Despite implementation of waste minimization programs by industry and government, actual progress toward reducing waste generation has not reached the levels we had hoped for. True progress will not be made while industry’s focus remains on regulatory requirements that rely heavily on end-of-pipe solutions. There is not enough investigation of process changes and materials substitution to eliminate waste from being generated at the source, while current technologies still transfer waste from one medium to another rather than eliminate or destroy it.

Although waste minimization began as a Resource Conservation and Recovery Act (RCRA) activity for hazardous waste (in fact, that is where the majority of economic incentives reside), that emphasis is rapidly changing; other incentives make it attractive to consider reducing non-hazardous or solid waste, air, and water releases.

Pollution prevention can be a win-win-win situation for industry, government, and the public. For industry, control and compliance can mean more efficient processes, lower product costs, and less long-term liability; for government, less regulation, permitting, and inspection; and the public can benefit from lower costs, less waste, and less exposure to toxicity. New regulations — including the Clean Air Act Amendments of 1990, the Pollution Prevention Act of 1990, requirements being considered under the reauthorization of RCRA, solid waste requirements being considered by many state and local regulators, and new pretreatment requirements in the Clean Water Act — are moving away from the “command and control” strategy of the 1980s. These regulations will be addressed primarily by process changes.

This article is the first in a series on how to conduct a pollution prevention audit, an assessment in which waste streams are traced back to their sources to determine where, how, and why they’re generated.
What are our priorities today? We are especially concerned with hazardous waste. The RCRA definition of waste is fine — but we should not be driven by regulatory interpretations. Sooner or later, regulators will share the responsibility for programs that have failed simply because the regulations are too restrictive to support good ideas that ultimately would benefit the environment. Pollution prevention should be incorporated into every level of regulatory review including site inspections, permit conditions, and ongoing compliance programs.

Industries should focus on two basic objectives: reducing toxicity and reducing the volume of wastes. Waste is defined as all gaseous, aqueous, solid, or semisolid materials that have no value and ultimately will be disposed of in the environment. Toxicity includes air toxics, water toxics, hazardous constituent toxicity, etc. Waste minimization programs would be infinitely more effective if we concerned ourselves with those basic objectives.

The true strength of a pollution prevention program is found in its ability to tap into changing technologies and achieve waste reduction goals without creating new waste streams or transferring those waste streams to other media. Technology is advancing at a rapid rate, and we must define and capture what is needed from new technologies to reduce waste.

The U.S. Environmental Protection Agency defines a waste minimization assessment as a “systematic, planned procedure with the object of identifying ways to reduce or eliminate waste.” We should begin with a multimedia site assessment, focusing on the processes that generate waste.

The Baseline Assessment

The first critical step is determining the baseline from which goals for future action can be set. Data are collected to establish an accurate inventory of waste streams. Each stream is followed back to its source to determine why it is generated. This is a radical departure from the way we have always thought about industrial processes. It is no longer acceptable to assume that a waste stream is a necessary part of a process. We must challenge existing and potential requirements for raw materials, water, and air, identify suitable alternatives for the chemicals and/or the processes that generate them, and review the multimedia aspects of the facility’s processes.

The purpose of this baseline assessment — dubbed the opportunity assessment to set it apart from the facility waste audit — is to learn as much as possible about the waste streams, to define the starting point, and to identify the opportunities to reduce or eliminate waste generation. Individual processes and operations should be thoroughly evaluated to provide data on:

- waste stream descriptions
- generating processes
- quantity of waste generated over time
- waste characteristics
- current waste disposal techniques

In many cases, the true cost of waste stream management should be evaluated by including the cost of raw materials, product loss, compliance, record keeping, liability, and the treatment and disposal of the waste stream.

An assessment has already been defined as a “systematic, planned procedure.” The steps in a good assessment should include:

- a kickoff meeting
- a facility walk-through
- data collection
- a detailed site assessment
- data assembly
- a filling in of the data gaps

The kickoff meeting agenda should cover team member roles, the schedule for the entire assessment cycle, and the expected results. It can be useful to make some preliminary visits during the pre-assessment phase to become familiar with the site and the people involved. These visits can make a difference in the level of cooperation from facility personnel in subsequent de-

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Industry still tends to focus on end-of-pipe solutions to waste management problems, and not on investigating opportunities for eliminating waste at the source.
Pollution prevention can prove to be a win-win-win situation for industry, government, and the public.

Industries should focus on reducing the toxicity and volume of wastes. This approach forms the basis for an effective waste minimization program.

detailed assessments. At least one initial walk-through is desirable, especially if some team members are not familiar with the facility. During the walk-through, team members should attempt to:

- understand where each operation, process, or activity fits relative to the others
- understand the relative roles of each operation, process, or activity to the end product or service
- interact with the operations staff

The next step is to collect as much data as possible prior to the detailed site assessment. Much information may be available from outside sources, but you’ll need initiative and ingenuity to find it. Indiscriminate research could adversely affect the project schedule and cost; look only for the information necessary to understand the process and develop and assess the options.

The most crucial pre-survey information comes from existing quantitative and qualitative data on waste streams and data on current efforts to manage or reduce that waste. Potential sources of information include regulatory reports, analyses and flow measurements, raw materials purchasing records, materials inventories, equipment cleaning and validation information, product specifications, design material balances, production records, operating logs, standard operating procedures, operating manuals, and waste manifests.

The information collected at this stage is the beginning of the key element in the entire program — the waste stream matrix.

Prior to the detailed assessment, allowances need to be made for possible variations in the initial data collected. The quality of the data should be assessed during collection. Perfection should not be the goal in this initial site assessment. In fact, the initial site assessment may uncover many surprises and gaps that may need some time to resolve. This problem-solving process often leads to the most successful waste-reducing projects, and should be encouraged.

The Detailed Site Assessment

The next phase is the detailed site assessment. The simplest and best advice is:

- ask
- listen
- simplify
- implement

Set goals for the assessment itself in terms of the processes that should be included, which data are crucial, which operators should be interviewed, etc. The data to be collected in the detailed assessment should be specified after the initial data collection.

The assessment can take from two days to two weeks depending on the size of the facility, the complexity of the operations, and the number of waste streams.

The interviews with the operations staff are crucial to understanding why and how waste streams are generated. Subsequently, the relationship between the assessment team and the operations staff can positively or negatively affect the results obtained. The assessment team should take care not to wear out their welcome with facility personnel. Data collection should take no more than three days. This time should be spent collecting waste stream data, observing operations, and interviewing operators.

A portion of each day should be set aside to record the data collected and to write down descriptive process information. A notetaker is useful in large surveys to assemble the descriptions and data and document the processes while on site. This frees the team to concentrate on the processes, while making it possible to review the information daily.

It is important to probe for long-term as well as short-term solutions to waste stream generation. Challenge existing and future requirements that lead to waste generation and identify suitable alternatives. It is extremely important to consider the multimedia aspects of waste generation: the object is to reduce or eliminate waste at the source, not transfer it to another waste stream.

Upcoming issues will continue this discussion of waste minimization assessments with selection of target streams and implementing programs based on the results.

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