\ per\ Month = Monthly\ cost\ (\$)$$

For example, a company uses plastic stretch wrap to wrap their pallets of cargo for shipping. Each roll of stretch wrap costs $20, and the company uses approximate 300 rolls a month. Using the formula above, it is determined that the company spends $6000 a month.

The company starts to use reusable pallet wraps after testing a couple of units and determining that they fit the operation well. With the use of pallet wraps, they use 150 fewer rolls of stretch wrap per month, which corresponds to savings of $3000 monthly and $36,000 annually.

The company had an initial capital investment of $10,000 for purchasing the pallet wraps. With this information, as well as the annual savings, a payback can be calculated. Using the formula above, it is determined that payback will be

$10,000+x/y = 0.28 years, or roughly 3 months

Annual savings and simple payback are good ways to determine if an idea is worth pursuing from a financial standpoint. A short payback period and a low initial capital investment are good, low-risk options to pursue. Options with a high capital investment and long payback period are a bit riskier and more ambitious, and should be given more consideration before pursuing.

Saving Money with a New Waste-Hauling Contract

Many source reduction measures can not only offer cost savings from less purchasing and handling, but also from a modified waste hauling contract. How much a waste hauler charges is generally based on number of containers, size of containers, frequency of pickup, and relative amounts of garbage and recycling.

For example, a business conducts a waste sort and determines that 15% of the garbage volume is plastic waste. A process change completely eliminates this waste, meaning that there is extra space in the dumpster. Without changing the contract, the business is paying for 15% empty space. The business owner contacts their waste hauler and determines that they can get smaller dumpsters since they generate less. With smaller dumpsters, the contract is modified and the business owner pays less each month. Another option would be to reduce the frequency of pick-up. Depending on how much waste is reduced, this option can save business owners hundreds of dollars annually.

Share progress and results

When a waste reduction measure is successful, it is important to share that success with employees and stakeholders. Those directly involved with the process will also appreciate seeing how their direct contribution made an impact. It bolsters employee pride in their business and encourages better performance. If the project is still in progress, employees will appreciate being kept informed on progress and how they can further contribute to its success.

“Green” initiatives, such as solid waste reduction, can also be used as marketing tools. Patrons appreciate when a business practices environmental stewardship. Green businesses often measure their success by their Triple Bottom Line, or Three P’s: People, Planet, and Profit. Effective solid waste management contributes to all of these.

Lastly, sharing the success of a waste reduction initiative may encourage more initiatives in the future. Successful projects that reduce costs and waste can help garner support for similar projects in the future.

Appendix

Baseline Information Record

Square footage of facility	
Number of employees	
Hours of operation	
Days of operation per year	
Frequency of garbage pickup	
Cost of garbage pickup	
Total cost of raw materials (monthly)	
Material A _____	
Material B _____	
Material C _____	
Material D _____	
Material E _____	
Total cost of operation/maintenance	
Total revenue from selling recyclables (if applicable)	

Resources

- http://www.glrppr.org/
- http://mnexchange.org/
- http://www.epa.gov/osw/nonhaz/municipal/pubs/bus-guid/work-c.pdf
- http://www1.gadnr.org/toolkit/docs/Worksheet%20D%20-%20Waste%20Sort.pdf
- http://www.foodwastealliance.org/wp-content/uploads/2014/09/Best-Practices-Toolkit-FINAL-5-1-14_rev091714.pdf
- http://www.nrdc.org/business/files/consumer-goods-packaging-report.pdf
- http://www.epa.gov/osw/conserve/tools/recmeas/docs/guide_b.pdf