Overview

In recent years, waste minimization has been growing in popularity. At the same time, the treatment and disposal of wastes has come under greater scrutiny. People realize that the volume of waste generated continues to increase while the availability of suitable treatment and disposal facilities continues to decrease. In fact, new technologies continue to bring about new and different types of wastes every day to be added to our growing disposal problems. Our country is clearly aware that our nation's wastes, especially hazardous wastes, pose a threat to human health and the environment when they are improperly handled or managed. In fact, proper handling and management of our land disposal facilities is still in question. Also, people are all too aware of our limited landfill capacity and the increasing difficulty of siting new treatment and disposal facilities. This drives up today's cost of disposal, which in turn results in the increased cost of goods and services, and it provides no assurances to the protection of our future generations.

Because of these circumstances facing our nation, waste minimization is now being approached as the last frontier of hope in dealing properly with the generation of waste today. In order to explore the benefits of standardization on this front, members of ASTM organized a new subcommittee on waste minimization. This subcommittee established a forum for exploring, developing, and expanding the coverage of voluntary consensus standards on waste minimization. In addition, a symposium was organized by Committees D34 on Waste Disposal and E38 on Resource Recovery to stimulate investigation into the standards development process and to encourage further dialogue and expanded implementation of waste minimization practices. This symposium, the Eighth Symposium on Hazardous and Industrial Solid Waste, presented information on managerial practices, auditing techniques, and specific practices used by industry and government activities.

The information presented can be useful to individuals who desire to put into practice those measures involving administrative or technological changes that diminish the overall amount or toxicity of waste generation for their company or activity, or it can be used in developing specific waste minimization strategies. To accommodate the reader, certain presentations are kept intentionally general in their approach while others are made specific.

The collection of 17 papers published in this volume has been grouped into five major categories. To accommodate the reader, these sections have been organized according to popular interest. These categories are general managerial practices, waste minimization audits, solvent recovery, used oil recovery, and miscellaneous separation and utilization practices.

General Managerial Practices

The papers in this section present several practices that can be used to initiate and improve a waste minimization program. The Department of the Army discusses its program from both a qualitative and a quantitative perspective. Here, studies are identified to refine the hazardous material tracking system used by the Army and the method used

to economically evaluate and rank waste reduction options. The Department of Energy describes some of their programs to deal with radioactive waste streams at the Feed Materials Production Center operated by the Westinghouse Materials Company of Ohio. They stress the importance of training, communication, and incentives; and they discuss the progress they have made without the use of "high technology." The Oak Ridge National Laboratory operated by the Martin Marietta Energy Systems, Inc., explains its research on a program of waste generation accountability through charges to those responsible for waste production. Because of the types of hazardous wastes they handle and manage, these two activities of the Department of Energy are highly proactive and encouraged by the beneficial aspects of a sound waste minimization program.

Waste Minimization Audits

This section on waste minimization audits stresses the importance of conducting a survey of an activity's wastes through those who are closest to the problem. These are the people who often have the best ideas and solutions. Here, the Office of Technology Assessment reviews their four phases of waste reduction, that is, common sense waste reduction, information driven waste reduction, audit dependent waste reduction, and research and development based waste reduction. The first two stages can be accomplished with simple checklists, which in turn, can shift the thinking of production people from ordinary production work, conventional pollution control, and common waste management practices to more beneficial waste reduction efforts. The latter stages require a greater commitment of resources and time. The Environmental Protection Agency, too, encourages the development of waste minimization audits to reduce the generation of hazardous waste. A model hazardous waste minimization audit procedure was developed by Versar, Inc. through the Agency's Hazardous Waste Engineering Research Laboratory in Cincinnati, OH. A summary of this procedure is provided, and the results of two case studies are carried out on two electroplating operation studies to test the procedure. Also, a six-phase auditing strategy is presented to assist industrialized facilities in developing waste minimization programs. This paper cautions against conducting these audits in a vacuum and emphasizes that successfulness of the audit can be measured only when the facility acts on the recommendations and realizes the expected benefits.

Solvent Recovery

The third section on solvent recovery presents some of the problems and solutions of waste minimization associated with a major group of chemical materials, especially those that have been identified as candidates for the land-ban regulations. As described in the paper on field sampling programs conducted at waste solvent treatment and recycling facilities, high-quality distillate products suitable for a variety of uses can be delivered while virtually all metal contaminants detected in the waste feed streams are transferred to the still bottoms and disposed of by offsite fuel supplement users, that is, asphalt kilns and blast furnaces. In this section, three field sampling programs conducted by Alliance Technologies Corporation for the Environmental Protection Agency's Hazardous Waste Engineering Research Laboratory are presented. Another paper on the methods for monitoring solvent condition and maximizing its utilization evaluates simple tests to be used as criteria for determining the condition of cold dipping (stoddard solvent), vapor degreasing (chlorinated solvents), and precision cleaning solvents (freon-113 and isopropanol), and for identifying when a solvent should be changed, thereby extending its usable shelf life. Another interesting paper presents a novel mobile solvent recovery system, for reclaiming

usable solvents on-site. The system has been designed to have the flexibility of reclaiming a wide variety of industrial solvents while still adhering to the regulations governing the quantities of wastes remaining within the system as residue, and minimizing the amount of cross-solvent contamination.

Used Oil Recovery

This section on used oil recovery identifies the regulatory restrictions, the types of waste oils involved, the options available for minimizing waste generation, and the process equipment needed to recover this material. One paper on minimizing waste oil disposal discusses minimization in terms of on-site recovery, on-site use as fuel, off-site disposal through fuel blending, off-site recycling, and hazardous waste fuels and the restrictions associated with these types of fuels. Case studies for utilizing waste oils as a fuel and for recycling waste machine coolants are also presented. Another paper presents a study on the demetallation of used oil before its burning, a method of facilitating compliance with the air pollution emission standards and the Resource Conservation and Recovery Act regulations. A novel approach for tanker cleaning operations is presented. A device used by the maritime industry for a number of years has been shown to be effective for use in the separation of oil from water at transportation service and repair facilities. Six field tests were made using different types of oil and oil mixtures, and the system required less capital investment and installation than the standard gravity separation systems.

Miscellaneous Separation and Utilization Practices

The last section on miscellaneous separation and utilization practices includes five papers. One paper discusses the efficiencies in waste processing. Here, the relationships between recovery efficiency and purity are explored. Criteria for an efficiency expression are discussed; current efficiency parameterization practices are discussed; and a current efficiency expression is presented. An alternative method of producing the efficiency distribution is developed. In another paper, the Environmental Protection Agency's Hazardous Waste Engineering Research Laboratory presents studies on three extramural projects in the area of waste concentration and resource recovery. In the area of magnetic separation, the Department of Energy, through their Oak Ridge National Laboratory, has developed criteria for selecting candidate wastes for testing the magnetic separation of uranium and other paramagnetic materials. Bench scale tests on the separation of uranium from magnesium fluoride waste indicate that a magnetic separation process could largely replace the expensive wet-chemistry process now being used at the Feed Materials Production Center in Fernald, OH. A paper on the elimination of precoat filter sludge hazardous waste presents a new liquid cyclone process, which can prevent further generation of ignitable hazardous waste, that is, sludge containing flammable solvent. The liquid cyclone system is designed to separate suspended solids from a polymer solution. Product and beneficial process changes resulting from the system change are discussed. On the topic of minimizing waste from municipal solid waste disposal facilities, studies have consistently found fly ash to contain levels of heavy metals, dioxins, acid gas constituents, and other pollutants in excess of regulatory standards, while the bottom ash stream is generally found to be within acceptable limits. A paper on the research and development activities of this waste has focused on the reuse of bottom ash as a lightweight aggregate. This process is showing very promising opportunities for recycling.

The papers briefly described here can provide a starting point for those who are becoming initially involved with waste minimization, or they can offer new and stimulating ideas

to help improve an existing program. More importantly, however, this collection of waste minimization papers from the Eighth Symposium on Hazardous and Industrial Solid Waste represents the free spirit and enthusiasm of the participants on this subject and their willingness to share these creative ideas to help others. The symposium committee gratefully acknowledges the efforts of the authors and personnel of ASTM that have made this publication possible.

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