CHAPTER 22

Summary

Nelson Leonard Nemerow

I have attempted to build the case for a change in industrial manufacturing from one consisting of waste treatment to one encompassing waste utilization. This significant change is made possible by using the concept of environmentally balanced industrial complexes (EBICs) instead of free-standing industrial plants. EBICs are designed so that each industrial plant utilizes some wastes from other adjacent plants with the result that no wastes escape into the external environment. The ultimate results are elimination of industrial environmental pollution and lower industrial production costs. Many examples, both realistic and potential, of such EBICs are given throughout the book.

Other useful resource information is given, such as the evolution from the Industrial Revolution era to the present. The academic and scientific development of environmental knowledge in the United States is also presented.

I have also expanded the EBIC concept to include examples of industrial–municipal complexes with the same overall objectives. In addition, byproduct exchanges and eco-industrial park examples of others are described to show a temporary bridge between the old and new EBIC practices. I have referred to these developments as *naturally evolving industrial complexes*.

I hope the case studies and background rationale for EBICs will provide more clarity and proof that the new method of industrial production is not only practical and economical, but also necessary and vital to our future.

Critique of the Subject of Environmentally Balanced Industrial Complexes

Franklin J. Agardy

Agardy, a partner in Forensic Management Associates, Inc., holds a bachelors degree in civil engineering from City College of New York, and master's and Ph.D. degrees in sanitary engineering from the University of California, Berkeley. He is one of the nation's leading experts in the water pollution control field and has extensive experience in hazardous waste management, solid waste, and landfill management, as well as environmental planning and analysis.

As a widely published authority on biological treatment systems and the treatment of industrial wastes, Agardy has served as a consultant to the U.S. Environmental Protection Agency, as well as local and state agencies with similar responsibilities. His experience includes air pollution control and solid waste management projects involving recycling and resource recovery, management of environmental impact studies for oceanographic and transportation systems, oil refineries, offshore terminal facilities, and power plants. His efforts have ranged from water-quality studies of lakes, lagoons, and marine systems to preparation of oil spill contingency and utility emergency plans. Litigation management support and expert witness activities have been a natural extension of these efforts.

Critique

Efforts to reduce and, indeed, eliminate "pollution" have been ongoing for well over 100 years. However, the concept of "industrial groupings" targeted to entirely eliminate pollution has been and continues to be voiced most prominently and vocally by one Dr. Nelson L. Nemerow.

How many times have we heard that the lessons of history point to the events of tomorrow. And, how many times have we ignored these lessons and "assumed" that we still had time to address and correct mistakes, mistakes often made in haste or in the name of "expediency." Even today, we hear that old slogan, The Solution to Pollution is Dilution. And although that slogan long ago wore out its welcome, we certainly still implement dilution as a solution, at least partially. Indeed, if the scientific projections are correct, global warming is being exacerbated by the ever increasing release of carbon dioxide to such a degree that it is exceeding the ecosystem's ability to "assimilate" the releases. A similar picture can be painted for the release of fluorocarbons to the

atmosphere and both domestic and industrial liquid wastes to numerous bodies of water around the globe. Once assimilative capacity has been exceeded, the rate of overall degradation increases rapidly and possibly to the point of no return. Indeed, is it possible, for example, to replace rain forests? I do not believe so.

Although there have been papers written and facilities constructed in which residuals from one industry or operation have been employed as feedstock for other industries, the examples did not lead to broad (or even narrow) acceptance of the approach. In a 1971 paper (1), the term "misplaced resources" was coined to describe residuals, so although the concepts described by Dr. Nemerow are not new, they were simply not fully developed and certainly not embraced. However, there is value in reviewing some of these efforts, in time sequence, to shed more light on the "historical perspective" leading to the "environmentally balanced industrial complex."

In early 1969, I had occasion to travel to Amarillo, Texas, and visit a 50,000-head cattle feedlot. The accumulation of feedlot wastes had reached such proportions that on windy days downtown Amarillo played host to a fine dust, with an associated odor that caused considerable grief to the community. The feedlot happened to be owned by a company that also had extensive natural gas holdings, with a gas transmission pipeline running directly through (actually under) the feedlot. So, how to take a waste stream and use it as raw materials such as was the case with the natural gas? The obvious solution was to anaerobically digest the feedlot waste, converting the majority to methane gas, which could (after removing the impurities) be added to the pipeline. Alas, the cost analysis demonstrated that the feedlot methane production exceeded the natural gas production by \$0.1 cent/ft^3. This was a sufficiently large enough differential to kill the project. The feedlot waste continued to pile up, the wind continued to blow, and the next attempt at a solution came years later. The story did have a positive ending in that the firm of CH2M-HILL did indeed design and build a bioconversion plant in the state of Colorado in the mid-1970s, converting feedlot waste to methane.

A similar story, also dealing with an agricultural waste, in this instance rice hulls, can be told. In the early 1970s, the State of California banned the burning of rice hulls, citing air pollution restrictions. One has only to visit the delta area of California to fully appreciate the extensive rice growing operations. So, once again a residual "needed a new home" and horse collars had long since gone out of style. Looking at the composition of rice hulls, one finds essentially a pure mixture of carbon and silica. Reflecting on the fact that the raw materials required in the manufacturing of cement include silica and that heat must be applied in the manufacturing of cement, it does not require a great leap of faith to appreciate that rice hulls contain the silica required for the cement and the carbon required for the fuel source. Again, the devil was in the economics, and California was just the wrong environment for such a combination of cement manufacturing and agribusiness, at least in the 1970s. Again, however, the idea did not die, and in the early 1980s, just such a plant was designed and constructed in Indonesia.

In 1971, the industrial/utility complex concept was described using several examples in which co-location of power-generating facilities (producers of large quantities of hot water) with other neighboring operations were "projected" to have a decided advantage over "going it alone." One of the examples included co-location of power generators with desalination plants, wherein the heat could be used to assist in

evaporation/separation. This simple co-mingling is, however, a one-directional dependency wherein the power plant benefits the desalting operation (other than reducing the ultimate heat load released to the environment) but continues to operate independently. This same one-directional dependency can be exhibited by co-location of power-generating facilities with municipal wastewater treatment plants (this concept works equally well with industrial wastewater facilities) where the increased temperature positively affects both chemical and biological processes through increased process efficiency (on a theoretical basis by at least 5%). As interesting as these ideas were, we as authors of the paper concluded by saying, "From a practical standpoint, we are also faced with people and political problems, mostly related to a reluctance to do things differently than they have been done in the past."

Have we finally reached that point of no return? I would hope not, but time is of the essence, and Dr. Nemerow has developed a carefully thought out and documented solution, which if (when) implemented will have a profound effect on our appreciation of waste residues as, indeed, misplaced resources and will represent a significant beginning to an entirely new age in the continuing battle to reduce and finally eliminate pollution—and, I might add, in a profitable manner.

In the final analysis, we no longer have the luxury of using "time" as "assimilative capacity." We no longer can depend on assimilative capacity at all. Finally, we can no longer equivocate, employing the age-old formula of "more studies." The birth of the "environmentally balanced industrial complex" signals the beginning of an entirely new approach to saving our environment. Having said this, I urge every reader to take this message of Dr. Nemerow's to heart and press on to an implementation strategy as soon as possible.