

# BOOKS

**Systems Approach to Air Pollution Control**, R. J. Bibbero and I. G. Young, Wiley, New York (1974). 531 pages. \$19.50.

The problem of air pollution control is so massive and intricate that it can be effectively approached only through a careful, systematic evaluation of the interrelationships of all its components. A so-called "systems approach" to air pollution control will have to involve cost-benefit tradeoffs among the multitude of competing interests. In contrast to a number of other books available, which consist of either collections of unrelated chapters written by different authors or a treatment of a specific aspect of air pollution, this book attempts to view the air pollution problems in a unified way from the broadest possible context.

After an introductory chapter and one on global sources, sinks, and residence times of air pollutants, the authors present a good discussion of the societal costs and effects of air pollution in Chapter 3. Chapter 4 contains an excellent summary of air pollution legislation enacted in the United States, which is perhaps the most easily accessible, exhaustive survey of its type. Unfortunately the authors do not attempt to comment on how the laws came to be enacted and why certain standards were adopted and not others. The history of the establishment of the current health-based air quality standards, for example, is a particularly revealing one into how profound legislative decisions are sometimes made on the basis of the scantest of evidence.

Chapter 5 contains a discussion of the types of control strategies one might construct. A rather unique discussion of the considerations in the design of an air monitoring network is the subject of Chapter 6. Chapter 7, devoted to the application of air pollution data, seems to be a collection of topics which did not fit well into any of the other chapters. The section on air pollution indexes is presented without critical interpretation and, from my point of view, could easily have been omitted. Mathematical models of air pollution is the subject of Chapter 8, most of which is based on Chapter 3 of *Meteorology and Atomic Energy—1968*, edited by D. H. Slade. Chapters 9 to 11 constitute an excellent treatment of pollutant measurement methods.

It is clear that this book is not intended for use as a textbook. It has no problems and virtually no examples. Where specific technical material is presented, it is often done so directly from

other sources and without much explanation, assuming a prior understanding by the reader. For example, the log-normal distribution (p. 32) transfer functions of air quality monitors (p. 228), the optimization of an air quality data communication network (p. 246), equations for wind speed (p. 288), and plume rise formulas (p. 294) are simply presented with no development. However, the authors do not propose this book as a text.

Although not specifically stated, I suspect the best audience will be pollution control engineers, who are already familiar with control methods (which are not covered in this book) and will benefit from seeing the entire systems approach. Given the book's focus, it seems to me that its major failing is a lack of an attempt to develop and apply the methods of optimization to air pollution. The need for a cost-benefit optimization approach is repeatedly stressed, but the authors never really get around actually to applying optimization theory to some concrete examples. The reader is left with the impression, "It's a great idea, but how do I do it?"

JOHN H. SEINFELD  
CALIFORNIA INST. OF TECHNOLOGY  
PASADENA, CALIFORNIA 91125

**Liquefied Petroleum Gases: Guide to Properties, Applications and Usage of Propane and Butane**, A. F. Williams and W. L. Lom, Wiley, New York (1974). 403 pages. \$33.50.

**Liquefied Natural Gas**, W. L. Lom, Wiley, New York (1974). 178 pages. \$18.00.

Both these books are quite complete and readable introductions to the LPG and LNG businesses, respectively. The authors are affiliated with the Esso Research Centre in Abingdon, England, and the books reflect a wealth of both individual and international corporate experience with these fuels. In fact, they almost could be titled "Everything You Always Wanted to Know About LPG (LNG) but Didn't Know How to Ask!"

The LPG book is divided into sections covering LPG sources, manufacture, physical and chemical properties, burning characteristics, bulk distribution and handling systems, and large- and small-scale uses. Because of the breadth of coverage, the book is not a complete handbook. However, descriptions are quite complete and highlight important factors. Extensive references and suggested further readings are pro-

vided for those who need additional information. This book should be of great value to anyone wishing to acquire an overview of the spectrum of LPG technology, ranging from LPG as a fuel to uses as chemical feedstocks, in farming or in the food industry. The book does not go into the economic and marketing aspects of the LPG business, although some worldwide usage statistics are provided.

One weakness of the book, in my view, is the rather cursory treatment of general safety and fire precautions. Less than three pages are devoted to this subject, and safe practice guidelines are presented in list form with little or no explanation. The authors include service and maintenance personnel in their suggested readership group; for such people the treatment of recommended safe practices is seriously inadequate and although the authors suggest further reading, they do not stress the importance of this for persons actually working with LPG systems.

Dr. Lom's book on LNG draws heavily on the published literature. He has organized the book well and covers topics which include a historical review of cryogenic and LNG technology, natural gas supply and demand, liquefaction plants, ships, storage and vaporization facilities, LNG utilization, safety, and future uses. Much valuable information is assembled in this book—the author undertook a monumental task and did quite well in selecting from the voluminous LNG literature to write a comprehensive book about LNG. Some minor contradictions and deficiencies will be obvious to specialists in particular aspects to LNG technology, but then this book is not intended for specialists except to provide them with an understanding of aspects of LNG technology outside of their specialty.

The book is weak in presenting physical property information for LNG. Some limited data are presented for methane and for the various pure components which may be found in LNG mixtures, but useful references to the considerable literature on LNG properties are not provided as they are in the LPG book. This volume, too, is weak in the safety area although a chapter is devoted to the subject. For example, specific hazardous distances are given for an incompletely defined LNG spill accident. The uses of high expansion foams and dry chemicals in controlling or extinguishing LNG fires

are described in a confusing manner.

On balance, nevertheless, both books are welcome additions to the libraries of those engineers and managers in a wide range of activities involving LPG or LNG technology.

ELISABETH M. DRAKE  
ARTHUR D. LITTLE, INC.  
CAMBRIDGE, MASSACHUSETTS 02140

**Introduction to Chemical Engineering Analysis**, T. W. Fraser Russell and Morton M. Denn, Wiley, New York (1972). 502 pages. \$17.75.

In the past two to three decades we have seen chemical engineering education swing from the Unit Operations—Technology school to the transport phenomena approach. At the extreme of this swing students have found the mathematics to be somewhat abstract and difficult to relate to reality. However, without this swing it is not easy to see how engineering could meet the demands of modern design. These authors present a good attempt to inject reality into the concepts of engineering analysis, which is the essence of engineering education.

Although the material covered is somewhat ambitious for an introductory text in chemical engineering, engineering analysis, as present in the first three chapters of Part I, is an excellent place to begin the formal education of engineers. The model development diagrams of Figures 3.5, 3.6, and 3.8 present a concise picture of the thought processes used in the analysis of physical processes. This section places proper emphasis on the mathematical model as a foundation for later sections, along with the essentials of dimensions and units. Since students often question the need for courses in chemistry, good choice is made of examples in reaction kinetics in this introductory part of the text.

The approach used in this textbook requires some maturity in mathematics, but Chapters 15, 16, and 17 of Part IV summarize the needed mathematics very effectively. The material in these chapters will require some attention as it is needed in the other parts of the text if the university does not have a strong applied mathematics department. However, the use of mathematics at this level should have a strong motivating influence on the students to master the topics covered in typical mathematics courses.

Parts II and III introduce the mass and energy balances in a refreshing way. The order of the material may require some instructors to reorient themselves, but the discussion of physical and mathematical principles as they are needed in the text has proven to be an effective approach in modern en-

gineering education. The use of data analysis in the examples serves as an excellent introduction to graphical techniques. The instructor using this text will find a wide choice of examples of engineering analysis, all very well chosen to illustrate the unique character of chemical engineering among the engineering disciplines.

The authors of this text have formalized an approach to introductory engineering education which this reviewer has found to be most effective through fifteen years of cut-and-try. Modern engineering requires more engineering analysis than unit operations calculations of the old school, and students require an early motivation by seeing the utility of the material they study. This approach is a step in the direction which will satisfy both these needs.

JAMES W. HALL  
BROWN AND ROOT, INC.  
HOUSTON, TEXAS

**Heat Transfer in Fires: Thermophysics, Social Aspects, Economic Impact**, P. L. Blackshear (ed.), Scripta; Washington, D.C. (1974). 513 pages. \$28.50.

This is a collection of technical discourses by several authors which provides an excellent introduction to the state of the art of the combustion aspects of fire. With minor exceptions, the various components of fire are described in a well coordinated and cohesive fashion. The fundamental relationships which have been developed to date are reviewed and with the references cited, this book provides a comprehensive source for engineers and researchers.

The first section focuses on the social and economic implications of fire. It presents reasons to better understand the physics of fire. The annual losses from fire are cited to introduce the question of how much should be spent to reduce these losses. As one might expect, however, the reader is left with the impression that the social and economic aspects are less well understood than the growing science of characterizing unwanted fires.

The main text discusses the gross character of accidental fires, bringing in principal factors such as fuel loading, geometry, and ventilation. The chapter on fires in enclosures offers a concise summary of spreading, flash-over, and fully-developed fires. This is followed by several chapters dealing with heat and mass transfer. Particular attention is paid to the condensed phase since the response of solid or liquid fuels in fires poses special analytical difficulties. Discussions of flames and condensed phase interactions, mass and energy balances, and the kinetics

of pyrolysis encompass the principal phenomena. The fluid mechanics of flames are also included.

The next section of the book relates textbook radiative heat transfer theories to fires. The final two chapters provide masterful summaries of fire spread and ignition.

Although the reader can conceive of other phenomena which are important parts of the fire problem, (for example, heat transfer processes relating to human injury and the generation of toxic gases), and which might be expected to fall within the implied objectives of the book, this work does serve as a very valuable reference for technicians concerned with accidental fires.

DONALD S. ALLAN  
ARTHUR D. LITTLE, INC.  
CAMBRIDGE, MASSACHUSETTS 02140

**Selecting Engineering Materials for Chemical and Process Plant**, L. S. Evans, Wiley, New York-Toronto (1974). 164 pages. \$14.95.

This book purports to be of value to "chemical, design and maintenance engineers responsible for the choice of engineering materials, in all process industries" and to be "suited to all material science chemical engineering and mechanical engineering courses in universities". This reviewer feels that only those individuals who have recently emigrated from the United Kingdom could find it comfortable to use. For use in America, it can only be confusing and strange, certainly inconsistent with the technical terms and usage normal to our educational background and technological literature. For example, "E" is the symbol for yield strength,  $R_{20}$ , the room temperature ultimate tensile strength (UTS) and  $R_t$ , the UTS at design temperature. Further, the book is inconsistent in its own terminology; for example, units for stress range from  $N/mm^2$  and  $N/cm^2$  to  $KN/m^2$ , while pressure is given both in  $Kgf/cm^2$  and  $N/cm^2$ . (A conversion table might prove of value to those not conversant with the mental gymnastics required to cope with so wide a range of units and to help anchor them to the American-English system still current in the United States.)

If the foregoing drawbacks were insufficient to recommend against this book, it also suffers from inaccuracies (for example,  $600^\circ C$  is cited as the temperature for the onset of creep in austenitic stainless steels, which is too high by about  $150^\circ C$ ), typographical errors (for example, on page 13, reference 41 should be 40 and on page 33, in Table 3.2, the column headings are misprinted), and careless printing (for