analysis and comparisons for LMFBRs are performed with the CORONA code, and for PWRs the PACTOLE code is used.

There is no space here to comment individually about all the papers, most of good to excellent quality. Extensive, complicated analyses and computation involving Monte Carlo, discrete ordinates S_n methods, and progeny were performed, reported, and discussed. The potential development of better competitive and implemented transport methods, vitally needed in shielding problems, should be encouraged.

There are a few misprints, mistakes, and omissions, but nothing terribly serious. The editors, all the teams and committees, and the authors are to be congratulated on a good job well done.

The proceedings of this conference should be of vital interest to the entire American Nuclear Society community, especially since it delineates where future efforts need be directed in solving streaming and damage problems.

Clarence E. Lee is a professor in the Department of Nuclear Engineering at Texas A&M University. He is currently doing research on analytical and numerical methods in diffusion and transport theory, charged particle transport, HTGRs (prismatic and pebble bed), fission product migration, and fast reactor accident analysis.

Nuclear Safeguards Analysis, Nondestructive and Analytical Chemical Techniques

Editor	E. Arnold Hakkila
Publisher	American Chemical Society, Washington, D.C. (1978)
Pages	213
Price	$22.00
Reviewer	L. B. Church

This book is the proceedings of an American Chemical Society (ACS) symposium held in March 1978. The 12 chapters commence with an overview as perceived by the U.S. Department of Energy (DOE) Office of Safeguards and Security. This excellent review chapter outlines the nature of the safeguards problem and reviews recent history in regard to the roles of the U.S. Atomic Energy Commission, U.S. Energy Research and Development Administration, U.S. Nuclear Regulatory Commission, DOE, and International Atomic Energy Agency (IAEA). Although the title of the book suggests that the book would be of interest to only analytical scientists working in the realms of reprocessing special nuclear materials (SNM) and safeguards, this clearly written first chapter is valuable reading for any scientist with a concern for the long-term role of nuclear power in our society.

The next six chapters show the need for two different types of analytical techniques: rapid or on-line analyses (often with relatively large uncertainties), to detect large and sudden diversions of SNM, and more refined, usually slower analyses (always with less uncertainty), to detect small diversions and/or losses. A key element in the safeguards problem (especially in dealing with the nonscientific public) is the role of uncertainties. To ensure accurate and reliable detection of diverted materials, the extent of the uncertainties of each measurement must be known.

There are four rather technical chapters each devoted to a separate analytical technique. Specifically, these techniques are x-ray absorption edge spectrometry, alpha-particle spectrometry, gamma-ray spectrometry, and calorimetry.

The book concludes with a chapter describing the accountability of a working on-line fuel reprocessing plant. Although this work was not given at the original ACS symposium, its inclusion provides the opportunity to see how safeguards analysis is accomplished at a working facility.

The major criticism of this reviewer has to do with the lack of international input to the book. Only one of the 12 chapters is by authors who do not work directly or indirectly (via a government funded lab) for the U.S. Government. Certainly safeguard experts are available in Canada, Great Britain, France, and through the IAEA. To read this book, one would get the impression (with the exception of the above-mentioned German authors) that the safeguards analysis problem is being researched only in the U.S.

Nevertheless, this volume has much to be said on its behalf. This reviewer found it to be well edited, clearly written, and a nice compromise between the technical and nontechnical aspects of the problem. Several chapters are valuable reading for scientists speaking before lay audiences, on behalf of or against nuclear power. The current state-of-the-art and science of analytical analysis as applied to safeguarding SNM is well presented.

L. B. Church received his PhD in nuclear chemistry at Carnegie Institute of Technology in 1966. Following 14 years of academic pursuits, he joined the Materials Analysis Laboratory of Tektronix, Inc. His current research interests involve the role of trace impurities in semiconductor materials.

Editor's Note: The following two reviews came to us by different routes, but since they have somewhat different perspectives, we decided to publish both together.

Nuclear Power: Technology on Trial

Author	James J. Duderstadt and Chihiro Kikuchi
Publisher	The University of Michigan Press, Ann Arbor, Michigan (1979)
Pages	228
Price	$16.00 hardcover; $8.50 in paperback
Reviewer	John M. Carpenter

These are days of crucial decision making with regard to U.S. national and worldwide energy policy. It is most

timely that authors James Duderstadt and Chihiro Kikuchi offer their excellent book, *Nuclear Power: Technology on Trial,* as a contribution to understanding the issues of nuclear electric power generation. The book is directed to the interested layperson; truly that broad group must come to appreciate the issues relating to this subject if rational decisions are to be made. The book goes far toward that end. I commend it to the broadest audience as a most worthy factual presentation.

Duderstadt and Kikuchi explore first whether or not nuclear electric power generation is a necessary part of the national and world energy picture, exploring the identifiable alternative energy sources as well as the prospects for conservation. Then they trace the development of nuclear power and explain the basic concepts of the technology. The authors next treat the social, economic, and environmental questions of nuclear electric power generation and discuss the details of the nuclear fuel cycle and the international aspects of the subject. The final chapter describes breeder reactor and nuclear fusion technology to complete the picture of nuclear energy sources.

The exposition is accompanied by numerous references to resource materials and the book contains a useful bibliography that provides readers with guidance to further study. An index of over 400 entries completes the book and facilitates its use as a resource. *Nuclear Power* is a useful, timely, scholarly contribution to rational debate of the question of how this country shall approach its energy future. A tribute to the care with which the authors prepared this book is the nearly complete absence of errors of any kind—typographical, logical, or technical.

But I must express some pessimism as to whether this book will truly accomplish its purpose. The facts are in the book. The authors have eliminated technical jargon as much as possible, but have adopted a scholarly style, which is natural to them and to those trained in scholarly inquiry, though unfamiliar to the "interested layperson." Furthermore, the gulf in understanding that separates the majority of concerned people from those who comprehend the technical matters is very great. The arguments require quantitative evaluations, that is, they depend on numbers and appreciation of what the numbers mean. The task of providing knowledge and perspective across this gulf to this large group is very difficult on this account, and I suspect has not yet, even with this excellent book, been accomplished.

The authors admit their bias toward nuclear electric power generation, being as they are a part of the nuclear community. The book takes a softly positive attitude toward the prospect, but is an honest presentation of the case.

It seems useful to make a few points not made in the book and to emphasize some that are.

Some people doubt whether an energy crisis really exists. There is not a present crisis in energy availability; there is a real foreseen crisis. Petroleum supplies are now adequate but certainly limited at some level; studies indicate the central point that production can keep up with demand only for another decade or so. What we are now experiencing is the result of observance of this fact by producers and refiners. United States oil companies and OPEC nations, without explicit admission, pursue the policy of conserving their own resources until prices are higher, while still producing for the present market. At the same time, capacity is not likely to be expanded much beyond its present level. This is because the economics of new facilities are such that new capacity and replacement plants must be planned to operate for several decades, a time longer than the petroleum resource is foreseen to last. Therefore, we are now entering a time of reduced growth, and the present petroleum energy crisis is one of the reduction of the growth rate of petroleum energy use. There is pain in adjusting to a change in growth rate, as there will be pain in adjusting to diminished supplies, which can be reduced by appropriate planning against the foreseen limitations. The crisis in actual petroleum energy availability is yet to come. (Some petroleum will always be available at some high price.) This is the only important point that is not made strongly in the book.

An important point made in the book but somewhat obscured is that the hazards of nuclear electric power generation are relatively well known and therefore arguable, while the hazards of conventional alternative electric power sources are not so well known but nevertheless accepted. Another point is that the connection between nuclear electric power generation and nuclear weapons or their proliferation is somewhat tenuous, even though these are equated in popular opinion.

Mechanisms for public input into decisions relating to nuclear power generation have from early times been a part of the U.S. program for nuclear energy development, a part of a general modern-day trend. The fact that this is not so much true in the case of the alternative energy technologies has led some concerned people to become involved in nuclear power issues in an expectable role as adversaries against the industrial and government proponents. This has had a general highly beneficial effect, but the opportunities for intervention have led to some unfortunate excesses.

Those with interest in the subject of nuclear electric power generation, and the related technical and social issues, should read Duderstadt and Kikuchi's *Nuclear Power: Technology on Trial.* The book is certainly within reach of readers with some science background, and the effort to take in and digest its contents will be richly repaid.

John M. Carpenter is a senior physicist at Argonne National Laboratory (ANL), where he serves as technical director of the Pulsed Neutron Source Program, and is responsible for the research and development activities. The Intense Pulsed Neutron Source IPNS-I, recently completed, is a new, accelerator-based type of source for basic materials research using slow neutron scattering and fast neutron damage techniques. Dr. Carpenter came to ANL in 1975 after initiating developments there on the pulsed spallation neutron sources in 1971, constructing the world's first prototype of such an instrument in 1974 and its successor in 1977. After receiving his degree in 1963, he became professor of nuclear engineering at the University of Michigan, where he pursued neutron scattering, neutron thermalization and instrument development research, and taught nuclear reactor physics, nuclear instrumentation, and reactor measurements courses.

Nuclear Power: Technology on Trial

Author	James J. Duderstadt and Chihiro Kikuchi
Publisher	The University of Michigan Press, Ann Arbor, Michigan (1979)