Book Reviews

Nuclear Reactor Safety, On the History of the Regulatory Process. By David Okrent, The University of Wisconsin Press (1983). 380 pp. $29.50.

Dr. Okrent is a well-known and highly respected member of the nuclear community. He is a professor of nuclear engineering at the University of California at Los Angeles and is the author or co-editor of three previous books in the field of reactor physics. For the past 20 years, he has been a member of the Advisory Committee on Reactor Safeguards (ACRS), now of the U.S. Nuclear Regulatory Commission (NRC), formerly of the Atomic Energy Commission (AEC). He is well qualified to write a book on nuclear reactor safety; however, this book is not really well described by that title. The subtitle comes much closer to revealing that the book is largely devoted to a history of the influence of ACRS letters and documents on the development of reactor regulations.

The book is based on a 1200-page unpublished manuscript and is primarily a summary of ACRS deliberations, particularly those that relate to nuclear plant siting policy and the "major safety issues which interacted strongly with siting policy." The accounts are factual, being based on the official minutes of the ACRS. I would have preferred a better account of some of the heated arguments that must have taken place during the committee meetings and a more frank expression of the author's opinion and frustration with commission and AEC/NRC staff inertia. However, as noted in the Preface, the author has placed "self-imposed restrictions on member interpretation of past ACRS action."

The ACRS reports do present an interesting account of the early history of reactor regulation and the essentially *ad hoc* development of siting considerations—"policy" would be too strong a word. The electric industry argued strongly for locating its nuclear generating stations near the load centers. Indian Point 1 was approved for construction at a location only 30 miles from New York City, thereby reflecting confidence in the containment vessel. In 1959 the AEC proposed criteria for site selection that included a requirement for an exclusion area, which was opposed by leaders of the nuclear industry. In 1962 the AEC adopted 10 Code of Federal Regulations, Part 100, which required an exclusion area, a low-population zone (LPZ), and a minimum distance to a population center. The radiation dose rates to individuals at the perimeter of the LPZ assume effective containment with a demonstrably small leak rate.

In 1962 Consolidated Edison Company proposed the construction of two pressurized water reactors at the Ravenswood site in New York City. Double containment would prevent the release of any radioactivity in the event of an accident. The attainment of zero leak rate was an item of debate within the regulatory staff and the ACRS, with no clear consensus but with serious doubts raised by some members. The application was withdrawn in view of the potential opposition, but other requests to build nuclear plants near population centers were propounded.

Okrent has made a careful search of reports and letters from national laboratories, the regulatory staff, and the ACRS in an attempt to learn just when and where it was first realized that, for large water-cooled reactors, full-scale core melt would be associated with loss of containment integrity. He points to minutes of a meeting in November 1965 in which the events are assumed to be independent. However, by June 1966, there was a discussion in an ACRS subcommittee meeting as to what would happen if a large amount of molten fuel were released to the containment. Okrent does not reveal who first used the term "China syndrome" to describe the phenomenon of a molten mass of fuel first penetrating the bottom of the containment vessel and then slowly burying itself deep in the ground below the reactor.

Once it was recognized that containment could not adequately protect the public in the event of a reactor-core meltdown, the regulators and the industry were faced with the dilemma of how to deal with the problem. The ACRS called for a major research program on means for protecting containment against a meltdown. However, in view of the obvious difficulties of such an approach, the manufacturers recommended that emergency core cooling be made so reliable that meltdown would be "incredible" and the term "design-basis accident" was coined. The Three Mile Island-2 accident has raised questions as to the reliability of core-cooling safety features and Okrent suggests that ". . . it will probably be necessary to apply new design features to mitigate the consequences of accidents involving core melt."

It is apparent from Okrent's book that the path of development of reactor regulations has been tortuous, that human judgment, though fallible, has played a major role. As one of the old timers in the business, I found the story fascinating and recommend it to my colleagues.

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About the Reviewer: Walter Jordan retired some years ago as an assistant director of the Oak Ridge National Laboratory retaining, however, active participation in nuclear matters. He frequently sits as an administrative judge on tribunals hearing arguments before the U.S. Nuclear Regulatory Commission on applications for licensing of electric generating stations. He has continued his academic interests at the University of Tennessee. Dr. Jordan completed his graduate studies at Cal Tech.