INDUSTRIAL COMPOSTING

Environmental Engineering and Facilities Management

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To my late brother, Elan Epstein

1932–2007

Preface

Composting of wastes is a very valuable technology in waste management and enhancing our environment. In the past fifteen years, it has evolved into a more sophisticated technology with greater emphasis on environmental and public health aspects. Particular emphasis has been on odor management, volatile organic compounds (VOCs) reduction, and bioaerosols management.

In the early 1970s and 1980s, research in the United States was concentrated on technology development with a special emphasis on pathogens. This resulted in the development of regulations designed to protect public health. In the 1990s considerable research was published on the utilization of compost and its importance in horticulture, erosion control, plant pathology management, and other uses. Today's research is primarily concentrated on emissions and their control.

Because of these successful efforts, composting increased, and more companies entered into the field with new and improved technologies.

In the United States, it is estimated that there are over four thousand composting operations. A majority of these are open facilities composting green wastes. Over 250 facilities are composting biosolids, and, predominantly, these are enclosed or partially enclosed sites. Interest is growing in composting of food wastes. Specialty composting, primarily composting of animal mortalities, has also increased. There is an excellent opportunity for composting of numerous industrial wastes, particularly from pharmaceutical, food processing, paper processing, and other organic waste producers.

From 1955 to 1972, I was at the University of Maine conducting research on runoff and soil erosion, soil–water relations with respect to plants, and management of animal wastes. In addition, I taught soil physics at the University of Maine and guided graduate students. In 1972 I joined a team of excellent scientists at the U.S. Department of Agriculture (USDA), Agricultural Research Station in Beltsville, Maryland.

At the largest USDA agricultural research station in the world, we began studies on land application of biosolids and composting. The principal scientists working on composting and land application of biosolids were Patricia Millner, Rufus Chaney, John Walker, Wiley Burge, George Willson, and Jim Parr. They were the best in their field. Patricia Millner and Rufus Chaney are still at Beltsville and are conducting excellent research.

We began doing research on biosolids composting in 1973. In the period 1973 to 1976, with the assistance of the above-mentioned scientists, I developed the aerated static pile (ASP) method and published the first paper on this subject (Epstein et al., 1976). At that time, we referred to it as the Beltsville method. John Walker began the research on biosolids composting using the windrow method. Two composting machines were available and tested. One was the Cobey Compost turner and the other manufactured by General Motors using the Terex front-end loader. We initially started composting biosolids (treated sewage sludge) from the Blue Plains Wastewater Treatment plant in Washington, D.C. Odor production was not a significant problem,

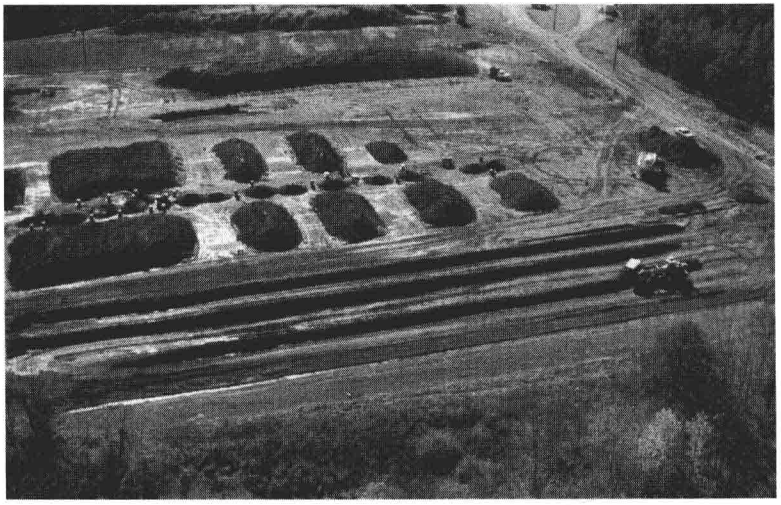

FIGURE 1 Windrow and ASP systems at Beltsville, Maryland. General Motors Terex composter is shown turning a windrow.

as residents were approximately one mile away, with a very dense, wooded area separating the research facility. At that time, we did not have too much material on our composting pad. Subsequently, undigested (raw sludge) was delivered to the site, and enormous odors were produced. It was then that we developed the ASP system. Figure 1 shows the Beltsville site. Both windrows and the ASP system are shown.

We were very fortunate to have as a neighbor Congresswoman Spellman, who lived in a community north of Beltsville and was concerned about the odors. She was an environmentalist and probably one of the first green congresspersons. With her support, we were able to galvanize public opinion and overcome the odor issue.

Our efforts at Beltsville provided sound scientific data for the U.S. Environmental Protection Agency (USEPA) regulations published as 40CFR503.

In 1980, Joel Alpert and I started E&A Environmental Consultants, Inc. Here, again, in our employment we had excellent engineers and scientists. Individuals such as Todd Williams, Charles Alix, Mark Gould, Larry Sasser, Chris Peiot, Ron Alexander, and Kathy Feldman were leaders in their field and superb scientists and engineers. They were also very decent, ethical individuals. E&A Environmental Consultants, Inc. was an excellent firm dedicated to its clients and the performance of the highest standards in the industry.

I thank Todd Williams, Charles Alix, and John Bouey for their technical advice and help on the three chapters dealing with odors. They provided excellent guidance and suggestions. I also thank Dr. Jonathan Wong, professor at the Baptist University in Hong Kong. He had me involved in two exciting composting projects and arranged for me to teach at the Baptist University of Hong Kong for one month.

Finally, I thank the U.S. Composting Council, its board of directors, members, and especially Dr. Stuart Buckner, for support.

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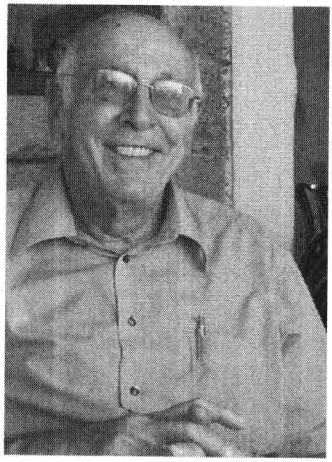
The Author



Eliot Epstein, Ph.D., is an internationally known expert in composting of waste material. He specializes in composting and biosolids management, solid waste, land application, and waste disposal. He is a soil physicist–agronomist by training. He spent 16 years as Research and Station Leader for the U.S. Department of Agriculture (USDA) Research Service at the University of Maine in Orono, Maine. In 1972, Dr. Epstein transferred to the USDA Research Center at Beltsville, Maryland, where he was the principal scientist on the project that resulted in the development of the "Beltsville" Forced Aeration (Aerated Static Pile – ASP) Composting System for waste.

Dr. Epstein has directed a variety of waste management projects for both government and industry, with tasks ranging from research and analysis to facilities design and operation. He has participated in many major composting programs performed in North America, Europe, and Asia, has authored over 150 technical papers on composting and biosolids-related issues, and has conducted technology transfer programs in sludge management and composting of various wastes for the U.S. Environmental Protection Agency (U.S. EPA) and the U.S. Department of Energy (U.S. DOE).

In 1997, Dr. Epstein authored the book *The Science of Composting* (CRC Press), and in 2002 published a book titled *Land Application of Sewage Sludge and Biosolids* (Lewis Publishers). Dr. Epstein was active in the Water Environment Federation, serving on their Residuals Committee. In 2007, he received the Pioneer Award in Disinfection from the Water Environment Federation. He was project leader on the U.S. EPA project to revise the White House document, 40 CFR 503, on Pathogen and Vector Attraction Control. Dr. Epstein has served as a consultant to the World Bank, the U.S. EPA, and the United National Development Programs.

Contents