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The First Step Toward Waste Reduction: Industrial Waste Audits

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Waste reduction makes good management sense. Where there is waste, there is inefficiency, and where there is inefficiency, there is an opportunity to reduce costs. Reducing waste increases productivity, safeguards the environment and strengthens the firm's economic base. Waste reduction is a demonstration of the firm's commitment to environmental protection.

Many firms have developed and implemented waste reduction and recycling as a normal way of doing business, and the returns have been favorable. This process is best initiated by conducting a waste audit.

Waste audits: Efficiency and safety go hand in hand

Twenty years ago, waste minimization meant "minimum cost disposal." Industrial waste was contained, treated (if necessary) and disposed. Generally, the only waste management information a firm received was from the individual who hauled their waste. This information seldom included waste reduction practices and was often self-serving to the hauler.

Today, this approach to waste management is not only impractical, but is unacceptable in terms of efficiency and the firm's social responsibilities.

Manufacturing processes are shifting from product optimization to system optimization in order not to make waste from the onset. Waste reduction pays long-term dividends and should be viewed as making an investment in a clean, safe environment — a social responsibility.

This publication explains the current waste minimization requirements, gives you a strategy for waste management, and tells you how to prepare for and perform a waste reduction audit.

Current waste minimization requirements

Statutory requirements relating to waste minimization are part of the 1984 Hazardous and Solid Waste Amendments (HSWA).

Section 3002 (a) (6) of HSWA requires that all generators describe "the efforts undertaken during the year to reduce the volume and toxicity of waste generated" as well as "changes in volume and toxicity of waste actually achieved during the year in question in comparison with previous years, to the extent such information is available for years to enactment of (HSWA)." This report applies to EPA-classed large quantity generators.

Section 3002 (b) requires generator certification for waste manifest (mandated under Section 3002 (a)) programs "to reduce the volume or quantity and toxicity of such waste to the degree determined by the generator to be economically practicable."

Finally, Section 3005 (h) requires the same certification for any new permit issued for the treatment, storage or disposal

of hazardous waste.

Additionally, the 1990 Omnibus Solid Waste Management Law states landfill waste must be reduced by 40 percent by 1998, requiring county and city governments to devise plans to achieve this goal.

A strategy for effective waste management

The waste audit is an integrated approach involving:

- **Source reduction options**
Any activity reducing or eliminating the generation of a waste within a process.
- **Recycling**
Using, reusing or reclaiming waste, either on-site or off-site.
- **Energy recovery**
Some specific wastes can be used beneficially as a fuel, under carefully controlled conditions, to recover the energy value.
- **Treatment**
Reducing the toxicity and/or volume of hazardous waste.
- **Land disposal**
Only considered as a last resort.

The waste audit is an in-plant analysis of each operation generating waste. This requires considering the following for each process:

- **Good operating practices**
management initiatives, improved operations and maintenance (including preventive maintenance) of existing facilities, waste stream segregation, scheduling and materials handling improvements, and spill and leak prevention.
- **Input substitution or input materials modification**
replacing a toxic substance used in a process with a nontoxic or less toxic substance, or using a purified or modified material.
- **Technology modification**
improving controls, energy and water conservation, process redesign, process modification and equipment changes.
- **Closed-loop recycling**
directly and immediately reusing waste that never leaves the original process for storage or purification.
- **Product substitution**
changing the final product to create less waste.

Preparing for waste reduction audits

Within every industrial facility, there are a number of distinct operations which, when combined in the proper sequence, lead to the production of a product. The process engineer refers to these as unit processes. To properly begin a waste reduction audit, it is necessary to list all the unit processes and assemble as much information as possible. This information should include:

Operational type categories

- Material storage
- Waste storage
- Manufacturing
- Waste blending
- Waste air emissions

- Recycling
- Wastewater emissions
- Waste treatment or disposal
- Other releases

Process categories

- Process description
- Equipment lists and specifications
- Operating manuals
- Piping and instrumentation diagrams
- Facility layout and elevation plans
- As-built drawings
- Equipment operating conditions (temp., pressure, etc.)
- Physical locations where materials are added to the operation
- Physical locations where emissions result
- Types of measurements made and recorded
- Analyses and assays performed
- Utilities affecting the process (steam, vacuum, coolant, nitrogen, wastes, etc.)
- All process reactions (stoichiometric description)
- Material/energy balance (design and operating)
- Cleaning steps and operations
- Frequency of operation

Include all intermittent processes, such as cleaning, make-up, blow-down and tank dumping, in the inventory process.

Performing the waste audit

To be effective, the audit must be conducted methodically and thoroughly under the direction of experienced individuals who understand the firm's processes and operations. It is necessary to record all data and information to ensure no operation is missed.

There are several Audit Handbooks available that provide the procedure and forms for recording information. Significant imbalances may occur due to measurement and estimation. Additionally, various inputs and losses, i.e. evaporation, may have been understated or missed altogether. Therefore, the compilation of accurate, comprehensive data is essential to a successful waste reduction audit. A preliminary material balance must be made to determine if the information has gaps or inaccuracies.

The opportunities to reduce waste are many, and they all cannot be accomplished and implemented at once.

Evaluate all the options and implement the one with the greatest potential first. The following criteria can help determine options with the greatest potential:

- Investment requirement
- Cost saving
- Market for recovered materials
- Quality control of production
- Output volume (same, improved)

Management must realize a waste reduction audit is not a one-time affair, but must be done on a regular basis. Documentation that is prepared during the waste reduction audit process can serve as the basis for the next audit.

Resources

The following material provides more in-depth information on industrial waste audits.

- Cummins, R.L., W.T. Dehn, W.H. Hudson, and M. L. Senske, Planning a Comprehensive In-Plant Solid Waste Survey, U.S. Department of Health, Education and Welfare, 1970.
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- Zausner, Eric R., An Accounting System (series), U.S. Environmental Protection Agency, 1970, 71.

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