membrane field that may equal or surpass simple membrane separation processes in economic importance by 1990. Unfortunately, an area not included in Chapter 3 involves barrier polymer films and smart barriers that can pass one component (eg. CO_2) while minimizing the passage of another (eg. O_2).

Compared to the first edition, the expanded second edition includes more detailed discussions of the principles controlling the various membrane separation techniques. Division of processes into concentration-driven, electrically-driven and pressure-driven categories is used to structure the discussion. Basic requirements and properties of membranes for each of these areas are clearly delineated. Properties of biological membranes, not treated in the original edition of the book, are described concisely in a separate chapter of the new edition. As in the other nine chapters of the book, the treatment of biological membranes and discussions of membrane formation processes and characterization of membrane properties are simple and written in clear understandable language that will not intimidate the uninitiated. Good up-to-date references are provided for the reader who is interested in delving deeper into the topic. Good summary discussions supported by a useful number of references characterize the treatments and make the book a recommended addition to the collection of anyone active or interested in becoming active in the membrane field.

W. J. Koros
Department of Chemical Engineering
The University of Texas at Austin
Austin, Texas 78711

Economic Methods for Multipollutant Analysis and Evaluation

By W. D. Baasel, Marcel Dekker, Inc., Pollution Engineering and Technology: A Series of Reference Books and Textbooks, Vol. 25, 1985, $65.00.

This text presents the Multimedia Environmental Assessment System developed by the Industrial Environmental Research Laboratory of the United States Environmental Protection Agency. The Multimedia Environmental Assessment System is designed to provide an economic and systematic screening tool for defining the potential hazard associated with polluted discharges to the air, water and soil. Unlike the typical approaches to defining risk that focus on the effects of single contaminants, this assessment method attempts to evaluate risks associated with multiple contaminants introduced into the environment by several paths. It is an attempt to address the problems associated with some of the overly narrow pollution control attempts of the past that have resulted in exacerbation of related pollution problems.

As with any simple method, however, it is subject to its share of criticisms. Particularly simplistic is the assumption of additivity of hazard associated with mixtures of pollutants when information to the contrary is unavailable. In addition, much of the method is simply the renaming of familiar measures of risk, such as threshold limit value, and the definition of new risk measures such as severity, which is simply the ratio of observed to desired concentration levels.

Regardless of the merits of the particular assessment system, however, it is an honest attempt to address the multipollutant, multimedia environmental problems that face the world today. He begins with an example of the pollution associated with a coal fired power plant and clearly demonstrates the need for simultaneous consideration of the risks associated with all discharges rather than approaching pollutants one at a time. The author provides an overview of the assessment process and follows this with chapters dealing with the details of each phase of this process. Throughout these chapters the author refers to concrete examples with tables of data appropriate for the examples. In addition, an extensive appendix is provided that summarizes desired concentrations (i.e. the multimedia environmental goals that are at the heart of the assessment system).

Other than my own hesitation to embrace the described assessment procedures, my main problem with the text was uncertainty over its readership. It seems aimed at a survey course in environmental assessment, and like most survey courses, it does not really prepare the reader to do anything. The preface suggests that the book will prove useful in the preparation of environmental impact statements but I think it is probably too general to be of much use in such an exercise. In addition, the author was forced to choose an almost uncomfortable balance between detail and generality. For example, the three paragraph discussion of gas chromatography in the chapter on chemical analyses is unlikely to impart much understanding to a person who knows nothing about the technique but is equally unlikely to be of much use to one who does.

However, the text does provide an overview of the current practice of multimedia environmental assessment to the reader. I found the book useful in that it reminded me of the important environmental decisions that must be made based upon incomplete and sketchy data and often seemingly arbitrary analysis techniques.

Danny D. Reible
Department of Chemical Engineering
Louisiana State University
Baton Rouge, LA 70803

Spray Drying Handbook, Fourth Edition

By K. Masters, Halstead Press, New York, 1985, 696 pp.

Since the appearance of the First Edition in 1972, Keith Masters' tome on spray drying has been the standard first reference consulted by practitioners in the field. With the Third Edition (1979), it became known as a Handbook, which is certainly an appropriate description.

The book gives primary emphasis to three areas. The first of these is description and selection criteria for equipment. The second is discussion of atomizers and atomizer characteristics, including analysis of drop-size distributions. The third is a listing and discussion of the many different product applications. The presentations on atomizers, drop-size characteristics, and equipment are probably the most comprehensive available. The coverage of products is good but somewhat uneven. For example, within the foods area there is much discussion of spray-dried milk products, but only 2½ pages cover instant coffee, which is a major product.

The Fourth Edition is not much different from the Third. Only one new subsection has been added (Equipment to Agglomerate Spray Dryer Fines). The figures are essentially the same. The list of references is exactly the same, with the result that there is, very unfortunately, no reference more recent than 1978. How little can one change in a book and still call it a new edition?

There is a good amount of current research in spray drying, as becomes

readily apparent to attendees at the International Drying Symposia. Some areas where there has been considerable recent activity but are not represented much in the book, are:

1. mathematical modeling of spray-air dynamics and of the resultant quantitative drying characteristics,

2. measurement and analysis of transport processes involved in the falling-rate period of drying, in the loss or retention of volatile flavor and aroma substances, and in thermal degradation,

3. description and interpretation of the factors governing changes in particle size and shape during spray drying, starting with the studies of Verhey in the early 1970's.

C.J. King
Dean, College of Chemistry
and Professor of
Chemical Engineering
University of California
Berkeley, CA 94720

LETTERS TO THE EDITOR

To the Editor:

Tanmoy Chakravarty, C. W. White, III, and W. D. Seider in their R&D Note in the *AIChE Journal* [31(2), 316(1985)] comment on the three liquid phases of the system ethylene glycol (1)/lauryl alcohol (2)/nitromethane (3) that was studied by Francis (1956) as well as by Gautam & Seider (1979). In this R&D Note Chakravarty et al. state: "In 1979 Gautam and Seider used the Rand method and a new algorithm for phase splitting to compute the compositions at equilibrium for a mixture of 40 mol % of ethylene glycol, 30% lauryl alcohol and 30% nitromethane at 295 K and 1.013 bar (1 atm). The extended Van Laar equation was used with the interaction coefficients for the binary pairs determined by Null (1970) who fit the experimental data of Francis (1956) with three liquid phases at equilibrium."

According to Chakravarty et al. (1985), Null (1970) used extended Van Laar equation to represent the experimental data of Francis (1956) for the ethylene glycol/lauryl alcohol/nitromethane system at 295 K and 1.013 bar (1 atm) and obtained the interaction coefficients in Table 2. See Table 1 in this letter which gives three liquid phases with compositions (plotted in Figure 1) that show poor agreement with the experimental data of Francis, especially for the phase concentrated in lauryl alcohol. Null's Figure 6.17 shows a mistakenly good comparison, but unfortunately, the calculated compositions are mole percents and were not converted to weight percents when plotted with the experimental data.

Chakravarty et al. have corrected this mistake, but another mistake seems to remain. The calculation procedure used in their R&D Note is similar to Null's in the sense they start with a liquid mixture which is split into three liquid phases. This feed mixture was 40 mol % of (1), 30% (2) and 30% (3) in Null's work as well as in Gautam and Seider (1979) and in their R&D Note. We plotted this as point F on Figure 1. Observe that this feed is not within the triangle defined by the three experimental liquid phases, although it is within the triangles calculated from the parameters of Null and from Chakravarty et al. It is impossible for this feed to be split into the three experimental liquid phases, unless a negative value for the amount of one of the phases at equilibrium was obtained allowing the material balances to be solved.

Analyzing the parameters used by the different authors for this system, it should be stated that according to Null, "The constants for the binary Van Laar equations were obtained from the mutual solubilities, as indicated on the plots given by Francis." Obviously Null predicts the

Table 1. Van Laar binary parameters and calculated compositions of the three liquid phases at equilibrium of the system ethylene glycol (1)/lauryl alcohol (2)/nitromethane (3).

	Null (1970) (From mutual solubility data)		Chakravarty et al. (1985) (From three liquid phases and mutual solubility data)		Ruiz and Marcilla (From mutual solubility data)		Ruiz and Marcilla (From three liquid phases data)	
a_{12}	1.496		−0.8904		1.218		−1.212	
a_{13}	4.588		3.501		3.211		3.126	
a_{21}	3.16		7.51		4.819		14.264	
a_{23}	4.68		2.655		4.684		2.135	
a_{31}	1.593		1.594		1.829		1.593	
a_{32}	2.878		2.457		2.715		2.852	
	mol % (3)	mol % (2)	mol % (3)	mol % (2)	mol % (3)	mol % (2)	mol % (3)	mol % (2)*
	98.13	0.86	92.88	2.66	93.17	0.77	89.54	1.35
	27.26	3.45	32.42	0.79	27.67	0.76	34.74	2.07
	9.56	72.00	23.55	37.19	11.00	65.49	24.50	30.51

*This calculated composition coincide with the Francis experimental data.