David Okrent

DAVID OKRENT

1922–2012

Elected in 1974

"For contributions in fast reactor design, including critical experiments, safety tests and analyses, and neutron cross-section evaluation."

BY WILLIAM E. KASTENBERG, GEORGE E. APOSTOLAKIS, AND DONALD G. BROWNE

DAVE OKRENT was a giant in his field. As an engineer and physicist, teacher and scholar, mentor and friend, he was steadfast in his desire for all of us—family, friends, and colleagues—to achieve our highest good, while at the same time he fought, unflinchingly, for the values he believed in.

Whether designing the earliest nuclear reactors for research, commercial, or military use, or developing and participating in the United States regulatory structure, and indeed worldwide, Dave's guiding principle was the protection of the health and safety of the public and the environment. And as a scholar and teacher, he stood for regulation based on sound science, making the fields of safety and risk academic subjects. He always spoke in straightforward and simple, yet profound terms—grasping the broader implications of our questions, and indeed our work, far beyond what we were asking. Dave's compelling statements at our first meetings with him—40 or more years ago—would change the course of our careers, as was true for so many others. His wisdom, piercing questions, and subtle wit will be missed!

David was born on April 19, 1922, in Passaic, New Jersey, the son of Abram and Gussie (née Pearlman) Okrent. After his graduation from the Stevens Institute of Technology in 1943, he was employed during the latter days of World War II at the National Advisory Committee on Aeronautics (NACA), where he concentrated his efforts on improving engine performance for allied aircraft. In 1946 he got a teaching fellowship at Harvard, where he received his doctorate in physics in 1951.

He began work as an associate physicist at Argonne National Laboratory in Illinois, working initially on the core of the first nuclear submarine, the USS Nautilus (SSN-571), and then on the core of the USS Seawolf (SSN-575), which was designed with a sodium-cooled fast reactor, saving 40 percent of the machinery space in the reactor compartment of the boat. He then turned his attention to the more fundamental issue of fast reactor physics, design, and safety, coauthoring three primary works on fast reactor physics between 1960 and 1970: *Fast Reactor Cross Sections: A Study Leading to a 16 Group Set* (with Shimon Yiftah and Peter A. Moldauer; 1960), *Computing Methods in Reactor Physics* (with Charles Kelber; 1968), and *Reactivity Coefficients in Large Fast Power Reactors* (with Harry H. Hummel; 1970). He was the chief physicist on the Experimental Breeder Reactor (EBR) II and the Transient Reactor Test Facility (TREAT) reactor, both located at the National Reactor Testing Station in Idaho. When there was a serious accident at EBR I in 1957, he turned his attention to issues of nuclear safety, becoming the leading expert in issues of safety in liquid-metal-cooled fast reactors. He attended the first Atoms for Peace Conference in Geneva in 1955, and served as the scientific secretary of the American delegation at the second conference in 1958.

In 1963 David was appointed to the Advisory Committee on Reactor Safeguards (ACRS), a statutory body advising the US Atomic Energy Commission (AEC; now the US Nuclear Regulatory Commission) on issues of nuclear reactor safety and licensing. The accident at the Three Mile Island (TMI) nuclear power plant occurred in 1979, during his service on the advisory committee. Called immediately to Washington, David chose to work primarily on lessons learned, already grasping the implications of TMI for the nation's nuclear power industry and working through the ACRS to ensure that many of his recommendations were adopted and implemented. He served on the committee until 1987, and reported many of the lessons he learned during his years with the ACRS in his 1981 book *Nuclear Reactor Safety: On the History of the Regulatory Process.*

One area of concern that David questioned was the safety of pressure vessel integrity in nuclear power plants. Together with ACRS members Theos J. (Tommy) Thompson and N.J. Palladino, this area of investigation led to the ACRS *Report on the Integrity of Reactor Vessels for Light-Water Power Reactors* (1974), formation of the AEC Heavy Section Steel Technology Program, and development of the field of fracture mechanics as a technical tool to analyze the safety of not only the pressure vessel but also piping and structural supports throughout the plant. These improvements were formalized in the publication of Section III of the Pressure Vessel Code of the American Society of Mechanical Engineers.

David was an early proponent of the importance of understanding the potential of seismic risk for nuclear power plants. As of late 1963 relatively little attention was given to such risk, even in seismically active areas such as California. This changed after the great Alaska earthquake of 1964, and David urged the development of a more formal process for evaluating seismic risk—not only in seismically active areas along the west coast of the United States but also east of the Rocky Mountains.

In addition, together with ACRS member Jesse Ebersole, David recognized the importance of systems interactions in nuclear power plants. The result was the development of important benchmark studies in nuclear power plants throughout the country.

It was also during this period that David began to ask, and seek answers to, the question "How safe is safe enough, and why?" US safety policy was based on "defense in-depth," which relied on engineering concepts such as redundancy and diversity in plant structures, systems, and components, and safety margins in determining limits on key physical parameters. David noted in his critical paper "An Approach to Quantitative Safety Goals for Nuclear Power Plants" (1980) that this approach would lead to the judgment that there was reasonable assurance that a nuclear power plant could be operated without "undue risk to the public" without saying what that risk actually was. The accident at Three Mile Island changed all that, and David took it upon himself to answer the above question by proposing numerical criteria for measuring safety, called quantitative safety goals.

David's work led to a paradigm shift in regulatory decision making, enabling a plant owner, a regulator, or the public to determine whether or not a nuclear plant is safe enough. Moreover, it led to the concept of risk-informed regulation, enabling stakeholders to determine whether changes to a plant were worthwhile or not.

David considered his seminal work on safety goals to be one of his most important contributions to reactor safety. And John Ahearne, former chair of the Nuclear Regulatory Commission, noted that "Dave Okrent many times thought beyond the current problem. In the concept of safety goals, he was at least a decade, and probably more, ahead of the regulatory system."

In 1971 Chauncey Starr, then Dean of Engineering, recruited David to UCLA to develop a nuclear engineering program. Starr himself, an early pioneer in the field of risk analysis, recognized that the young nuclear engineering faculty at UCLA needed senior leadership and direction. Feeling right at home in an academic environment, David was responsible for making nuclear reactor safety and the emerging field of risk analysis (assessment and management) academic subjects by establishing funded research projects and developing courses at the graduate level.

Among his early projects at UCLA was an NSF-funded study that developed the first probabilistic methodologies for assessing risks associated with severe natural phenomena (e.g., hurricanes, tornadoes, earthquakes, meteors and meteorites), dam failures, accidental chlorine releases, as well as the risk to the public on the ground in the vicinity of airports due to aircraft crashes. Equally novel was David's inclusion of social scientists, such as Paul Slovic, Sara Lichtenstein, and Baruch

Fischhoff, expanding on Starr's early work on risk perception and pioneering new approaches for both assessing and interpreting public attitudes toward risk.

David went on to develop research programs and courses on liquid-metal-cooled fast spectrum reactors and then, after the TMI accident in 1979, on light water reactors. He also directed a three-year EPRI-funded project on fusion reactor safety, the first comprehensive study of its kind.

He served as advisor to over 50 graduate students and more than a dozen postdoctoral fellows at UCLA. He was never at a loss with regard to exploring new avenues of research, new concepts for improving reactor safety, unique approaches for regulation, or new approaches to consider intergenerational equity in societal decision making.

Between 1979 and 1992 he also served on the National Research Council's Committee on Maritime Hazardous Materials, National Materials and Manufacturing Board, Electrical/Nuclear Power Engineering Peer Committee, Committee on Future US Nuclear Power Development, and the Risk and Impact Panel of the Committee on Nuclear and Alternative Energy Sources (CONAES).

David received many honors and awards throughout his life, but felt that his greatest honor was election to the National Academy of Engineering in 1974 for his efforts in fast reactor safety. He was the recipient of two Guggenheim Fellowships, the first Argonne Universities Association Distinguished Appointment Award in 1970, and the US Nuclear Regulatory Commission's Distinguished Service Award in 1985. The American Nuclear Society honored him on three occasions: with the Tommy Thompson Award for nuclear safety in 1980, the Glenn Seaborg Medal for scientific and engineering research contributions to the development of peaceful uses of nuclear energy in 1987, and the George C. Laurence Pioneering Award for lifetime achievements in the development of reactor safety philosophy in 2007.

His daughters wrote that David was also companion to his beloved wife, Rita, in her bead hunting and travels. From the time Rita started her bead business in the 1970s, David assisted her. Many years later, he organized her inventory, got it appraised, and built and ran her website. He became a bead expert himself in the process and designed necklaces with Rita once she became ill. Even at age 90, David remembered details of customer purchases and assisted his daughter, Jocelyne, with his knowledge of the inventory, customer purchases, and with running the business.

David retired from active teaching in 1991 but continued an active research program until the early 2000s. His wife of 57 years, Rita (née Holtzman), predeceased him in 2005. He died at his home on December 14, 2012. He leaves his son Neil, daughters Nina and Jocelyne, and four grandchildren.

Equidem beatos puto, quibus deorum munere datum est aut facere scribenda aut scribere legenda, beatissimos vero quibus utrumque.