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EDITORIAL

Minimizing Wastes

Among the advanced countries, efforts are increasing to reduce wastes and associated pollution. The U.S. National Academy of Engineering (NAE) has sought to bring good judgment to this effort. It has sponsored workshops addressing what it calls "Industrial Ecosystems." It has issued three publications* derived from the workshops that present experiences of a number of engineers in activities aimed at achieving waste reduction. The overall NAE approach is summarized in the following statement: "...the reshaping of industrial systems for environmental and economic success is based on efficient use of materials and energy, substitution of more abundant and environmentally preferable materials for those that are rare or environmentally problematic, reuse and recycling of products and materials, and control of waste and emissions."†

Progress is being made in the reduction of the content of waste streams, but the task is complex. Each of the thousands of industrial materials and consumer items presents a different set of problems. Some are tractable; for example, the recycling of paper products, aluminum, and scrap iron. In these instances the compositions are simple, the volumes to be recycled are large, a market exists, and the economics are favorable. But for other items a variety of impediments exists, such as the fact that the compositions of items are complex, or toxic substances are involved.

About 75% of the weight of automobiles is recycled. When a vehicle reaches a junkyard, useful subcomponents such as batteries, starters, tires, and generators are removed. Then the remainder is crushed to small lumps, and the iron separated for recycling. The remaining 25% (called "fluff") consists of plastics, liquids, and glass and has been sent to waste dumps. Recently, the German government has mandated that auto manufacturers take total responsibility for disposing of their products at the end of the vehicles' useful life. This edict will impact American companies that have sales there. It will ultimately lead to changes in designs that will facilitate disassembly and enhanced recycling of parts.

Components present in computers are numerous and complex. Processes involved in manufacture earlier gave rise to pollution, notably emission of chlorinated hydrocarbons. Teams of engineers have been devising means of minimizing pollution during production and in disposal of outmoded products. In one instance, they found that current technology was environmentally superior to alternatives. Replacement of lead solder by a solder containing either bismuth, indium, or silver was not justified when one considered total environmental impacts, beginning with the mining of the various elements.

In seeking to minimize hazardous wastes, it is sometimes necessary to consider tradeoffs. A new, highly efficient lamp has been created that if widely used would save an enormous amount of energy. The lamp contains mercury. Should use of the lamp be promoted?

To achieve minimization of wastes and environmental contamination in the United States, a combination of improved regulations and economic incentives will be required. At present, the regulatory machinery is not functioning optimally. For example, some of the regulations concerning the transportation and processing of waste discourage the reuse of waste. The result is unnecessary use of virgin material and unnecessary management and disposal of potentially useful material.

One of the workshops brought together engineers from Japan and the United States. In general, the technical problems encountered in the two countries are similar. Both sets of engineers also are affected by government regulations. In contrast to the situation in the United States, the Japanese government and industry work closely together.

As Japan and other countries gain experience and improve their waste management, they may well provide useful lessons for the United States. In turn, technology developed in the United States will be helpful to others. The rate of progress will be enhanced if means are found to improve the economics of recycling and waste minimization.

Philip H. Abelson

*B. R. Allenby and D. J. Richards, Eds., *The Greening of Industrial Ecosystems* (National Academy of Engineering, Washington, DC, 1994); D. J. Richards and A. B. Fullerton, Eds., *Industrial Ecology: U.S.-Japan Perspectives* (NAE, Washington, DC, 1994); D. J. Richards and R. A. Frosch, Eds., *Corporate Environmental Practices, Climbing the Learning Curve* (NAE, Washington, DC, 1994). †From Allenby and Richards, page v.