to belong to a "new class" of elitist and leftist well-heeled "thinkers" (a "Penthouse Proletariat") who really oppose growth in any form provided they are not themselves inconvenienced. This reviewer notes that such individuals and groups have come under increasing attack recently, whether it be by the NAACP declaring its support for nuclear power or by a recent magazine article analyzing the opposition to more electrical power for the Hudson River valley.

All the pro-nuclear arguments are well-supported by references that seem fully applicable, and this reviewer noted no scientific inaccuracies in the presentation, although the figures for radiation backgrounds superposed on a map of the U.S. (p. 56) seem low.

Repeating, this is a *must-read* book for the mass of information, in readily usable form, packed between its covers. The author's style is much harder hitting than is usual for pro-nuclear authors and thus may not appeal to some, although others will find it most appealing. Now, if only the news media would reprint this book, or some excerpts therefrom, in some of that space that is so regularly wasted by some hack writer of the "news" services, or some columnist, in rehashing the same tired old inaccuracies and worse, then . . . .

Hugh F. Henry has been head of the Physics Department of DePauw University since 1961. Prior to that, his responsibilities at the Oak Ridge Gaseous Diffusion Plant included those of criticality safety and health physics. His publications in these general fields include the book, Fundamentals of Radiation Protection, *which was published by Wiley-Interscience in 1969. He spent a sabbatical leave during 1968-1969 at the National Reactor Testing Station in Idaho Falls, and spent a similar leave during 1975-1976, with his time divided between the National Radiological Protection Board and the U.K. Atomic Energy Research Establishment, both at Harwell, England. He is a member of the U.S.A. Standards Institute (USASI) Committee on Radiation Protection and has been a U.S. delegate to meetings of the International Standards Organization (ISO) in this field.*

Two-Phase Flows and Heat Transfer
(Proceedings of a NATO Advanced Study Institute, August 16-27, 1976, Istanbul, Turkey)

Editors	S. Kakac and F. Maylinger
Publisher	Hemisphere Publishing Corp.
Pages	Vol. I, 547; Vol. II, 542; Vol. III, 374
Price	$118.00 for three volumes
Reviewer	Pasquale M. Sforza

This collection of papers is essentially the Proceedings of an Advanced Study Institute on Two-Phase Flows and Heat Transfer sponsored by the NATO Scientific Affairs Division, the Scientific and Technical Research Council of Turkey, the Turkish Atomic Energy Commission, and the Middle East Technical University. This meeting, planned as a forum for advanced instruction on two-phase flows, particularly involving heat and mass transfer, was held at the University of the Bosphorus, Istanbul, during the period August 16-27, 1976. The format of the meeting included in-depth invited lectures as well as a number of contributed papers. The meeting was described as an international forum, with 140 participants from 22 countries listed as in attendance. It is interesting to note that fewer than 10% of the attendees were from the U.S., and among these only five universities were represented.

These three volumes present 54 papers in 1453 pages, an impressive quantity of material. The editors offer two formats for consideration of the areas covered in the meeting. The first is that which gives chapter headings to the three volumes: Generalities and Two-Phase Flow Instabilities in Vol. I; Two-Phase Flow Heat Transfer, Burnout, Transient and Film Boiling, Augmentation of Heat Transfer, Industrial Applications of Two-Phase Flow, and Nuclear Reactor Safety in Vol. II; Boiling Phenomena, Modeling Studies, Heat Transfer and Pressure Studies, and Unsteady Flows and Reactor Applications in Vol. III. Also included at the end of Vol. III is a chapter entitled "Research Recommendations," in which a group of researchers present suggestions for further research and describe urgent problems in two-phase heat and mass transfer. A second topical guide is offered by the editors under the following headings: Equipment and Applications, Instabilities, Measurements and Instrumentation, Models and Scaling, Nuclear Reactors and Power Plants, Patterns and Regimes, Reactor Safety, Theory and Correlations, and Thermophysical Properties. Those papers dealing with a given topic are listed alongside the heading.

The first portion of Vol. I begins with two papers dealing with general features of two-phase flow, description of the different regimes of flow, and effects of two-phase flow on heat transfer. Various measurement techniques useful for two-phase gas-liquid flows and derivations of the equations that describe such flows are the subjects of the six following papers. Scaling criteria for two-phase flows are covered next, followed by papers on constitutive relations. Two extensive papers, one on "Momentum Exchange and Pressure Drop in Two-Phase Flow" by L. Friedel describing extensive correlations, and another, "Single-Phase and Two-Phase Flow Behavior in Primary Circuit Components" by J. G. Collier, describing the performance of such components as bends, tees, manifolds, etc., in two-phase flow situations, are included. The final portion of Vol. I concerns two-phase flow instabilities and begins with a detailed "Review of Instabilities in Two Phase Systems," by A. E. Bergles. Three papers on particular cases of two-phase flow oscillations and instabilities follow.

Volume II begins with a section on two-phase flow heat transfer, which is concerned primarily with boiling phenomena. Experimental results are extensively quoted, including interesting photographs of boiling regions immersed within thermal boundary layers in "Two-Phase Boundary Layers in Subcooled Boiling" by M. Cumo. This is followed by a section devoted to problems of burnout, which includes a two-part review on pool boiling systems and on subcooled and low quality forced convection systems by A. E. Bergles. Next are two extensive reviews, one on post-dryout heat transfer by J. G. Collier and one on augmentation of two-phase heat transfer by A. E. Bergles. Also reviewed are

industrial aspects of two-phase flows and data on mass transfer parameters in gas-liquid reactors. The final section of Vol. II is concerned with nuclear reactor safety. Included is a paper by C. W. Solbrig that examines some of the experimental work being conducted on loss-of-coolant accidents (LOCAs). Following this is a two-part paper by G. Yadigaroglu and E. Elias, which evaluates the state-of-the-art of heat transfer and fluid flow in the reflooding phase of a LOCA. Other problems relating to heat transfer problems in nuclear reactors are treated in the remaining papers of the volume.

The final volume of the set covers several different topics. The first section contains papers that deal with boiling phenomena and includes cinematographic and interferometric studies of boiling effects as well as a study of simulation of boiling by use of refrigerants. Modeling studies are the subject of the next section, which begins with a review of the theory of equilibrium homogeneous transient two-phase flow by C. W. Solbrig and D. Gidaspow. Other models treated in this section include a system mean void fraction model for transient phenomena, a dynamic model of gas-heated steam generators, and a model for nonequilibrium effects in rapidly expanding two-phase media. The next section concentrates on heat transfer and pressure studies, and the final section is devoted to unsteady flows and reactor applications. The papers in this last section address problems of phase separation and prediction of pressure and liquid level decrease during a LOCA, burnout experiments on model rod bundles, and dynamic instabilities in steam generator pipes. The volume closes with suggestions for further research and a description of urgent problems in two-phase flows, offered by a group of experts in the field. Inasmuch as ten such experts give their own opinions, it is not possible here to describe them; however, they are of great interest since they are very diverse, reflecting as they do the particular concerns of the individuals involved. The suggestions also indicate that there is much work to be done in the field and that, despite extensive study, two-phase flow investigations still rest on a relatively primitive foundation.

This three-volume set is a very useful reference work on heat transfer in two-phase flows primarily because of its breadth and depth. There are many review-type papers and hundreds of references to the literature, both old and new. An index is provided, but it is rather superficial considering the scope of the work. These volumes are not really suited for service as textbooks, although they are valuable as references. They should be of interest to readers of *Nuclear Technology*, since a good portion of the books is devoted to nuclear reactor problems. There is no apparent attempt at editing for uniformity, which is the rule for works of this sort, so that some papers are much more informative and readable than others. The most glaring omission in the set, in my opinion, is the almost complete absence of detailed numerical analysis of the problems of two-phase flow. Practically all of the analytic work is global, semi-empirical, and correlative in nature. Numerical analysis seems to be a virgin area in the field, perhaps because of the basic uncertainties in the constitutive equations for such flows. Nevertheless, in the journals, papers on theoretical aspects of single-phase flows are almost uniformly numerical analyses. It is expected that there should be a thrust to start numerical modeling of the complicated problems of two-phase flows. On the other hand, experimental investigations were quite evident, covering much material quite completely. But again, there was a certain global aspect to the experiments rather than detailed structural measurements. It is expected that more advanced methods would be applicable, such as hot film anemometry, laser Doppler velocimetry, laser Raman scattering spectroscopy, etc.

On the whole, this set is impressive and useful for reference work in the field of two-phase flow heat transfer. In my opinion, it signals a turning point in the field, where the global aspects of observational study will evolve inevitably to enhanced (numerical) predictive capability and advanced diagnostics for measurement of structural details of such flows.

Pasquale M. Sforza is professor of mechanical and aerospace engineering at the Polytechnic Institute of New York. He has served on the faculty there for 13 years and has been active in the field of heat, mass, and momentum transfer, particularly in the areas of boundary layers and free shear flows. Dr. Sforza pioneered detailed studies of three-dimensional turbulent jet flows and is currently involved in studies of two-phase combustion chamber and nozzle flows for ramjet engines.

The Chemical Thermodynamics of Actinide Elements and Compounds
Vol. I, *The Actinide Elements*
Vol. II, *The Actinide Aqueous Ions*

Authors	Vol. I, F. L. Oetting, M. H. Rand, and R. J. Ackermann Vol. II, J. Fuger and F. L. Oetting
Publisher	International Atomic Energy Agency (1976)
Pages	Vol. I, 111 pages; Vol. II, 65 pages
Price	Vol. I, $8.00; Vol. II, $5.00
Reviewer	Gregory R. Choppin

These small books are the first two of a series of critical evaluations on an international basis of thermodynamic data of actinide systems of interest to nuclear science and technology. Both monographs are well organized and, in simple direct statements, offer expert critiques of thermodynamic data. Emphasis is placed on the reliability and consistency of the data as well as on the authors' judgment of its accuracy. Data are presented in both SI and older units in separate tables.

The first monograph evaluates data on allotropy, heat capacity, melting point and heat of fusion of the solid and liquid metals, as well as vapor pressure and other thermodynamic properties of the ideal monatomic gases. Thorium through curium is covered, with briefer discussion of berkelium and californium. A summary section does an excellent job of comparing and correlating the data. The data are presented in tabular form as a function of temperature in the final 54 pages.