



Colorado Department
of Public Health
and Environment

Tools for Identifying Cost-Saving Pollution Prevention and Materials Efficiency Opportunities

Introduction - Going beyond the “low-hanging fruit”. Many companies have already implemented pollution prevention (P2) improvements and are aware of at least some of the benefits, including reduced material and waste disposal costs, reduced compliance burden, and improved business image. However, after a few early successes (usually the relatively easy and most cost-effective P2 measures, often referred to as the “low-hanging fruit”), finding additional opportunities becomes more difficult.

One way to find additional P2 opportunities is through networking with other businesses. State and local P2 technical assistance programs are also helpful in many cases in providing information about successful P2 practices used by other businesses. Nevertheless, after a few years, many companies’ pollution prevention efforts tend to lose momentum and run out of ideas.

Process Analysis Tools

One key to finding further opportunities for increased efficiency and pollution prevention improvements is through the use of process analysis tools. Two tools or methods which many businesses have found to be helpful, both for process/quality improvement and for pollution prevention, are process mapping and materials accounting. Ideally, use of these tools would involve a multi-disciplinary team of the key people responsible for operating and maintaining the production processes being investigated and for purchasing and managing the input materials/inventory, as well as the environmental/P2 staff.

Process Mapping

A process map is a visual representation of a process, showing all the steps of the process and the materials inputs and outputs, including wastes, for each step. Process maps can be drawn at different levels of detail from very general to very detailed, depending on the the need. For example, a process map for microbrewing is shown on the attached page.

The process map is a useful tool to help show all the sources of wastes of all types within a process, and to help understand the process at the same time. (If you want to change a process, you need to understand it first.) In the above example, all the wastes are labeled with letters (a, b,

c, etc.), so that the wastes can be easily referred to for further investigation. It is also very important to note ancillary processes such as wastewater treatment, and intermittent processes such as cleaning of process equipment in between batches or production runs. *Each waste or non-product output identified is an opportunity to reduce or eliminate that waste.*

Materials Accounting and Metrics

A related tool for identifying P2 or waste reduction opportunities is materials accounting, or in other words, the measurement and tracking of materials use within a process. Materials balance calculations can be used to verify measurements/estimates of waste quantities, based on the amounts of input materials and product yield. (If your total inputs are within 20% of the total outputs, that is usually adequate for a “first cut”, in order to prioritize the most significant losses for further investigation.) Since gathering the data for these calculations can be somewhat time-consuming, you might want to start with your facility’s top 5 materials based on raw material costs. In addition you may want to consider doing materials balance calculations for your top 5 materials based on the largest waste disposal costs or the greatest environmental concerns (such as air permits, TRI releases, etc.). The materials balance calculations often reveal bigger losses than expected, which again are *opportunities for improved efficiency/P2.*

An important part of good materials accounting practices is the establishment of good metrics. In other words, it is important to determine which quantities will be measured and tracked on a regular basis for your facility. Without these measurements, managers and employees will not know how well they are doing, and achieving progress will be very difficult. (What gets measured, gets managed.) For example, for the process shown above, for each type of beer, the facility should measure and track the amount of beer produced (in gallons) compared to the amounts of input materials, including malt, hops, yeast, and water use. The facility should also consider tracking the energy usage per gallon of beer produced to measure progress in energy efficiency.

True Costs of Wastes

Another tool which is helpful in the process of identifying and prioritizing P2/waste reduction opportunities is assigning and tracking more complete, “true” costs to your wastes/emissions. In calculating the costs of wastes, many companies use the cost of waste disposal, or perhaps the cost of the lost raw materials plus waste disposal costs. There are often other “hidden” costs which are significant as well, including the following:

1) for rejects or scrap from manufacturing processes:

- the value of machine time, labor, and utilities (value added) for all the steps in the process prior to the step where the scrap was generated
- sale value for rejects at the last stage of the process

2) for regulated wastes or emissions:

- operating costs, including maintenance, for treatment/pollution control equipment
- sampling and analysis costs
- permit fees
- labor costs for managing or treating the waste/emissions

By including all significant costs in the costs of wastes, you are bringing to your managers’ attention the potential cost savings available through materials efficiency/pollution prevention

opportunities.

Targeting/Prioritizing P2 Opportunities

Using these tools will help you identify your facility's top wastes based on volume or costs. Based on this list, you should develop ideas for new P2 projects (together with the P2/quality team, if you have one). Which projects will be the most beneficial? Which are the most likely to be approved by your managers for implementation?

The best targets are projects which will *achieve cost savings and improve environmental performance*, and in addition:

- the project is connected to a process which is already planned to be changed for some reason, or
- the project will help improve other things your company cares about (such as quality, throughput, or turnaround).

By linking P2 projects (usually considered “environmental” projects by management and given a lower priority) with projects or improvements which management is already pursuing or interested in pursuing, the P2 project will have a much greater chance of being implemented.

Summary

The three tools described briefly above - process mapping, materials accounting/improved metrics, and assigning the true costs of wastes, can help your facility identify and implement additional pollution prevention improvements and achieve additional cost savings, improving your company's competitiveness as well as environmental performance.

Acknowledgements

The above fact sheet was written by the Colorado Dept. of Public Health and Environment (CDPHE) P2 Program, based on two recent Colorado workshops on P2 and “materials productivity” assessment tools, presented by Terry Foecke of Materials Productivity, LLC, (651) 603-8282, and workshops and tools developed by Bob Pojasek, Pojasek and Associates, (781) 641-2422. The process map for microbrewing is from the “POTW Pollution Prevention Project” developed by Pollution Prevention Management Co. for the Oregon Dept. Of Environmental Quality.

For more information or a free site visit and assistance with applying these tools, please call Kirk Mills of the CDPHE P2 Program, (303) 692-2977.