



**Thomas Raymond Wellock.** *Safe Enough?: A History of Nuclear Power and Accident Risk.* Oakland, California: University of California Press, 2021. 376 pp. \$49.95, cloth, ISBN 978-0-520-38115-5.

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Since the inception of the atomic age during the 1940s, notions of safety surrounding nuclear power plants and their energy production processes have polarized and galvanized scientists, politicians, government agencies, and ordinary citizens. On the one hand, pronuclear activists believed that atomic energy's apocalyptic capability deterred wars, enabled energy too cheap to meter, and delivered other public benefits such as medical advancements. On the other hand, antinuclear activists viewed the radioactive dangers and destructive potential as a geopolitical and environmental hazard risking the health and welfare of the human race. The nuclear power plant marks the debate's epicenter as a tangible artifact boosting national pride and power as well as portending impending doom due to the faith that humans have placed in this technology.

But what exactly are the risks associated with operating nuclear plants? In *Safe Enough? A History of Nuclear Power and Accident Risk* (2021), Thomas R. Wellock, the historian for the US Nuclear Regulatory Commission (NRC), delivers a well-researched examination aimed at helping us understand the history of this complex question. He provides an insider's account of the turbulent path that risk perception and quantification took in de-

termining what was "safe enough." He argues that the enthusiasm and trepidation caused by the rise in nuclear power made the NRC's primary task to determine when nuclear power plants became safe enough to operate. Thus, the challenge for the NRC was to reconcile the tension between calculating and regulating the risk associated with operating nuclear power plants, and promoting a narrative to the American people that the nuclear industry was safe and could be trusted to provide social goods for its citizens.

Seven chapters shape the book's structure, each flowing chronologically. Using an avalanche of intricate details, Wellock is mindful not to let the reader lose sight of the book's overall goal of shining a light on the debate surrounding the safety of the US nuclear industry and the effectiveness of a novel form of risk measurement: probabilistic risk assessment, or PRA.

In the first five chapters, Wellock reveals a cultural paradigm shift with exacting precision by explaining how changing philosophical NRC safety interpretations moved away from qualitative toward quantitative measures of risk. He succeeds by drawing from an exquisite array of sources, notably including the NRC archives and congressional records from the Joint Committee on Atom-

ic Energy as well as his personal correspondence with this history's most prominent actors.

The book's last two chapters move beyond internalist NRC history to explore how PRA became utilized outside the US nuclear industry. This transition might seem like an abrupt change of direction, but the author explains how PRA became a valuable tool for analysis as NASA reflected upon the *Challenger* tragedy and how applications of PRA created a bridge across national and Cold War borders, particularly in the wake of the Chernobyl disaster. Overall, *Safe Enough?* takes a novel approach toward understanding conceptions of safety, by revealing how risk assessment became a critically important aspect of nuclear energy's past.

The strengths of Wellock's work shine through in his intensive detailing of PRA's history. This first-of-its-kind risk assessment tool developed by MIT engineering professor Norman Rasmussen created a path geared toward answering what had become a seemingly unanswerable question: "What is the probability of a major reactor accident?" (p. xiv). Navigating between pronuclear and antinuclear activists, institutional turf wars on Capitol Hill, and within the nuclear industry, Wellock chronicles how Rasmussen's efforts culminated in the *Reactor Safety Study* (1975), also known as "WASH-1400." The author convincingly details the ways in which WASH-1400 endorsed quantifiable risk assessments for nuclear accidents, making these risks more understandable to the public. This influential report became a catalyst for how nuclear regulatory processes and reactor safety factored into how American and international agencies assessed nuclear risks.

Additionally, *Safe Enough?* seamlessly uses its sources to show how this philosophical shift from risk-based regulation to risk-informed regulation followed anything but a linear, predetermined course. Wellock deftly narrates how regulatory change evolved from the complex social interactions among NRC officials. He also injects technical

explanations of nuclear technology to keep the reader on track and focus on the book's central theme: the quest to determine how much risk was knowable and acceptable. He is most effective as he contextualizes the human factors element as a causal force leading to the Three Mile Island accident. By placing the man-machine interface into the narrative, Wellock shows how haphazard control room layouts compromised the safe operation of nuclear power plants, further complicating efforts to quantify risk.

My critiques of this book are minimal. Readers unfamiliar with nuclear history may become overwhelmed by the esoteric terms and detailed discourse of regulatory debates and the narrative's sudden transition to PRA's applications outside the nuclear industry. Despite these very minor challenges posed to readers, the author does well to explain terms and concepts throughout the book's journey. Wellock brings the story full circle in his last chapter by employing the social and political contexts of the past and applying PRA's lessons learned to the world's most recent nuclear accident at Fukushima. By doing so, he gives readers a more sophisticated understanding of how the problem of quantifying risk has a complex past yet remains far from being solved any time soon.

*Safe Enough?* is an important book that elucidates an essential historical narrative for nuclear historians while informing readers of its present-day relevance. Wellock explains how we are still searching for accurate quantification of the risk associated with the operation of nuclear power and helps readers traverse the evolution from qualitative to quantitative risk analysis. *Safe Enough?* will be useful for years to come. It goes beyond statistical analysis and delves into the human dimension by revealing how politicians, scientists, the Nuclear Regulatory Commission and Atomic Energy Commission, and civilians debated and mostly disagreed on the accuracy of calculating and assessing nuclear risk. *Safe Enough?*

should be assigned to graduate students studying how states, societies, and technology interlace to form public policy. Historians of technology will find this book immensely useful for examining hu-

man interactions with technology, particularly assessing nuclear reactors as political artifacts.

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