Aeration Control
System Design
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This is an engineering manual.

There are a lot of excellent resources available for energy conservation in wastewater treatment facilities. They contain a great deal of useful information on developing and implementing energy conservation programs. Most of them discuss aeration in general and automated aeration control in particular. Many of them include case histories identifying successful implementations of aeration control and showing the resulting savings. A few identify unsuccessful attempts and how to avoid problems.

To the best of my knowledge none of the available resources provide the detailed engineering procedures required to design, commission, and test an aeration control system. To the best of my knowledge none of the available resources provide detailed guidance on applying the multiple engineering disciplines—mechanical, electrical, and environmental—necessary for successful system design.

The information in this book is the result of over 30 years experience in analyzing energy consumption in wastewater treatment plants. It includes the lessons learned in the design of over 200 aeration control systems. This is hard-won knowledge, and was gained by personal experience in all of the tasks needed to develop concepts, sell management on the cost-effectiveness, get operator buy-in, and work through the inevitable start-up issues. The intent is to explain the nuts and bolts details of what to do—and what not to do—in designing aeration control systems.

There are two concepts that appear repeatedly in this book. First, there are no hard and fast rules. Steady-state operation is virtually nonexistent in wastewater treatment. This leads to the second concept. Whenever possible the assistance and input of equipment manufacturers should be obtained in order to obtain the highest level of precision possible in calculations.
Unfortunately, equipment manufacturers may not be responsive enough to meet the tight deadlines associated with many energy conservation and control designs. Worse, in some cases the information obtained may not be pertinent or even accurate. A thorough knowledge of the many aspects of aeration system operation is necessary to filter good information from bad and to make independent evaluations when outside sources fail. My intent is to provide that knowledge.

Another theme that appears throughout this text is “reasonable accuracy.” One unfortunate side effect of the wide availability of computers, math software, and advanced modeling programs is the tendency to create elaborate analyses of various alternatives. The results, calculated to 10 or 20 digits, are reassuring and intellectually satisfying. There is a tendency to forget that the elaborate calculations are all based on initial assumptions that are only correct to two or three significant digits!

There is a time for detailed and precise calculations, and sophisticated modeling can provide insight into relationships between variables that would be difficult to achieve in any other way. However, when the early stages of the design process require deciding between multiple alternatives, it is generally adequate to use what used to be called “slide rule accuracy.” Then, when the problem has been narrowed and the needed supporting data gathered, more advanced calculation methods can be used for the final analysis and design confirmation.

This book will show in detail how to predict savings, how to design systems that meet the mechanical, electrical, and process requirements, and how to commission the systems to secure successful operation. It is wide ranging in scope, but focused on providing practical guidance to creating aeration control systems that the operators will feel comfortable leaving in automatic.
First and foremost the credit for making this book possible goes to my wife, Ginny. I know—everybody says that. In this case Ginny has earned the credit a hundred times over. She gave me support and encouragement, of course. But more than that she backed me 30 years ago when I had “an idea,” supported me when I began a business to commercialize that idea, figured out how to feed our family through the long lean years getting started, and for many years handled the finances for the business purely as an act of love. “Thanks” is inadequate, but all I have.

I also need to thank our employees. Over the years they contributed their hard work, ideas, and expertise to improving and implementing aeration control systems. All of them were important, but a special “thank you” goes to Tim Hilgart. He stuck it out through the tough times and was in it for the long haul. In my long career I have met no better engineer or finer man.

Finally, I want to thank my brother Paul and all of the plant operators I have worked with over the years. These professionals contributed insights, ideas, and encouragement. Some also contributed harsh and much needed criticism because they knew and understood reality in a way that no engineer really can. I hope this book repays their efforts by helping engineers design solutions—not problems!

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