

CHAPTER 13

Prologue to the Twenty-First Century

In the 1940s, 1950s, and even into the 1960s, industrial waste treatments were patterned after those used to treat municipal wastes. In the 1960s and 1970s, we favored combining industrial wastes with municipal ones. During the 1970s and 1980s, we began to treat industrial wastes separately with more exotic and efficient methods and to seek exterior markets for them in other industries. All of these methods and systems from the 1940s to the 1980s were only partially successful and certainly inappropriate and generally outdated by the 1990s.

During the 1950–1980 period, when industry piped and even pumped industrial wastewaters into municipal sewers and sewage-treatment plants, representatives were aware of the accompanying problems and the inefficiencies that resulted. However, industry overlooked these and succumbed to the relative ease of disposal. Industrial costs were lower and legal responsibility for environmental degradation was avoided or at least jointly shared with the municipality.

Major requirements had to be met before industrial wastes could be treated along with municipal sewage. These requirements are valid even today and are more difficult to meet now than in earlier years (Nemerow and Agardy 1998). Such requirements include technical, economical, legal, and managerial ones.

Technical

Industrial wastes must be compatible (treatable) with the sewage. Industrial wastes must be equalized and proportioned to the flow and pollution load of the sewage. Industrial wastes should not contain any material toxic or detrimental to the operational objectives of the sewage-treatment plant. Industrial wastes should not contain any substances hazardous to the operating personnel or those of the environment near the effluent discharges. Industrial waste bypasses to the treatment plant must be provided if and when these wastes fail to meet the aforementioned four requirements. Proper treatment of the bypassed industrial waste must be employed to ensure environmental protection.

Economical

The cost to industry for combining its waste with city sewage must be low enough to provide sufficient incentive to use this system. Such provisions have usually been attained by the imposition of a sewer service charge. The charge often is based on the industrial pollution load that is being treated and/or removed by the treatment system. However, the variation in economic benefit to industry has been tremendous from one city to another. It has varied from the free use of the sewer and sewage-treatment plant or a nominal charge based on flow similar to householders to as prohibitive as a charge based on all extra pollutants. The free or nominal use of the municipal system has long been an unofficial “boon” to industry. Even the prohibitive charge to industry has often been economically acceptable because it avoided legal and/or managerial responsibilities on the part of the industry itself.

Legal

Once an agreement between the city and its industry has been reached, industry avoids at least part, if not all, of the lawful responsibility of any external environmental damages. Many times this alone has provided sufficient incentive to industry for this mode of solution to its waste problem. Industry often used this system when its wastes were difficult to treat or even hazardous when discharged separately to a watercourse.

Managerial

To industries of the 1940–1970 era, treatment and disposal of wastes represented a managerial burden. Because of this industrial attitude, combined treatment with municipal sewage was viewed as a welcome solution.

Conditions for Rejection

Despite its general use and acceptability, there were and still are situations in which combined treatment is not recommended. I recall the two most important ones here:

1. Perhaps most important of these in the long run is the lack of compatibility between municipal and industrial officials. As a result of a lack of a good understanding and cooperative relationship between them, technical problems will not be resolved satisfactorily.
2. Physical problems of industrial plant location, pumping, and the nature of hazardous waste may make this system unworkable.

All other adverse situations often can be overcome, if these two causes for rejection are absent.

Methods of Industrial Waste Reuse

Because of the problems and ineffectiveness of combined treatment and the situations that automatically call for its rejection, industry has sought other solutions. The most logical and most used solution is that of reusing its own wastes. The method first and generally used is reusing wastes within its own industrial plant. When possible, in-plant reuse is most economical and effective. However, such situations are ideal and seldom encountered in actual practice. As one plant manager put it, "Our wastes are wastes because they are not useful to us in any way."

The next potential for waste reuse is to contract with a "scavenger" collector to transport such wastes to a large central industrial waste-disposal plant. Such systems are costly to an industry for small volumes of wastes and impractical for larger volumes. They may, however, relieve the industrial plant of managing liability of disposal, which I discussed earlier.

The last waste-reuse technique involves the direct marketing of waste as a resource for another industrial plant. To use this method, industry must go through the familiar systems of selling its waste as it does its products. Selling is neither easy nor guaranteed and may involve giving more waste product characteristics information than it would like. Finding a suitable buyer for its waste, in fact, may even be more difficult than for its primary products. Waste exchanges, which publish industry waste needs and prices, assist plants to find buyers. Disclosure of waste character for sale remains a stumbling block for sellers using the direct method. A byproduct synergy system developed during the 1990s is an advanced method of direct reuse by another industry (see Chapter 9-D).

In replying to the question of whether the costs of recycling manufactured products is really less than the original cost of producing these same products Sherry Seethaler (2003) opines the following limited to aluminum cans, paper, plastic, and glass:

Aluminum: "Recycling aluminum is both economically and environmentally advantageous." She refers to rather well-known Environmental Protection Agency (EPA) data showing that it takes 95% less energy to make a can from recycled aluminum than from virgin bauxite. Also, the cans can be repeatedly recycled, thus saving valuable landfill space.

Paper: She admits that "recycling paper requires more water than reducing paper from wood but releases fewer toxic chemicals." Also, the recycling of paper eliminates the production of methane, a greenhouse gas, in landfills.

Plastic: She points out that plastic reuse (by melting and converting to other products) is "environmentally sensible because plastic is derived from crude oil." However, the wide variety of additives and other contaminants makes separation "arduous and expensive."

Glass: The original manufacturing of glass (like aluminum) requires very high production temperatures to melt and fuse the quartz sand, soda ash, limestone, and minerals, whereas recycled crushed glass melts at a much lower temperature, thus requiring less energy when it is added to the raw materials.

The Ultimate for Industrial Waste Reuse: EBIC

All of the previous descriptions of combined treatment lead to the main conclusion of this prologue. Because of the aforementioned inadequacies of combined treatment, a new solution is evolving. I have designated its terminology as the environmentally balanced industrial complex (EBIC). This new system has developed not only because the previous solutions were inefficient, but also because industry and society have grown exponentially so as to imperil our environmental resources beyond their capacity.

The EBIC can be described simply (Nemerow 1995) as a selective collection of compatible industrial plants located together in one area (complex) to minimize (or eliminate) both environmental impact and industrial production costs. These objectives are met by using the waste materials of one plant as the raw materials for another with minimal transportation, storage, and raw material preparation. When a manufacturing plant neither treats its waste nor stores or pretreats certain of its raw materials, its overall production costs must be reduced significantly.

Elimination of waste-treatment costs alone may be sufficient to influence industrial managements to continue to produce their products in the highly competitive world market. It should be our obligation to minimize waste-treatment costs and maximize protection of the environment.

Reuse costs within these complexes can be absorbed easier into production costs than end-of-the-line waste-treatment costs. Despite the advantages of the EBIC, many factors must be identified, clarified, and answered properly before a complex system can be accepted. For example, reasonable matches of waste quantities and raw materials must be established. In addition, the type of labor and worker numbers available in an area, as well as the marketing of products from the area, need clarifying. The key to feasibility for any complex lies finally in production economics and environmental protection.

Although we expect that during the twenty-first century many U.S. industries will transfer to overseas locations, certain ones are expected to thrive in the United States. Medical instrument manufacturing that requires careful monitoring and collaboration between hospitals, doctors, and manufacturers is one. Others include manufacturers that produce large equipment such as household items and furniture (difficult and costly to ship from afar), and producers of foodstuffs that are either frozen, perishable, or both. Hightech and innovative new industries will probably also be on the rise locally in the United States during the twenty-first century. Industries such as aluminum plants may also increase and return to mainland United States, if and when less expensive electrical energy becomes available. All of these types of industries are good candidates for an industrial complex system.

A realistic and optimistic suggested procedure for future industry was proposed on the op-ed page of the *Wall Street Journal* (“The greening of America, June 27, 2003, p. A12). “The key to future ‘green’ progress is maintaining (not stifling) the free market growth and innovation that can produce hydrogen cars or find a way to turn wind into cheap power.” The op-ed writer acknowledges that free marketers admit that pollution is an “externality” that has yet to be internalized into normal production costs.

There are many potential EBICs that will yield several salable products and result in no wastes reaching the external environment (Nemerow 1995). Another important advantage that is readily apparent to the environmental engineer is that generally no waste treatment is necessary within the complex. When, in some cases, waste treatment is required to render it directly reusable, another product also results.

There is an opportunity for industry and municipality to combine in the future to produce industrial products directly from municipal wastes. In such cases, the solid contaminants contained in municipal sewage would be converted within the treatment plant to industrial products for sale instead of for disposal on the land.

For example, settling tank sludge can be rotary dried, pulverized, amended, bagged, and sold as fertilizer to the agricultural industry. Floating matter from this same settling basin can be skimmed and rendered by steam heat treatment to produce—with certain additions—animal feed for this same agriculture industry. We practice both these treatments today to some degree and in a few instances. However, a concerted effort needs to be made to design municipal treatment plants to include industrial production as an integral part of its operation. This also requires a closer collaboration of industrial and municipal services rather than a haphazard afterthought following municipal sewage treatment.

Another example is the fish-food industry and municipal sewage treatment. In this case, the sewage treatment plant would be designed not only to purify its wastes, but also to produce fish such as Tilapia for sale from this same treatment. Effluent from such a plant would be recirculated into algae ponds that serve as food for fish pond production. Excess effluent would be sold to the agricultural industry for irrigation water.

I challenge municipal, federal, industrial, and environmental engineers who read this book to “think” design and operation of truly combined treatment so that no effluents reach our fragile and disappearing environment. At the same time, we will be producing valuable industrial products at lower costs.

References

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