BOOK REVIEW

Selection of books for review is based on the editor's opinions regarding possible reader interest and on the availability of the book to the editor. Occasional selections may include books on topics somewhat peripheral to the subject matter ordinarily considered acceptable.

Aging and Life Extension of Major Light Water Reactor Components

Editor V. N. Shah and P. E. MacDonald

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Reviewer James P. Blanchard

The shutdown of the Yankee Rowe nuclear plant in 1992, despite the 10 years remaining on its operating license, provides convincing evidence that the aging of nuclear power plant components is of vital importance to today's nuclear utilities. Several estimates have indicated that operating our current reactors to and beyond the end of their licenses can save the industry over 300 billion dollars. Unfortunately, these savings can, in some cases, be offset by the cost of proving that a plant can continue to operate safely. In fact, Yankee Rowe was shut down not because it was unsafe, but because the cost of proving that it could continue to operate safely was more than the utility was willing to risk, given the uncertainty of the relevant regulatory processes. With this as background, it is clear that an understanding of the mechanisms of component aging, as well as appropriate characterization and prevention techniques, will be extremely valuable to utilities over the next decade.

Shah and MacDonald have compiled a comprehensive review of the aging of light water components, providing detailed technical information regarding the identification, characterization, prevention, and cure of the primary mechanisms for aging and failure of the major light water reactor components. The material for the book was gathered during the editors' involvement with the U.S. Nuclear Regulatory Commission's Nuclear Plant Aging Research Program, and over 29 contributors are listed near the front of the book. These contributions are carefully identified at the beginning of each chapter. Despite the fact that each of the major chapters in this book is based on the work of different authors, the quality of both the writing and content is uniformly high. For this, credit must be given to the editors, who have done an outstanding job in compiling the data needed for practicing engineers to study and understand component aging.

The book begins with identification of the major pressurized water reactor (PWR) components [boiling water reactor (BWR) components are identified in Chap. 16] and follows with 13 chapters covering each of these major components. Following identification of the major BWR components, the next seven chapters cover the major BWR components. The final two chapters cover cabling and diesel generators, respectively. For ranking the components, the editors have chosen to define major components as "those items that are relatively large, difficult, and expensive to repair or replace, and which are normally expected to last 40 or more years." For the PWRs, the reactor pressure vessel is selected as the most important component because of its importance for the safety of the plant. The containment and basemat are ranked second because they are barriers against release of fission products. For the BWRs, the first two major components are identical, but the order of importance is reversed, because the degradation of the pressure vessel by neutron-induced embrittlement is less severe than in a PWR. One can quibble with the exact rankings chosen by the editors, but overall their choices seem quite solid.

The editors express four main goals for the book: identification of susceptible components, identification of degradation sites and mechanisms, evaluation of in-service inspection methods, and identification of techniques for prevention or reduction of degradation. As a materials scientist, I was somewhat disappointed by the lack of detail provided regarding the fundamental mechanisms of the degradation. For example, the book describes the issue of vessel embrittlement by noting the importance of copper and nickel alloying elements in the ferritic steel vessels, but there is little discussion of the mechanisms for this phenomenon. It would be convenient to have these mechanisms presented along with the other information provided in the book, but this is probably beyond the scope of this already lengthy text. There are ample references to papers dealing with the details of the proposed degradation mechanisms, so those who are interested can easily find more information. This is a reasonable approach, given the editor's goals.

The value of the text lies in the last two goals of the book, those dealing with inspection and prevention. Because many current licenses will expire in the first decade of the next century, utilities must begin now to assess the levels of degradation in these major components and to prepare for license renewal (to the extent that it is desirable). In addition, utili-

ties must begin to institute preventive techniques for reducing end-of-life degradation for those components that are of importance for their particular plant. This will ensure maximum life for the existing components and could potentially save billions of dollars. By treating these important topics along with the more common issues of identification of major components and degradation mechanisms, this book provides an outstanding reference for nuclear professionals who are directly or indirectly concerned with component aging.

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