DEFENSE NUCLEAR FACILITIES SAFETY BOARD: THE FIRST TWENTY YEARS

A Report Prepared by the Federal Research Division,
Library of Congress
under an Interagency Agreement with the
Defense Nuclear Facilities Safety Board (DNFSB)

September 2009

Author: *Priscilla Offenhauer*

Project Manager: Alice R. Buchalter

Federal Research Division
Library of Congress
Washington, D.C. 20540–4840
Tel: *202–707–3900*
Fax: *202–707–3920*
E-Mail: *frds@loc.gov*
Homepage: *http://www.loc.gov/rr/frd/*

★ 61 Years of Service to the Federal Government ★
1948 – 2009

PREFACE

The Defense Nuclear Facilities Safety Board (DNFSB or the Board), an independent oversight organization within the executive branch, was created by Congress in 1988 to provide advice and recommendations to the secretary of energy regarding public health and safety at the defense nuclear facilities managed by the Department of Energy.

This study captures how the Board met the competing national security, health and safety, environmental, government, and public demands placed upon DOE's defense nuclear facilities, explicating the principles and techniques the Board employed to efficiently function as a federal agency and effectively fulfill the Board's unique mandate under the Atomic Energy Act of 1954, as amended. While it chronicles events, the study also serves as the tutorial for those charged with the future administration of the Board's enabling legislation, making available to the current and future leadership the philosophical and jurisprudential underpinnings of the form of governance captured in the Board's enabling legislation and the resolution of changing and sometimes opposing national requirements.

The first chapter discusses the handling of safety issues in the defense nuclear complex prior to the creation of the Board. The chapter also examines historical circumstances that produced pressures to move toward more external regulation, including major accidents involving nuclear technology (especially Chernobyl), the waning of the nuclear arms race, and the lifting of the secrecy about the safety risks and environmental damage.

The second chapter reviews the debates in Congress that led up to the legislative compromise that created the Board as an expert body that would act as an independent adviser to the secretary of energy, rather than as a regulator.

The third chapter describes the development of the Board's manner of proceeding when it conducted oversight, in particular, how it interacted with the Department of Energy, congressional oversight committees, and the public, and how it wielded the tools that Congress granted it to exert authority that was effectively action-forcing.

The fourth chapter examines important recommendations on nuclear safety, both site-specific and complex-wide, that the Board issued to the secretary of energy, and how their follow-up was handled.

The fifth chapter discusses the shift of emphasis in the Board's activities that occurred with the end of the nuclear arms race and weapons production in 1992, mainly, the shift to

greater emphasis on the stabilization and safe storage of surplus nuclear materials, as well as the safe execution of weapons dismantlement.

The sixth chapter focuses on the Board's advocacy of Integrated Safety Management to support longer-term, more comprehensive safety planning in the weapons complex, and the reexamination by policymakers and the Board of whether current oversight arrangements sufficed to ensure safety. In addition, the chapter examines the Board's increased technical oversight activities of design and construction projects throughout the DOE defense nuclear complex.

TABLE OF CONTENTS

INTRODUCTION

The Defense Nuclear Facilities Safety Board, (DNFSB or the Board), an independent executive-branch organization, was established by Congress in 1988 to provide technical oversight of the Department of Energy's (DOE) defense nuclear facilities in order to protect the health and safety of the public and workers. The Board was charged with identifying potential safety threats posed by the facilities, elevating such issues to the highest levels of authority, and informing the public.

In creating the Board, one aim of Congress was to provide an expert body to act as an adviser to DOE on establishing, and operating in accordance with, standards comparable to those that prevailed in the commercial nuclear power industry. The Board's responsibilities to review the standards that underpinned safety pertained to all life-cycle phases of defense nuclear facilities—design, construction, operation, and decommissioning. The Board is also responsible for investigating any event or practice at a DOE facility that had or could adversely affect public health and safety, for analyzing design and operational data pertinent to safety, and for pre-construction design reviews and construction oversight for DOE nuclear facilities.

Congress provided the Board with a variety of powers to carry out its oversight mission, chief among them, the power to issue formal recommendations to the secretary of energy—recommendations that the secretary is not required to accept, but is required to answer. In its efforts to formulate its recommendations and other advice, the Board is empowered to conduct investigations and studies, gather information, issue subpoenas, hold public hearings, and establish reporting requirements for DOE. The Board is statutorily required to make reports to Congress at least annually on its oversight activities, any recommendations issued to the secretary of energy, and improvements in safety achieved at defense nuclear facilities as a result of its activities.

DEFENSE NUCLEAR FACILITIES SAFETY BOARD: A COMPROMISE SOLUTION

The Board emerged at a particular historical juncture that made the prevailing type of governance in the nuclear weapons complex appear less tenable. Since the inception of the complex during World War II and the early Cold War years, it had been managed by the Department of Energy and its predecessor agencies without independent external oversight

within the executive branch. The nuclear arms race and the Cold War sense of urgency about maintaining a strong nuclear deterrent force legitimized secretive operations in the complex and the prioritization of production needs over safety concerns.[1] The waning of the nuclear arms race in the late 1980s eroded the justification for secrecy and undermined public acceptance of production/safety trade-offs that sacrificed safety. This erosion was compounded by accidents involving nuclear technologies, such as the Chernobyl reactor accident, which aroused generalized public concern about nuclear safety. In addition, revelations mounted about the environmental and safety issues that had accumulated at the aging facilities in the weapons complex in the course of the nuclear arms race. These factors engendered increasing public distrust and led public officials and lawmakers to question the capacity of DOE to manage the complex and ensure the safety of operations without independent external oversight.

At the same time, the international security environment was highly unsettled in the late 1980s, making the period one of significant uncertainty in terms of what U.S. national security needs were and what the nation's nuclear deterrent posture would be. Although the Cold War was winding down and downsizing of the nuclear weapons arsenal and complex was in the offing, national security policymakers did not know how much production capacity would still be needed. Fearing interference with national security imperatives, they were reluctant to impose a type of regulation on the weapons complex that might endanger national security by inhibiting the freedom of the national security establishment to make necessary security-related decisions. Policymakers were wary of stringent forms of full regulation that would produce what amounted to, as they put it, "unilateral disarmament" by imposing undue delay and expense in the name of safety on the defense production mission of the weapons complex. Many policymakers resisted full regulation as ill suited to handling the extremely complex technical issues affecting the U.S. nuclear deterrent capability. At the same time, they recognized that a precondition for the ongoing public support for U.S. nuclear deterrent policy was to decrease the radiological risks posed by the nuclear weapons complex, and to do so in a way that was convincing to an alarmed public.

The complicated sets and crosscurrents of concerns about the nuclear weapons complex fueled a contentious debate when Congress took up the question of establishing an external

[1] F.G. Gosling and Terrence R. Fehner, *Closing the Circle: The Department of Energy and Environmental Management, 1942–1994* (Washington, DC: U.S. Department of Energy, 1994), 5.

oversight body. The extended debate within Congress and the administration turned not so much on the need for such a safety body but rather on defining its form and providing it with powers that struck the right balance among competing and conflicting goals. The debate eventually produced a compromise piece of legislation that sought to give the newly created Board sufficient powers to further safety and to establish credibility with the public, but not so much power as to permit the Board's insistence on safety upgrades that were at the expense of essential production for national security needs.

The legislative compromise embodied in the Board's enabling legislation took into account the special defense-related considerations dictating that the Board not be a full-blown regulator. The enabling legislation did not give the Board formal regulatory authority or enforcement powers. Instead, the Board was an expert body that would provide independent oversight and act as an adviser to the secretary of energy. However, the legislation contained elements designed to ensure that the Board's advice would carry significant weight with the secretary of energy and could not be lightly dismissed or disregarded. Providing the Board's advice with such weight, and the Board with substantial power, was key to engendering public confidence, as well as ensuring safety improvements in the weapons complex.

Among the elements designed to lend weight to the Board's advice were provisions that imposed requirements on the secretary of energy to respond in specified ways to the Board's advice, recommendations, reporting requirements, and requests for information. In the case of formal recommendations, DOE's obligations for response were laid out as a definite sequence of actions in a specified time frame. These requirements contributed to the seriousness with which the secretaries of energy always took Board advice and recommendations. In the two decades of the Board's operation, the secretary accepted, and formulated implementation plans for, all of the formal recommendations the Board issued.

Another important key to the Board's power was the make-up of the Board, specifically, the eminence and capabilities of the five Board members. The Board's enabling legislation called for a five-member Board composed of recognized technical experts. The composition of the Board as envisioned by the lawmakers was a unique blend of technical nuclear-safety expertise and proven managerial capability. The idea was to create a body of seasoned experts who would become honest brokers of technical information to ensure that the administration and Congress would have unbiased and timely information on the state of the DOE nuclear complex as regards

the health and safety of workers and the public.[2] Congress and the administration sought well-respected leaders capable of addressing problems in the defense nuclear complex from an engineering perspective, and of navigating the uncharted territory of external oversight in a highly dynamic period in the international security environment and in the nuclear deterrent posture of the United States. The lawmakers expected the Board members to balance their efforts to improve safe operations at the U.S. defense nuclear facilities with their recognition of DOE's duty to do its essential national defense work of maintaining an effective nuclear deterrent without unjustifiable delay or expense.

The five-member inaugural Board assembled by the administration in the course of 1989 more than fully embodied the requirements of the Board's congressional creators. The exemplary group collectively brought many decades of high-level engineering and management experience in various aspects of nuclear safety—ideal experience for organizing a highly technically competent staff, interacting effectively with the Department of Energy and Congress, and communicating with the public to restore public confidence. Above all, as intended by the legislative creators of the Board, the Board brought a depth of scientific, technical, and managerial skills commensurate with the enormity of the safety challenges and the unique hazards that the nuclear weapons complex posed.

THE NUCLEAR WEAPONS COMPLEX AND ITS CHALLENGES FOR SAFETY OVERSIGHT

The U.S. nuclear weapons complex and nuclear arsenal, products of the nuclear arms race, achieved their 1989 size and character a quarter century earlier, in the late 1960s.[3] At its peak, the complex—an immense, widely dispersed industrial, laboratory, and testing enterprise—consisted of some 16 major installations and many smaller facilities spread over a dozen or so states.[4] A number of the defense nuclear sites occupied vast tracts of land, including the Hanford Site in the state of Washington, the Savannah River Site in South Carolina, the Idaho National Engineering Laboratory, the Nevada Test Site, and the Oak Ridge Reservation in Tennessee. The Hanford Site alone was huge. The largest of the three original World War II–era

[2] Interview, Kenneth M. Pusateri (Board general manager, 1989–2006), Washington, DC, January 3, 2008.
[3] Stephen I. Schwartz, ed., *Atomic Audit: The Costs and Consequences of U.S. Nuclear Weapons Since 1940* (Washington, DC: Brookings Institution Press, 1998), 491. See also U.S. Department of Energy, Office of Environmental Management, "History," August 26, 2008, http://www.em.doe.gov/pages/History.aspx.

sites for nuclear weapons production—Hanford, Oak Ridge, and Los Alamos National Laboratory—Hanford was roughly half the size of Rhode Island, at nearly 600 square miles.[5] The Idaho site topped 800 square miles, and Savannah River occupied 300 square miles.[6]

Evolving since World War II, the weapons complex engaged up to the late 1980s in four types of arsenal-building operations, which were concentrated at particular facilities and sites—research, nuclear materials production, the manufacturing of weapons components, and weapons testing.[7] Weapons research and design was conducted at DOE's three defense laboratories, Los Alamos and Sandia National Laboratories in New Mexico and Lawrence Livermore National Laboratory in California. The processing and production of nuclear materials, notably plutonium and tritium, took place chiefly at the Hanford Site and the Savannah River Site. For example, Hanford, with its nine plutonium reactors built between 1943 and 1963, along with five reprocessing facilities, produced 64 metric tons of plutonium over 40 years.[8] Uranium processing was a task of the Idaho National Engineering Laboratory and the Feed Materials Production Center in Ohio. The fabrication of warhead components took place at the Rocky Flats plant in Colorado, the Y-12 plant at Oak Ridge, the Mound plant in Ohio, and several other locations. Weapons assembly was conducted at the Pantex plant in Texas, and nuclear testing at the Nevada Test Site.[9] Collectively, in the period up to 1989, the facilities manufactured tens of thousands of nuclear warheads, and conducted more than one thousand test nuclear detonations.[10]

At the time the Board began operations in 1989, with its mandate to identify and mitigate radiological risk in the weapons complex, the hazards that the Board expected to confront included those associated with DOE's production of nuclear materials, most notably, hazards posed by operating nuclear reactors. Although all of the major production facilities were then in a stand-down condition, having recently been shut down for safety reasons, DOE expected that production would resume once safety upgrades of the production infrastructure were made. Thus

---

[4] Gosling and Fehner, 2.
[5] U.S. Department of Energy, Hanford Site, "Hanford Overview," March 25, 2008, http://www.hanford.gov/?page=215& parent=0.
[6] U.S. Department of Energy, Office of Environmental Management, "Savannah River Site Overview," September 10, 2008. http://www.em.doe.gov/SiteInfo/SavannahRiver.aspx?PAGEID=MAIN.
[7] U.S. Congress, Office of Technology Assessment, *Complex Cleanup: The Environmental Legacy of Nuclear Weapons Production*, OTA–O–484 (Washington, DC, February 1991), 15, http://www.fas.org/ota/reports/9113.pdf.
[8] U.S. Department of Energy, Hanford Site, "Hanford Overview."
[9] OTA, Complex Cleanup, 18–19.

the Board's review of potential contributors to risk initially included a focus on DOE's preparations to restart production. When DOE's production mission definitively ended with the end of the Cold War in 1992 and the downsizing of the weapons complex, DOE's mission shifted, and the Board's safety focus shifted accordingly. The risks and safety issues on which the Board focused became exclusively those involved in maintaining the safety and reliability of the nation's remaining, smaller nuclear weapons stockpile and in cleaning up contaminated sites and facilities. The Board's oversight focused on the safe execution of the dismantlement of nuclear weapons to achieve arms control objectives, the storage and disposition of surplus fissionable materials, and the decontamination and decommissioning of facilties.[11]

Notwithstanding this early shift of the Board's specific safety focus, the magnitude of the risks the Board sought to mitigate was formidable, and indeed only heightened by the cessation of production and the cleanup efforts that followed. Nearly 50 years of nuclear weapons production had left a legacy of vast quantities of nuclear waste and surplus materials. The complex held in storage millions of gallons of high-level radioactive liquid waste in tanks awaiting treatment, and still larger quantities of waste with lower levels of radioactivity.[12] Other radioactive wastes and residues in processing lines and deteriorating temporary packaging existed throughout the complex in sufficient quantities to pose the risk of criticality accidents and radioactive releases to the environment. Radioactive and other toxic materials had already resulted in widespread contamination of soil and groundwater at DOE sites. Numerous potential mechanisms for the release of hazardous materials posed ongoing risks to workers and the public, e.g., fire, inadvertent detonation of explosives, chemical reactions, equipment malfunctions, natural disasters, failures in aging facilities, and human error. Other hazards in the complex were associated with the arsenal of nuclear weapons itself and the activities required to maintain the enduring stockpile, as well as to dismantle thousands of excess or obsolete weapons. Such activities posed dangers unique to the weapons complex, because they involved co-located explosives and nuclear material. As the Board often pointed out,

> Unlike commercial nuclear facilities, the risks at these defense nuclear facilities are not solely a function of the quantities of nuclear material present but more

[10] Gosling and Fehner, 2.
[11] Defense Nuclear Facilities Safety Board, "About DNFSB: Who We Are," http://www.dnfsb.gov/about/index.php.
[12] U.S. Congress, Congressional Budget Office, *Cleaning Up the Department of Energy's Nuclear Weapons Complex* (Washington, DC, 1994), 1, http://www.cbo.gov/ftpdocs/49xx/doc4914/doc26.pdf.

importantly, the material processes involved and the potential for explosive dispersal of radioactive materials or inadvertent nuclear detonation.[13]

[13] Defense Nuclear Facilities Safety Board, *FY 2010 Budget Request to the Congress* (Washington, DC, May 2009), http://www.dnfsb.gov/about/files/budget/budget_fy2010.pdf.

CHAPTER 1: NUCLEAR SAFETY REGULATION BEFORE THE BOARD'S CREATION

NUCLEAR POLICIES, GOVERNANCE, AND MAJOR U.S. NUCLEAR LEGISLATION UP TO THE ABOLITION OF THE ATOMIC ENERGY COMMISSION

The nuclear weapons complex had its origins during World War II in the Manhattan Project, the "epic, top-secret engineering and industrial venture" that created atomic weapons in less than three years.[14]

The Manhattan Project, Atomic Energy Act of 1946, and Atomic Energy Commission

The U.S. Army Corps of Engineers, beginning in 1942, directed the Manhattan Project, rapidly developing and managing the construction of a nationwide network of research and production facilities that operated in secret.[15] During the race to create the bomb, the three main sites developed were Los Alamos, New Mexico, with its weapons design laboratory, Oak Ridge, Tennessee, with its monumental uranium-enrichment plants, and Hanford, Washington, with its three plutonium production reactors and two reprocessing plants to extract plutonium from the reactor fuel.[16]

To build and operate the complex, which was federally owned, the army's project leadership used the practice of hiring private corporations as contractors.[17] This recourse to a consortium of contractors, which was justified by the wartime national emergency, set the precedent for the government-owned, contractor-operated (GOCO) system that has prevailed in the nuclear weapons complex ever since.[18]

---

[14] U.S. Department of Energy, Office of Environmental Management, *Environmental Management: History* (Washington, DC, August 8, 2008), http://www.em.doe.gov/pages/History.aspx.

[15] A. Costandina Titus, *Bombs in the Backyard: Atomic Testing and American Politics* (Reno: University of Nevada Press, 1986), 7.

[16] F.G. Gosling, and Terrence R. Fehner, *Closing the Circle: The Department of Energy and Environmental Management, 1942–1994* (Washington, DC: U.S. Department of Energy, 1994), 1. The first three reactors at the Hanford site remained in operation for some 20 years. The B-reactor began production in September 1944 and shut down in February 1968. The D-reactor, operational in December 1944, and the F-reactor, producing by February 1945, shut down in June 1967 and June 1965, respectively. In 2008 the B-reactor was declared a National Historic Landmark.

[17] George T. Mazuzan, and J. Samuel Walker, *Controlling the Atom: The Beginnings of Nuclear Regulation, 1946–1962* (Berkeley: University of California Press, 1984), 10–11.

[18] Barton C. Hacker, *Elements of Controversy: The Atomic Energy Commission and Radiation Safety in Nuclear Weapons Testing, 1947–1974* (Berkeley: University of California Press, 1994), 10–11. According to Hacker, about seven-eighths of the 44,000-strong wartime workforce in the Manhattan Project were private-sector employees. See

Another precedent set during the Manhattan Project was that the nuclear weapons complex was "self-regulating," in that it had the "authority to regulate its own nuclear safety."[19] The project's leaders in the Corps of Engineers managed the project without independent oversight by any agency or staff external to the project. In managing nuclear safety, the project leadership disseminated in an ad hoc fashion the then-limited knowledge of its project scientists about mitigating the hazards of the use of nuclear energy.[20] The leadership augmented the scientists' advice with the expertise of the project's private-industry contractors in matters of general industrial and chemical safety. Participants in the project had great leeway to use their own judgment in applying such safety-related information.

After World War II, the U.S. Congress took up the question of the future governance of the nuclear weapons complex and the future utilization of atomic energy. One of the major issues was whether the nuclear enterprise should remain under military management or be transferred to control by a civilian government agency.[21] After a protracted debate, Congress passed legislation that affirmed civilian government control while leaving "military applications" of atomic energy the "paramount" mission of the nuclear enterprise.[22] The legislation, the Atomic Energy Act (AEA) of 1946, was the first major nuclear-era statute and has remained a cornerstone of U.S. nuclear policy.[23] The act established the civilian-led U.S. Atomic Energy Commission (AEC), a single federal agency that for the next 29 years combined the functions of managing and regulating the production and uses of atomic energy.[24] As prescribed by the 1946

---

also U.S. Congress, Office of Technology Assessment, *Hazards Ahead: Managing Cleanup Worker Health and Safety at the Nuclear Weapons Complex*, OTA–BP–O–85 (Washington, DC, February 1993), 62.

[19] Glenn Russell George, "Negotiated Safety: Intragovernmental Risk Regulation in the U.S. Nuclear Weapons Complex" (Ph.D. diss., Harvard University, May 1995), 50, 57 (accessed via Proquest). On the concept of "self-regulation," see also, "Appendix 2: Statement by Joseph J. DiNunno Relative to the Report of the Advisory Committee on External Regulation," A2/1–2, in Defense Nuclear Facilities Safety Board, *Report to Congress on the Role of the Defense Nuclear Facilities Safety Board Regarding Regulation of DOE's Defense Nuclear Facilities* (Washington, DC, November 1998), http://www.dnfsb.gov/pub_docs/dnfsb/rc_199811.pdf. Joseph J. DiNunno, Board member of the Defense Nuclear Facilities Safety Board, uses the term "self-regulation" in several historical accounts of regulatory arrangements that prevailed in the nuclear weapons complex prior to the 1980s.

[20] Joseph J. DiNunno, "Ideas for Improving Department of Energy's Safety Management of Nuclear Facilities, A Discussion Paper," October 26, 2001, 2/2, http://www.dnfsb.gov/pub_docs/dnfsb/ts_200110_multi.pdf.

[21] Mazuzan and Walker, 3.

[22] Titus, 27.

[23] *Atomic Energy Act of 1946*, Pub. L. No. 79–585, ch. 724, 60 Stat 755, August 1, 1946. See also Bert Chapman, "The Defense Nuclear Facilities Safety Board's First Decade," *Journal of Government Information* 27 (2000): 347, http://docs.lib.purdue.edu/lib research/70.

[24] J. Samuel Walker, *A Short History of Nuclear Regulation, 1946–1999* (Washington, DC: U.S. Nuclear Regulatory Commission, January 2000), 43.

law, the new agency took over the army's responsibilities for the nuclear weapons complex, beginning in January 1947.

The commission authorized by the 1946 law was composed of five civilian members nominated by the president and confirmed by the Senate for staggered five-year terms of office.[25] The commissioners were not required to be nuclear scientists or experts and, indeed, were more usually legal, business, or management professionals.[26] Not scientists themselves, the commissioners relied for scientific and technical advice on one of the several support committees provided for by the 1946 Atomic Energy Act, the General Advisory Committee, which consisted of nine presidentially appointed civilian atomic scientists. Another mandated advisory committee, the Military Liaison Committee, was made up of military officers appointed by the secretaries of war and of the navy, and provided the AEC with Pentagon input.[27] The third statutory committee, the Joint Committee on Atomic Energy (JCAE), ensured a continuing prominent role for Congress in nuclear matters. The JCAE, until disbanded in 1977, was the sole congressional committee with nuclear responsibilities.[28] Made up of nine members each from the Senate and House of Representatives, the JCAE served as a legislative-branch "watchdog" to keep Congress apprised of atomic affairs and to monitor the operations of the five-member executive-branch AEC.[29] The bicameral and bipartisan committee was vested with full jurisdiction over "all bills, resolutions, and other matters in Congress relating to the Commission or to the development, use or control of atomic energy," including budget authorizations for the AEC and international nuclear agreements.[30] Through public hearings and other public informational activities, the committee eventually played a significant role as a champion of commercial nuclear power.

---

[25] Mazuzan and Walker, 4.
[26] Robert Pool, *Beyond Engineering: How Society Shapes Technology* (New York: Oxford University Press, 1997), 191.
[27] Mazuzan and Walker, 3.
[28] On committee oversight, see Stephen I. Schwartz, "Congressional Oversight of the Bomb," in Stephen I. Schwartz, ed., *Atomic Audit: The Costs and Consequences of U.S. Nuclear Weapons Since 1940* (Washington, DC: Brookings Institution Press, 1998), 513–17. See also Titus, 19.
[29] Interview, John T. Conway, March 26, 2008. Conway was an inaugural member of the Board and its first chairman, serving from October 1989 to April 2005. Previously, he had served as staff director on the JCAE. On the JCAE, see also Mazuzan and Walker, 11–12.
[30] Pub. L. No. 79–585, ch. 724, Section 2(b), 60 Stat 755, 757. See also Titus, 28. Uniquely among modern joint committees, as Conway observed, the JCAE had the authority to produce, as well as to report bills. The committee also produced studies and publications and held hearings in both public and secret executive sessions.

In the initial eight years, the AEC devoted itself almost exclusively to its military mission, the management of the design and production of a stockpile of nuclear weapons.[31] This predominance of the military mission, notwithstanding that the AEC was a civilian body, was in accordance with the 1946 AEA. The act clearly specified that the primary purpose of atomic development, at least in the short run, was to produce a nuclear arsenal for defense. The act contained the provision that the president "from time to time" could direct the commission to deliver "weapons to the armed forces for such use as he deems necessary in the interest of national defense."[32] The act also provided for a second eventual goal—one envisioned to involve the private sector—of developing atomic energy for peaceful purposes. However, the 1946 act mandated that the AEC establish a military-headed Division of Military Applications and give its functions priority.[33] The emerging Cold War confrontation with the Soviet Union and the imperatives of the resultant nuclear arms race reinforced this statutory priority of military production.[34] As the Cold War developed, most of the AEC's resources were absorbed in defense-related activities as the commission refurbished the production and research facilities built during the war, and expanded the defense nuclear complex.[35] For the first 15 years of the AEC's 29-year existence, 70 percent of its expenditures went to the weapons-development programs carried out by the commission's Division of Military Applications.[36] For another half decade, military-related programs commanded the most of the AEC's time and the major portion of the budget.[37]

The statutory priority and Cold War urgency of the AEC's military mission made for considerable continuity between the wartime management of the nuclear weapons complex and

[31] Mazuzan and Walker, 13, 17–18.
[32] Pub. L. No. 79–585, ch. 724, Section 6(a), 60 Stat 755, 763.
[33] The 1946 Atomic Energy Act mandated four operational AEC divisions: research, production, engineering, and military application. Research was later subdivided into sections for physical research and biomedical research. Production was responsible for producing nuclear material. Engineering was concerned with building reactors. And military application dealt with nuclear weapons. See Mazuzan and Walker, 4; and Titus, 27.
[34] See Titus, 22–31.
[35] On the growth of the nuclear weapons complex, see Kevin O'Neill, "Building the Bomb," in Stephen I. Schwartz, ed., *Atomic Audit: The Costs and Consequences of U.S. Nuclear Weapons Since 1940* (Washington, DC: Brookings Institution Press, 1998), esp., 35–41, 64–69. To meet the early Cold War's escalating requirements for fissionable material, the AEC authorized major overhauls of the original reactors and two new plutonium reactors for the Hanford plant. At Oak Ridge, an addition to the existing K–25 plant was built, along with a third gaseous diffusion plant for the production of uranium 235.
[36] Titus, 27.
[37] Alice L. Buck, *A History of the Atomic Energy Commission*, DOE/ES–0003/l (Washington, DC: U.S. Department of Energy, July 1983), 1, http://www.atomictraveler.com/HistoryofAEC.pdf.

its governance under the early Cold War AEC. The AEC, for example, placed a similar premium on maintaining secrecy about nuclear activities. A major provision of the Atomic Energy Act of 1946 justified atomic secrets in the name of national security.[38] In turn, the need for secrecy made the continuation of government ownership of nuclear facilities attractive, because of fear that private possession could jeopardize military secrets. The 1946 act maintained the federal government's monopoly over nuclear energy and technology. All nuclear reactors and production facilities were government-owned, and all technical information and research results were under commission control. At the same time, for the actual operation of the complex, the law allowed the AEC to let contracts, and it chose to continue the system of private-sector contractor operation initiated during the Manhattan Project.[39] A further element of continuity with wartime management was the exceptional freedom the AEC enjoyed to marshal the services of highly qualified scientists and technical personnel. In the case of the AEC, Congress provided the commission with privileged appointment and position classification authorities whereby its employees, although federal personnel, were exempt from many of the restrictions and limitations of the Civil Service system.

The AEC's statutory responsibility for fostering and managing the nuclear enterprise was coupled in the 1946 act with a second charge for the commission, namely, the obligation to regulate the very activities and facilities it managed. In particular, according to the dual mandate specified in the act, the AEC was responsible for the achievement of safety in the fulfillment of its nuclear weapons mission. While managing the operations of the nuclear weapons complex, the AEC was authorized to ensure their safety or, in the wording of the act, Section 12(a), to

> (2) establish by regulation or order such standards and instructions to govern the production and use of fissionable and byproduct materials as the Commission may deem necessary or desirable to protect health or to minimize danger from explosions and other hazards to life or property.[40]

The act omitted any detail as to how the commission should regulate the health and safety aspects of the nuclear enterprise. The act provided only that the AEC would "establish . . .

---

[38] Eugene A. Rosa and William Freudenburg, "The Historical Development of Public Reactions to Nuclear Power: Implications for Nuclear Waste Policy," in Riley E. Dunlap et al, eds. *Public Reactions to Nuclear Waste: Citizens' Views of Repository Siting* (Durham, NC: Duke University Press, 1993), 33.

[39] Mazuzan and Walker, 7, 9–11. Among the early industrial firms contracted to operate the weapons production facilities were DuPont, Union Carbide, Monsanto, and Philips Petroleum. See also DiNunno, *Ideas for Improving Department of Energy's Safety Management of Nuclear Facilities*, 2/4.

[40] Pub. L. No. 79–585, ch. 724, Section 12(a)(2), 60 Stat 755, 770.

standards and instruction" for the complex, and implied that it would carry on the same kind of self-regulation that prevailed during the Manhattan Project. That is, the standards and instructions would be established and enforced in processes entirely internal to the commission itself.[41]

For help in carrying out the safety and health component of its dual mandate, the AEC made provisions early on to set up advisory committees on various aspects of nuclear safety.[42] Such committees were a source of expert advice for both the federal personnel of the AEC and its corporate contractors. Among the panels advising on safety, the most important was an independent advisory committee of scientists first assembled in late 1947 "to counsel the AEC on reactor safety."[43] Originally known as the Reactor Safeguards Committee, the body was soon merged with a panel on facility siting under the new name of Advisory Committee on Reactor Safeguards (ACRS).[44] This expert body, although strictly advisory and without statutory authority in its first decade, performed such vital tasks as reviewing the designs of existing and proposed reactors and advising on the potential hazards of their operation.[45] An early issue addressed, for example, was whether the safety of a reactor necessitated its enclosure in a concrete radioactivity-containment vessel or could be sufficiently assured by geographic isolation and the use of ventilation systems with filters.[46] The committee accepted the latter, unenclosed design in the case of the military's early large reactors, while later calling for containment structures for commercial reactors.[47] The committee's advice and recommendations

[41] George, 52.
[42] Pub. L. No. 79–585, ch. 724, Section 2(b), 60 Stat 755, 757.
[43] Pool, 90.
[44] Pool, 90, 190–97. See also George, 53.
[45] See Pool, 190. After 1957, Congress mandated that the ACRS review all applications to build and operate nuclear power plants.
[46] Michele Stenehjem Gerber, *On the Home Front: The Cold War Legacy of the Hanford Nuclear Site* (Lincoln: University of Nebraska Press, 1992), 24–26. See also *The History of Nuclear Power Safety*, http://users.owt.com/smsrpm/nksafe/forties.html, which states: "In the earliest large reactors, the plutonium production reactors at Hanford, the role of geographic isolation in protecting the safety of the general public was emphasized. At its first meeting in 1947, the Reactor Safeguards Committee of the Atomic Energy Commission considered containment for protection of the general public." Eventually, analyses by the ACRS of "maximum credible accidents" contributed to the adoption of containment vessels for reactors. Used as of the mid-1950s in commercial power plants, such vessels were recommended as a safer alternative to the filtered ventilation system previously used to ensure against accidental radiological releases. See Pool, 91ff, and O'Neill, 73.
[47] On the ACRS's view of containment domes, see Gerber, 102–3. See also J. Samuel Walker, *Containing the Atom: Nuclear Regulation in a Changing Environment, 1963–1971* (Berkeley: University of California Press, 1992), 57–59.

on such issues as containment were in no way binding.[48] The AEC was not required to respond to such recommendations in any particular way, or to implement them.

Other early expert advisory panels provided advice to the AEC on safety topics besides the design safety of nuclear facilities. For example, shortly after the AEC began operations, it set up a 12-person Safety and Industrial Health Advisory Board to survey health and safety issues throughout the complex, such as fire-protection practices and hazardous waste management. On the topic of waste disposal, the advisory panel warned as early as 1948, "The disposal of contaminated waste in present quantities and by present methods (in tanks or burial grounds or at sea), if continued for decades, presents the gravest of problems."[49] The panel called for more laboratory and field study of waste disposal and other issues, and for less diffused managerial responsibility for health and safety. Another group of subject matter experts in the Division of Biology and Medicine, beginning in 1948, conveyed its research results on the biological effects of radiation on people and the environment to the AEC, which largely relied on its contractors to make use of the results. As in the case of its other advisory panels, the AEC was free to disregard the safety recommendations of its own experts.[50]

The Atomic Energy Act of 1954

By 1954, under the AEC's direction, the defense nuclear complex had greatly expanded, and a massive stockpile of nuclear weapons had been accumulated. The nation's security interests appeared more reconcilable than before with the private-sector use of nuclear technologies for civilian commercial purposes.[51] Such use had been envisioned in the AEA of 1946 but had taken a back seat to defense-related applications of nuclear energy in the buildup of nuclear weapons during the early Cold War years.[52] Advocates of civilian uses, including the Joint Committee on Atomic Energy and President Dwight D. Eisenhower, now urged Congress to change the Atomic Energy Act to accommodate private enterprise in nuclear matters.[53]

---

[48] Pool, 90.
[49] Gosling and Fehner, 8.
[50] Pool, 90.
[51] Titus, 31.
[52] Mazuzan and Walker, 19–22, 25–29.
[53] In 1952 the JCAE issued a paper entitled "Atomic Power and Free Enterprise" that urged the private sector to develop nuclear power for commercial purposes. Two years later, President Eisenhower called for turning "atomic swords into plowshares" and urged Congress to enact the necessary legislation. See "President Eisenhower's "Atoms for Peace" Speech, Before the General Assembly of the United Nations on Peaceful Uses of Atomic

In 1954 Congress passed a sweeping revision of Atomic Energy Act of 1946 to permit for the first time private-sector development of a commercial nuclear power industry.[54] The Atomic Energy Act of 1954 as amended, which remains the primary U.S. statute governing nuclear matters, both commercial and defense-related, loosened many of the earlier AEA restrictions to create the necessary conditions for private-sector nuclear activity.[55] The amended act modified the conditions pertaining to ownership and use of nuclear materials and reactors, and ended the government's eight-year monopoly on such ownership, making possible the private ownership of nuclear power plants by utility companies. The act also lifted the government's exclusive control of technical data on nuclear matters, thereby diminishing the hindrance that secrecy posed to the advancement of nuclear technology for non-military purposes.[56]

With the opening up of the nuclear enterprise to private development, the AEC acquired augmented statutory responsibilities. From 1954 until the elimination of the AEC in 1974, the commission's charge encompassed both military and civilian applications of nuclear energy. The law contained the proviso that defense applications were still the top priority of the commission; it was to pursue peaceful applications of nuclear energy only "to the maximum extent consistent with the common defense and security and with the health and safety of the public."[57] However, most of the amended act dealt with the AEC's new charge of helping to establish a viable commercial nuclear enterprise. The structure of the commission was divided into two distinct categories: those dealing with atomic energy and those with atomic weapons. A new Division of Civilian Applications, headed by a civilian, was assigned primary responsibility for the development and application of civilian uses of atomic energy.[58] The Division of Military Applications, whose director by law still was a member of the armed forces, retained responsibility for weapons development.[59]

As in the case of military uses of nuclear energy, the AEC had a dual mandate vis-à-vis civilian applications. The act assigned the AEC the functions both of advancing the use of commercial nuclear power and of regulating its safety. In its role as a promoter of nuclear power,

---

Energy," December 8, 1953, *atomicarchive.com,* http://www.atomicarchive.com/Docs/Deterrence/Atomsforpeace.shtml.

[54] Walker, *A Short History*, 2–5.

[55] *Atomic Energy Act of 1954*, Pub. L. No. 83–703, ch. 1073, 68 Stat 919, August 30, 1954.

[56] Walker, *A Short History,* 5. See also Titus, 31–33.

[57] Pub. L. No. 83–703, ch. 1073, 68 Stat 919, 921.

[58] George, 54.

[59] Hacker, 12. See also Titus, 32–33.

the AEC was "to encourage widespread participation in the development and utilization of atomic energy for peaceful purposes."[60] The AEC was also to provide the fledgling nuclear power industry with technical, research, and financial assistance in adapting nuclear fission to the generation of electricity.[61] With the backing and urging of Congress's Joint Committee on Atomic Energy, the AEC became heavily engaged in nuclear reactor projects, seeking acceptable reactor designs. The AEC performed such research in collaboration with private utility vendors and in parallel with the U.S. Nuclear Navy's Naval Nuclear Propulsion Program, led by Admiral H. G. Rickover. The navy's program to develop nuclear reactors for naval-vessel propulsion, the Naval Reactors Program, was also under AEC oversight jurisdiction and proved to be a crucial source of engineering expertise and management discipline for building a commercial nuclear power industry.[62] The navy's own task of harnessing fission to produce a controlled release of energy to propel a naval vessel demanded design and testing rigor, system reliability, and a strong regard for safety, all characteristics reinforced by Rickover's leadership.[63] Rickover emphasized strong top management guidance to contractors, training, adherence to safety standards, and standards and procedures designed with major input by system designers.[64] The contractors for early civilian reactors relied heavily on the experience their engineers and scientists had gained through the work on the naval projects, as well as projects in the nuclear weapons program. The AEC's Reactor Development Division also brought naval and weapons-development experience to bear in its work with private utility vendors on reactor designs.[65]

Besides the development help on technical matters provided to the nuclear power industry by the AEC, another major service the AEC performed to advance the industry was to support necessary changes in the law pertaining to nuclear matters. In particular, the AEC supported the need for indemnity legislation that would shield private utility owners from huge liability claims in the event of a catastrophic accident in a nuclear power plant. Utility owners

[60] Pub. L. No. 83–703, ch. 1073, 68 Stat 919.
[61] Walker, *A Short History*, 4.
[62] Pool, 46–52, 194.
[63] Mazuzan and Walker, 16–17, 21–22.
[64] Interview, John W. Crawford Jr., September 21, 2008. An inaugural Board member on the Defense Nuclear Facilities Safety Board, Crawford served for 10 years in the Naval Nuclear Propulsion Program under Admiral Rickover, becoming Deputy Manager, Naval Reactors Program.
[65] See Mazuzan and Walker, 21–22. Soon after enactment of the Atomic Energy Act of 1954, Duquesne Light Company received permission to design and build the first "commercial" nuclear power plant at Shippingport, Pennsylvania. The project began in September 1954, with Westinghouse as the contractor. The U.S. Navy had

were hesitant to pursue nuclear power as long as they could be destroyed financially by the liability arising from a nuclear accident.[66] Thus, a precondition for stimulating the private capital investment necessary to launch the industry was to ensure an upper limit on private liability claims. The AEC backed an amendment to the Atomic Energy Act that would provide government coverage for liability claims in excess of a specific cap. Congress enacted the amendment, known as the Price-Anderson Act, in 1957.[67] This third significant nuclear-era law, which added Section 170 to the AEA, authorized the AEC to enter into indemnification agreements with the owners of private reactors.[68] These owners were obliged to carry $60 million in private insurance coverage for each reactor, the maximum available from the consortium of insurers.[69] However, as that amount did not approach the AEC's estimates of possible liability costs arising from a nuclear accident, the AEC, per the Price-Anderson Act, would supplement the private protection with an amount up to $500 million.

Divergent Safety Regimes in the Nuclear Power Industry and the Weapons Program

The dual mandate of the AEC, after the expansion of its jurisdiction to the commercial sector, included, as before, responsibility for regulating the safety of the nuclear enterprise. Under the 1954 AEA, the purview of the AEC's regulatory power now extended to private, commercial applications of nuclear energy, as well as to federal, defense-related applications. The amended act of 1954 reiterated much of the general language of its 1946 predecessor, assigning the AEC broad regulatory authority and directing it to "(1) protect health, (2) minimize danger to life or property, and (3) require the reporting and permit the inspection of work performed thereunder, as the commission may determine."[70] Section 161 of the act made reference to tools—standards and instructions—that the AEC was to use to promote safe nuclear operations. According to Section 161,

---

contracted with Westinghouse in the late 1940s to provide a research facility and technical expertise for the development of a nuclear propulsion plant for naval vessels.

[66] Walker, *A Short History*, 13–15.

[67] *Price-Anderson Nuclear Industries Indemnity Act*, Pub. L. No. 85–256, 71 Stat 576, September 2, 1957.

[68] See *Atomic Energy Act of 1954, as Amended,* § 170, which was added by Pub. L. No. 85–256 § 4, 71 Stat 576. See also Mazuzan and Walker, 199–212.

[69] Chapman, 348.

[70] Pub. L. No. 83–703, ch. 1073, Section 31(c), 68 Stat 919, 927.

> In the performance of its functions the Commission is authorized to—
> . . .
> b. establish by rule, regulation, or order, such standards and instructions to govern the possession and use of special nuclear material, source material, and byproduct material as the Commission may deem necessary or desirable to promote the common defense and security or to protect health or to minimize danger to life or property . . .
>
> (i) (3) to govern any activity authorized pursuant to this Act, including standards and restrictions governing the design, location, and operation of facilities used in the conduct of such activity, in order to protect health and to minimize danger to life or property."[71]

The 1954 AEA, like its 1946 predecessor, allowed the AEC to establish "standards and instruction" to protect health and safety.[72] The 1954 act did make one expectation clear about the AEC's enlarged regulatory mission, namely, that its oversight would proceed along different paths for private commercial and defense-related activities. In the case of privately owned facilities, Congress envisioned a licensing arrangement as the means of furthering the protection of public health and safety. The Atomic Energy Act of 1954 required all commercial nuclear facilities to be licensed and gave the AEC the authority to act as a nuclear licensing agency.[73] Licensing was a mechanism by which continuing public control over private activities could be exercised. Such continuing control was a precondition for the acceptability of the private ownership of nuclear facilities, the private use of fissionable material, and private industrial access to needed technical information. For defense-related nuclear operations, Congress established no licensing scheme.[74] The exempted facilities were owned by the federal government and bore a different relationship to the public interest. Their regulation was not taken up as a matter requiring statutory change.

The introduction of a licensing requirement for the commercial nuclear power industry and its omission for the defense nuclear complex contributed over time to a widening divergence in their respective regimes for regulating safety. The divergence between the commercial and defense sides of the nuclear enterprise in regard to safety began slowly at first and then

[71] Pub. L. No. 83–703, Section 161(b) and 161(i)(3), ch. 1073, 68 Stat 919, 948–49.
[72] See U.S. Congress, Office of Technology Assessment, *Managing the Nation's Commercial High-Level Radioactive Waste,* OTA–0–171 (Washington, DC, March 1985), 83, 95, http://www.princeton.edu/~ota/disk2/1985/ 8514_n.html; Mazuzan and Walker, 30–31; and Rosa and Freudenburg, 34.
[73] Buck, 6.
[74] George, 175.

accelerated. Eventually, the two sides, although broadly similar as users of nuclear technologies, addressed safety issues in a different manner.

Driven by licensing dynamics, this growing difference was masked initially by the fact that the two sides both had rather loose safety standards and casual safety management. Under the licensing arrangement, the authorization to build or operate a commercial nuclear power plant was contingent upon safety reviews by AEC staff of the potential private licensee's facilities and operating practices. During the infancy of nuclear power, such reviews leading to the issuance or denial of a license, had much in common with safety reviews performed as part of health and safety programs in the weapons complex. In both instances, reviews proceeded on a case-by-case basis and without reference to clearly defined standards as to what constituted safe installation design or operations.[75] The basis for judgments about safety, given the still limited and fluid knowledge about nuclear matters in the mid-1950s, was the "consensus of experts."[76] Another commonality that marked early nuclear safety reviews of both government-owned defense and commercial facilities was their reliance on the same organizational source of expertise on reactor designs, the Advisory Committee on Reactor Safeguards, the AEC's principal safety group.[77] The ACRS grew in influence after 1957, when an amendment to the Atomic Energy Act upgraded its status to that of a statutory advisory committee to the AEC, with a mandate to review all applications to construct and operate nuclear power plants.[78] Offering the AEC independent technical safety evaluations, the ACRS not only reviewed every proposal for a power reactor, but also performed periodic safety reviews of such defense facilities as Hanford's new production reactor—the N-reactor, built in 1963—and the Savannah River production reactors.[79]

Although nuclear safety reviews performed for the purpose of licensing commercial nuclear facilities and those performed in the weapons complex did not at first sharply

[75] Walker, *A Short History*, 8.
[76] DiNunno, *Ideas for Improving Department of Energy's Safety Management of Nuclear Facilities*, 2/4.
[77] Walker, *A Short History*, 13. The ACRS, interested in how to ensure reactor safety, drew upon the engineering expertise of the national laboratories, which researched the technical aspects of reactors, for example, how fuel elements would react if the temperature of the core exceeded normal operating temperature, how much pressure a reactor containment vessel could withstand, and whether an emergency core-cooling system would perform as designed.
[78] Pool, 90. See also Buck, 6. This upgrade of the ACRS reflected the recognition by proponents of nuclear power that a single accident in a nuclear reactor could severely weaken the nascent industry.

differentiate the regulatory regimes of the two sides of the nuclear enterprise, the requirement of licensing for commercial plants resulted in a regulatory regime and approach quite different from that pursued in the weapons complex. The licensing requirement produced a number of interacting effects.[80] One was increased pressure on the commercial nuclear industry to develop consistent and measurable standards as the foundation upon which licensing could rest. Another effect was to necessitate the enlargement and organizational consolidation of the regulatory staff charged with processing applications for licenses and monitoring compliance with their terms. A third effect was to open up the commercial nuclear enterprise to increased public scrutiny, because of the public's right to request public hearings or review as part of licensing proceedings, and its right to prior notice and an opportunity to comment—"prior notice and comment"—on standards proposed for promulgation as regulations in the U.S. Code of Regulations.[81]

With respect to standards, the need for a clear and publicly defensible technical basis for the licensing of commercial plants prompted the AEC to step up its efforts to specify the safety requirements to which the private vendors of nuclear power were obliged to adhere. The AEC sought standards and requirements that embodied available scientific information and, following the lead of the Naval Nuclear Propulsion Program, moved increasingly to the use of written standards.[82] During the 1960s, the AEC worked toward greater rigor in several important areas, including standards on protection measures against radiation exposure, requirements to prevent major radiation releases from a power reactor, and standards relating to reactor safety engineering issues, such as pressure vessel integrity and emergency core cooling systems. Gradually the AEC's standard setting on the commercial side took the form of promulgating legally binding regulations in a formal process that included prior issuance for public comment. The first topic addressed in this formal rulemaking process was the required elements in a reactor

---

[79] U.S. Congress, House of Representatives, Committee on Energy and Commerce, Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities: Hearings on H.R. 783, H.R.. 2047, and H.R. 3123*, 100th Cong., 1st sess., November 5, 19, 1987, 34. See also Buck, 6.

[80] J. Samuel Walker, *Containing the Atom: Nuclear Regulation in a Changing Environment, 1963–1971* (Berkeley: University of California Press, 1992), 37ff.

[81] Interview, Sherri Wasserman Goodman, Alexandria, VA, September 10, 2008. Goodman was on the professional staff of the Senate Armed Services Committee when the creation of the Board was debated. See also Walker, *A Short History*, 13. The Price-Anderson Act included a provision that required public hearings on all reactor applications.

[82] Defense Nuclear Facilities Safety Board, *Fifth Annual Report to Congress* (Washington, DC, February 1995), 78, http://www.dnfsb.gov/pub_docs/reports_to_Congress/all/rc.php.

site. In 1962 the AEC's specification of reactor siting criteria, which emphasized quantitative measures, was codified in Title 10, Part 100, of the U.S. Code of Federal Regulations.[83] Other regulations followed, along with regulatory guides to aid in judging compliance. In connection with private-sector licensed operators, the AEC operated increasingly as a true regulator. Besides the power to define standards and promulgate regulations, it also had enforcement authority, including the power to maintain surveillance of licensed reactors and to threaten operators with the withholding, suspension, or non-renewal of a license.

The AEC's efforts to develop standards and regulations necessitated organizational changes that gave greater prominence to its regulatory arm. In 1961 the AEC modified its internal structure to separate regulatory functions from operating functions and upgraded the former by placing them under a newly created director of regulation, who reported directly to the commissioners.[84] The AEC also expanded its regulatory staff. A larger staff was needed to handle the increased workload brought on by the formalization of standard setting and regulation, as well as the mid-1960s boom in orders and construction of commercial nuclear power plants. From a slow start of only eight small power reactors ordered prior to 1966, 52 reactors were on order by November of that year, flooding the AEC with applications for licenses.[85]

In addition to strengthening the AEC's regulatory arm and standard setting, its licensing and regulatory activities under the 1954 act provided the avenues for public as well as judicial involvement in its processes of decision-making about commercial nuclear power.[86] For example, by law, following any change in a licensing application, the public had a specified period during which a public hearing could be requested to provide a forum for airing concerns

---

[83] For discussion of 10 CFR Part 100 in a meeting before the Defense Nuclear Facilities Safety Board, see *Public Meetings and Hearings, 1991, Before the Defense Nuclear Facilities Safety Board*, vol. II of II (Washington, DC: Defense Nuclear Facilities Safety Board, 1991), 187–90. See also J. Samuel Walker, *Three Mile Island: A Nuclear Crisis in Historical Perspective* (Berkeley: University of California Press, 2004), 52–62.

[84] Buck, 8.

[85] Merritt E. Langston, "Continuing Evolution of U.S. Nuclear Quality Assurance Principles, Practices and Requirements," Part I, August 2005, 5, http://www.hss.energy.gov/CSA/CSP/qa/NQAStandardsEvolution1.doc.

> An exponential growth in the nuclear power plant market began in 1965. This growth followed the successful demonstration of commercial nuclear power at the Shippingport, Pennsylvania, nuclear plant. At that time, eight reactors with a combined capacity of 4,870 megawatts electrical (Mwe) were on order. In the first eight months of 1966, 15 more reactors with a total capacity of 11,800 Mwe were ordered. By November 1966, there were 52 civilian power reactors with a total capacity of 26,890 Mwe on order. The AEC predicted an increase in capacity of from 80,000 to 110,000 total Mwe by 1980. Plant capacity had increased in size from several hundred to 1,100 Mwe.

and opinions.[87] Similarly, opportunities for public comment were part of the formal process for promulgating regulations. In addition, licensing decisions became subject to judicial review. During the early years of commercial nuclear power, such avenues for outside involvement drew largely benign public and media attention to the industry and served to elicit community acceptance of industry and AEC decisions, for example, on plant siting.[88] As the industry rapidly grew during the 1960s and early 1970s, however, the avenues for involvement brought interventions by outside parties that challenged industry and AEC freedom of action. Such parties included local citizens groups, media, state and local governments, antinuclear and environmental activists, and, finally, the judiciary, all of which questioned the industry's handling of safety, health, and the environment.[89] By the early 1970s, when the nuclear power industry and the AEC were increasingly under fire by such outside parties, citizen activists frequently exploited the hearing process to delay the construction and raise the costs of nuclear power plants.[90]

The type of answerability to public concerns that the AEC's licensing procedures brought to the commercial nuclear power industry and its AEC regulators did not pertain on the defense side of the nuclear enterprise or to the staff in charge of the commission's health and safety programs in the nuclear weapons complex. The evolution of such programs, although exhibiting some parallels to that of the AEC's private-sector regulation, did not involve the institution of any practices that would normally occasion or allow public hearings. The federally owned nuclear facilities were exempt from licensing by statute, and the AEC staff for these facilities developed health and safety standards without recourse to the formal processes of promulgating regulations.[91] The staff did pursue improved definitions of standards and requirements and

---

[86] Anthony R. Buhl, Thomas Murley, George Edgar, and Donald Silverman. "NRC Regulation of DOE Facilities," *Nuclear News,* May 1997, 29.
[87] Rosa and Freudenburg, 41–42.
[88] Rosa and Freudenburg, 34.
[89] Walker, *Three Mile Island*, 9–17.
[90] Pool, 195.
[91] George, 54. See DiNunno, *Ideas for Improving Department of Energy's Safety Management of Nuclear Facilities*, 2/4. According to DiNunno,

> In 1959, for closer scrutiny of the operations of its own nuclear facilities, the AEC consolidated its subject matter experts in applied health physics, fire protection, and industrial health and safety standards into an Operational Safety Division. These experts, along with those in the Division of Biology and Medicine, had been largely advisory to weapons production managers . . . .The establishment of the Operational Safety Division marked the first forceful federal insertion of safety expectations into the production programs of the government's weapons contractors.

captured them informally in a Manual of Standards.[92] However, the standards they developed, mainly designated as orders and directives, had a different status from legally binding regulations and could be instituted and changed without public notice and comment. The absence of practices that invited public involvement shielded the nuclear weapons side of the nuclear enterprise from public scrutiny. Another contributor to the absence of public involvement in the weapons program was national security concerns.

The comparative invulnerability of the defense side of the nuclear enterprise to public scrutiny and challenge, even as the public mood concerning nuclear activities darkened by the late 1960s, contributed to the continuation of a relatively relaxed safety regime in the weapons complex. Under this safety regime, for example, the processes of defining, using, and enforcing standards were pursued without a great sense of urgency. A key task of the weapons program's health and safety staff was to formulate orders and directives to be written into contracts and followed by the weapons contractors.[93] This task of formulation was given to delay, allowing contractors to rely on their own experience for many safety issues.[94] In these tasks, the contractors typically continued the ad hoc and case-by-case approach of the nuclear enterprise's earlier days, and contractors neither offered, nor were systematically called upon to give, feedback that could inform the ongoing efforts of AEC staff on the defense side to formalize safety-related standards.

With respect to the standards—the orders and directives—that *had* been defined and written into contracts, compliance was far from a given. Accustomed to working according to their own standards, contractors tended to view the safety orders and directives written into their contracts as "'goals' to be met over time," rather than as strict requirements demanding adherence.[95] Both the means and the will to punish contractors for their non-adherence to contractual standards were limited. Numerous factors hampered stringent enforcement, including insufficient numbers of technically qualified AEC staff to monitor and inspect operations and facilities. Also, the AEC was highly dependent on its consortium of contractors to realize the weapons production goals that were part of the commission's dual mission of production and

[92] DiNunno, *Ideas for Improving Department of Energy's Safety Management of Nuclear Facilities*, 2/4.
[93] National Academy of Sciences, National Research Council, Committee to Assess Safety and Technical Issues at DOE Reactors, *Safety Issues at the Defense Production Reactors: A Report to the U.S. Department of Energy* (Washington, DC: National Academy Press, 1987), esp., 222–26, in "Appendix H, Structure of the DOE Safety System: Technical Discussion," http://books.google.com/books?id=q2MrAAAAYAAJ&printsec=titlepage.
[94] Office of Technology Assessment, *Hazards Ahead*, 54.

safety. While in theory contractor non-compliance with a contract's built-in safety orders could be grounds for abrogating a contract, in practice the AEC's dependence on its contractors undercut its leverage to enforce their attention to the safety of operations. The priority of production goals limited the AEC's incentive to enforce safety requirements.

The weaknesses of the weapons program's system for ensuring safety escaped sustained public, media, and congressional criticism longer than did safety issues in the commercial nuclear power industry. The main safety issue related to nuclear weapons that received attention prior to the mid-1980s was the radioactive fallout resulting from aboveground nuclear weapons testing.[96] The flare-up of concern about that issue subsided with the 1963 ban on aboveground testing of nuclear weapons, leaving the commercial nuclear power industry the chief target of the public's increasing skepticism about the nuclear enterprise and growing distrust of its governing body, the AEC.[97]

By the 1970s, citizen activists opposed to nuclear technology took advantage of the AEC's comparatively wide avenues for public involvement in commercial nuclear activities and appeared regularly at AEC licensing hearings for nuclear power plants to express safety concerns, e.g., about the chances of a large-scale accident and the hazards of long-lived radioactive waste, as well as economic arguments. Opponents of nuclear technology filed petitions with the AEC and legal motions with the courts, seeking to stall the licensing and operation of nuclear power plants, and thereby to block the nuclear industry's expansion.

NUCLEAR DOUBTS AND THE ENERGY CRISIS

The safety concerns involving commercial nuclear power were attributed in part to the AEC's dual mandate, now widely seen as involving conflicting, perhaps even irreconcilable, objectives, i.e., on the one hand, to advance the growth of a private commercial nuclear industry and, on the other hand, to ensure its safety. To be sure, the AEC had striven to balance these objectives. After the early period of the nuclear industry, when the industry's launch and growth had priority, the AEC had upgraded its regulatory arm, giving more influence to those charged with safety, and acted as a far more stringent regulator. Still, balancing these objectives was

[95] Buhl, et al., 29.
[96] Walker, *A Short History*, 17–21.
[97] Buck, 4–5. The Limited Test Ban Treaty of 1963 banned atmospheric testing while permitting underground testing.

difficult to achieve, and many viewed the commission as still too caught up with the industry it regulated.

The Breakup of the AEC

After years of public debate, Congress judged the AEC's dual mission to be no longer tenable and enacted the Energy Reorganization Act (ERA) in 1974 to separate the commission's two conflicting objectives and assign them to different federal agencies.[98] Senator Abraham Ribicoff, chairman of the committee with primary jurisdiction for the act, explained its rationale,

> [T]he development of the nuclear power industry has been managed by the same agency responsible for regulating it. While this arrangement may have been necessary in the infancy of the atomic era after World War II, it is clearly not in the public interest to continue this special relationship now that the industry is well on its way to becoming among the largest and most hazardous in the Nation. In fact, it is difficult to determine . . . where the commission ends and the industry begins.[99]

The legislation of 1974 disbanded the AEC and assigned its responsibility for nuclear safety in civilian nuclear applications, including all commercial nuclear plants, to the newly created U.S. Nuclear Regulatory Commission (NRC). The NRC, an independent regulatory agency that began operations in January 1975, inherited "all the licensing and related regulatory functions of the Atomic Energy Commission."[100] The 1974 act transferred the AEC's regulatory arm intact, including existing regulations and the staff and programs that governed safety in the nuclear industry.[101] The NRC also was assigned some units that had previously provided safety support to both the power industry and the weapons program. The NRC inherited, for example, the

---

[98] *Energy Reorganization Act of 1974*, Pub. L. No.93–438, 88 Stat. 1233, October 11, 1974, as amended, 42 U.S.C. Sec. 5801 *et seq*.

[99] 120 Cong. Rec. 28129 (1974) (statement of Senator Ribicoff). Ribicoff, who chaired the Committee on Government Operations, reported the act to the Senate in June 1974.

[100] Pub. L. No. 93–438, Sec. 201(f), 88 Stat 1233, 1243. See Terrence R. Fehner and Jack M. Holl, *Department of Energy, 1977–1994: A Summary History* (Washington, D.C.: U.S. Department of Energy, November 1994), 18–20, http://www.osti.gov/bridge/servlets/purl/10106088-mgIkuD/webviewable/10106088.PDF. Although the NRC's mandate generally restricted NRC authority to the regulation of the commercial nuclear industry, the NRC licensed some government-owned nuclear facilities, including some operated for the military. None of these NRC-licensed, government-owned facilities were involved in weapons production. See also Buhl et al, 28–30.

[101] Interview, John E. Mansfield, Board vice chairman (since 2007; Board member, 1997–present), Washington, DC, August 25, 2008. See also Pool, 196; and George, 55.

Advisory Committee on Reactor Safety, whose focus became almost exclusively commercial nuclear activities.[102]

With the enactment of the 1974 act, the NRC was not given any developmental, operational, or promotional responsibilities for either commercial nuclear power or the weapons program. A second new agency, the Energy Research and Development Administration (ERDA), was given these non-regulatory responsibilities of the AEC—mainly, managing the nuclear weapons and naval reactor programs—as well as energy development programs.[103] Becoming the managing agency for the nuclear weapons complex, ERDA also assumed responsibility for safety in the weapons program, since, when the NRC was created, no comparable independent safety authority was created for defense nuclear facilities.[104] Under the new arrangement of 1974, the duties to ensure safety and production continued to reside in the same agency, ERDA.[105] Thus, the agency restructuring of 1974, while undoing the problematic duality of the AEC's mission on the civilian side of the nuclear enterprise, left such a duality of agency mission in place on the side of the weapons program. This difference in agency arrangements for the power industry and the weapons program was ultimately to reinforce and sharpen over time the divergence that had already developed in the two spheres' respective safety regimes.

The Birth of the Department of Energy in the Era of Energy Crises

In 1977 further organizational changes occurred in the energy arena, this time precipitated not by dissatisfaction with the AEC, but by the nation's ongoing energy crisis and concerns about U.S. vulnerability to energy supply–disrupting events, such as the oil embargo of

---

[102] The ACRS is subject to the NRC regulations set forth in 10 CFR Part 7.

[103] Pub. L. No.93–438, Section 102(g), 88 Stat 1233, 1235–37. The Energy Reorganization Act perpetuated the AEC's compartmentalization of military applications by stipulating a statutory position, "Director of Military Applications" within ERDA. ERDA assumed "activities relating to research and development on the various sources of energy (and) other functions, including but not limited to the Atomic Energy Commission's military and production activities and its general basic research activities."

[104] Pub. L. No. 93–438, Section 2a, 88 Stat 1233. The statute that established ERDA charged it with operating the agency to "advance the goals of restoring, protecting and enhancing environmental quality, and to assure public health and safety."

[105] DiNunno, *Ideas for Improving Department of Energy's Safety Management of Nuclear Facilities*, 2/6. According to DiNunno,

> ERDA's organization included an Assistant Administrator for Environment and Safety. The functions of this Environment and Safety group, like those of its predecessors, were largely in support of the line. The functions included a lead role in sponsoring biomedical and environmental research, oversight of a health and safety laboratory, development of environmental control

1973. To the Carter administration, the energy crisis demonstrated a need for comprehensive national energy planning and coordination. The Carter administration wanted both to raise energy issues to a higher level on the policy agenda and to enhance energy-planning efficiency by centralizing the dispersed energy-related activities of various federal agencies. The administration concluded that the reorganization of 1974, in its establishment of ERDA, was inadequate to current needs and proposed to replace ERDA with a new cabinet-level department that incorporated ERDA's functions, along with some others.[106] At the administration's urging, Congress enacted the Department of Energy Organization Act of 1977, creating the Department of Energy (DOE), which began operations on October 1, 1977.[107] The act transferred to DOE the duties previously performed by the short-lived ERDA, including control of the nuclear weapons complex.[108] For the defense-related tasks so transferred, Congress required a continuing compartmentalization of weapons-related activities under an assistant secretary for defense programs and national security functions. In addition, the DOE enabling legislation expanded the new department's non-nuclear management responsibilities beyond the non-nuclear duties, primarily research, that ERDA had performed. DOE inherited and consolidated, for example, non-nuclear energy regulatory programs, including those of various cabinet-level departments.[109]

Thus, with the establishment of DOE, responsibilities for the weapons complex came to reside in an organization whose functions were more encompassing than those of its immediate predecessor, ERDA, as well as quite different from those of the AEC, whose focus had been on nuclear matters exclusively. As the successor to both the AEC and ERDA for defense nuclear activities, however, DOE was still the carrier of a dual mission, inheriting both managerial and regulatory responsibilities. DOE's charge was both to manage the production of nuclear weapons and to ensure the safe operation of DOE production facilities. Assigning DOE the broad goal of

---

technologies, development of safety standards, compliance oversight, coordination of safety reactor research, and waste management and transportation.

[106] Fehner and Holl, 22–23; Titus, 35.

[107] *Department of Energy Organization Act of 1977*, Pub. L. No. 95–91, Title II, Section 201, 91 Stat 565, 569. See also U.S. Department of Energy, Office of Environmental Management, *Linking Legacies: Connecting the Cold War Nuclear Weapons Production Processes to Their Environmental Consequences* (Washington, DC, January 1997), http://www.em.doe.gov/Publications/linklegacy.aspx.

[108] These defense functions were transferred to DOE by Pub. L. No. 95–91, Title II, Section 203(a)(5), 91 Stat 565, 570.

[109] George, 56. See also DiNunno, *Ideas for Improving Department of Energy's Safety Management of Nuclear Facilities*, C/2.

protecting public health and safety, and mentioning environmental protection, the act stated that DOE's mission was to include:

> [I]ncorporation of national environmental protection goals in the formulation and implementation of energy programs and to advance the goals of restoring, protecting, and enhancing environmental quality, and assuring public health and safety.[110]

The act made clear that DOE's statutory authority included the power to establish, impose, oversee, and enforce compliance with nuclear safety requirements.[111] Otherwise, like earlier nuclear-related legislation, the act lacked specifics as to how to accomplish safety aims. As the National Academy of Sciences/National Research Council later commented about the law that created DOE, "Congress gave DOE nearly complete discretion to determine how it should go about protecting the public."[112]

The newly created DOE focused the bulk of its attention on activities to address the energy crisis —energy development and regulation to promote efficiency and conservation—rather than on the nuclear weapons complex.[113] Regarding the weapons complex, DOE, following its AEC/ERDA predecessors, emphasized the production of nuclear materials and weapons. With respect to such issues in the weapons program, DOE carried forward the system of "self-regulation" inherited from its predecessors, and continued to develop and maintain the internal system of orders and directives under which nuclear safety had been regulated. DOE specified the set of orders to be written into its management and operation (M&O) contracts and formulated other types of guidance for its contractors.[114] In doing so, DOE often adopted NRC standards as part of its internal orders.[115] Otherwise, DOE remained resistant to outside pressures for improvement in environment, safety, and health (ES&H) protection measures in its nuclear operations, for example, pressures arising from the growing national environmental protection movement. From the time of its establishment in 1977, DOE came under pressure to comply at DOE weapons-production sites with environmental statutes and

[110] Pub. L. No. 95–91, Section 102 (13), 91 Stat 565, 568; 42 U.S.C. Section 7101 et seq., section 7191.
[111] Pub. L. No. 95–91, Section 102 (13), 91 Stat 565, 568.
[112] National Academy of Sciences, National Research Council, *Safety Issues at the Defense Production Reactors*, 224.
[113] Fehner and Holl, 22–26.
[114] Interview, Mansfield. Within DOE's safety regime, standards-based operation was relatively strong in relation to reactors, but weaker in other areas. For a description of the various types of standard-like instruments that DOE used to promote safety, see National Research Council/National Academy of Sciences, *Safety Issues at the Defense Production Reactors*.

regulations, e.g., the recently enacted Resource Conservation and Recovery Act of 1976 or RCRA, administered by the states, and, slightly later, the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, or CERCLA, also known as "Superfund," which was administered by the Environmental Protection Agency (EPA).[116] However, DOE, like its predecessors, was intent on remaining "self-regulating" for health and safety matters at defense nuclear facilities and resisted being compelled to comply with such laws, claiming exemption under the terms of the Atomic Energy Act.[117]

While DOE initially was successful in fending off pressures to submit its nuclear facilities to the external constraints, such as environmental laws, similar kinds of pressure brought dramatic change to the commercial side of the nuclear enterprise and its regulator, the NRC. The commercial industry faced environmental and civic activism generated by deteriorating public confidence in the safety and environmental benignity of nuclear technologies, and by alarm at the long-standing, apparently intractable problem of nuclear waste. Such intensified public concern and activism, plus the high costs of nuclear power generation, brought an abrupt halt to further growth of the industry.[118] After 1978, no U.S. utility company ordered a nuclear power reactor, and all orders placed after 1974 were eventually canceled.[119] This collapse of new orders in turn changed the NRC's focus. The NRC continued its licensing and regulatory activities, gradually developing "a full set of legally binding regulations and a wide range of interpretive guidance to judge compliance." However, with the end of new applications for plant construction, the NRC's focus in standard setting was less on the safe design of reactors than on the safety standards for their operation and maintenance.[120]

THE THREE MILE ISLAND SHAKEUP: AFTERMATH

The efficacy of such efforts to improve safety management in the two sides of the nuclear enterprise was suddenly called into question at the end of that decade by the trauma of the core-

---

[115] House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities*, 208.
[116] Pub. L. No. 94–580, 90 Stat 2795, and Pub. L. No. 96–510, 94 Stat 2767.
[117] Len Ackland, *Making a Real Killing: Rocky Flats and the Nuclear West* (Albuquerque: University of New Mexico Press, 2002), 200, 205.
[118] Walker, *Three Mile Island*, 42.
[119] U.S. Department of Energy, Energy Information Administration, *The Changing Structure of the Electric Power Industry, 2000: An Update*, DOE/EIA–0562(00) (Washington, DC, October 2000), 161, http://www.eia.doe.gov/cneaf/electricity/chg_stru_updated/toc.html.
[120] See Walker, *A Short History*, 61.

melt accident at the Three Mile Island (TMI) nuclear power plant in Pennsylvania. The accident, the most serious in U.S. commercial nuclear plant operating history, began at the plant's Unit 2 on March 28, 1979.[121] About half of the radioactive, heat-producing core melted before the reactor could be brought to a "cold shutdown" a month later.[122] For a time, the events in progress at the plant raised fears that widespread radioactive contamination would escape the containment vessel—fears fueled by an erroneous NRC warning about an explosive "hydrogen bubble" within the reactor.[123] The crisis ended without a major radiation release, injuries, or the need for a general evacuation, but it hardened preexisting public and media suspicion about the nuclear enterprise, both the technology and its governance. As had been the case in earlier flare-ups of public alarm about nuclear technology, public concern was relatively undifferentiated, pertaining to all things nuclear, whether commercial or defense-related.

While the Three Mile Island accident was a major setback for trust in all things nuclear, the accident was an impetus for safety improvements. Although the accident brought added scrutiny of nuclear safety across both sides of the nuclear enterprise, the direct and immediate impact of the accident as a driver of safety upgrades was much greater in the commercial industry and at the NRC than in the weapons program and at DOE.[124] Accounting for this difference in part was still the greater vulnerability of the commercial side to the exertion of various kinds of public pressure. Another reason for the difference in the immediate impetus to safety improvements was simply the fact that the TMI accident involved a commercial plant, whose regulation was the NRC's responsibility.

In the aftermath of the accident, a presidential commission, the Kemeny Commission, was set up to investigate the accident and directed, among other things, to address whether licensed commercial nuclear power reactors should be allowed to continue operating.[125] The Kemeny Commission answered in the affirmative but identified, and proposed as a precondition, significant items requiring industry-wide corrective measures. Because analyses of the accident

[121] U.S. Nuclear Regulatory Commission, *NRC: Our History*, February 3, 2009, n.p., http://www.nrc.gov/about-nrc/history.html#aec.
[122] Walker, *Three Mile Island*, chapters 4–8.
[123] William Lanouette," The Atom, Politics, and the Press" (Washington, DC: Media Studies Project, Woodrow Wilson International Center for Scholars, December 1989), 106.
[124] Interview, Goodman.
[125] For an account of post-TMI safety-related changes in the commercial industry, see Joseph V. Rees, *Hostages of Each Other: The Transformation of Nuclear Safety Since Three Mile Island* (Chicago: University of Chicago Press, 1996).

underscored that severe accidents could result from small equipment failures compounded by human error, the NRC henceforth placed far greater emphasis on the training of reactor operators and "human factors" in plant performance.[126] The NRC also called upon the industry to make wide-ranging improvements in emergency-response planning, the documentation of plant operating histories, radiation protection practices, and human factors engineering. In addition, the NRC tightened and stepped up its regulatory oversight activities. Based on a recommendation of the Kemeny Commission, the NRC, for example, established onsite inspectors at all its licensed sites.[127]

In making these post-TMI reforms, the NRC attempted to emulate the most successful model in the history of nuclear technology, Rickover's Nuclear Navy. Based on observation of navy practices, the NRC and the industry remedied a good deal of pre-TMI sloppiness in operations, establishing more detailed rules and specifications covering more seemingly minor matters, as well as more disciplined record-keeping.[128] In addition, the NRC augmented its own efforts by delegating some of its responsibilities to a new industry group, the Institute of Nuclear Power Operations (INPO), which was founded in response to a recommendation of the Kemeny Commission Report.[129] Funded by the U.S. nuclear power industry, INPO was created to improve the sharing of operational experience and best practices among nuclear power plants.[130] INPO conducted nuclear plant evaluations, identified strengths and common operational deficiencies, and disseminated its findings and data analyses within the nuclear industry, typically without revealing the names of particular plants or making its findings public.[131] In addition, based on the data it collected, INPO set performance objectives, defined benchmarks of quality in reactor operations, and disseminated guidelines industry-wide.[132]

---

[126] Walker, *A Short History*, 51–53.
[127] House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities,* 174.
[128] Pool, 204.
[129] U.S. Congress, House of Representatives, Committee on Energy and Commerce, Subcommittee on Energy Conservation and Power, *Nuclear Reactor Safety,* 99th Cong., 2d sess., May 22 and July 16, 1986, 3.
[130] Interview, Mansfield. Pointed out that DOE contractors on the defense side of the nuclear enterprise eventually formed a counterpart on INPO, the Energy Facility Contractors Group (EFCOG), which had the similar aim of sharing best practices. On INPO, see Rees, 41ff.
[131] On INPO's treatment of its data as "proprietary," see House Energy and Commerce Subcommittee on Energy Conservation and Power, *Nuclear Reactor Safety*, 3.
[132] Matthew L. Wald, "10 Years After Three Mile Island," *New York Times*, March 23, 1989, http://query.nytimes.com/gst/fullpage.html?res=950DE0DF1738F930A15750C0A96F948260&sec=&spon=&page wanted=print.

Similarly sweeping and direct post-TMI changes did not take place in the nuclear weapons complex or at DOE. Among notable short-run effects of the TMI accident was a comprehensive self-assessment conducted in 1981 for the secretary of energy on the safety of DOE's production reactors.[133] The 1981 report, known as the Crawford Committee report, was authored by a panel whose head, John W. Crawford Jr., would later become an inaugural member of the Defense Nuclear Facilities Safety Board. The Crawford Committee report revealed numerous safety deficiencies in DOE nuclear operations and DOE.[134] The report faulted DOE on a number of grounds, including a lack of adequate standards, inadequate requirements for ensuring the quality of operating personnel, and spottiness in implementing lessons learned from the TMI accident. On the issues of standards and training, the report criticized DOE in explicitly comparative terms, chiding it for falling short in safety upgrades compared to the NRC and the commercial nuclear industry. The report stated,

- DOE Headquarters policies, instructions, and other information relating to nuclear matters . . . have not been upgraded to take into account the standards and requirements reissued by NRC.
- A coordinated DOE-wide program relative to TMI Lessons learned has not been established, and only isolated corrective measures are evident at reactor sites.
- DOE lags behind the commercial nuclear industry in issuing uniform unambiguous requirements for the selection, training, and qualification of reactor operating personnel.[135]

The report concluded with a call for further study, as well as recommendations for internal organizational changes in DOE that would elevate the status of ES&H functions.

The findings of the Crawford Committee report accorded with a later summary assessment by a congressional staff participant in the Defense Nuclear Facilities Safety Board's establishment, namely, that the nuclear weapons complex, relatively speaking, "did not benefit from the safety upgrades prompted by the Three Mile Island accident."[136] The staffer mentioned several reasons, both long-term and shorter term, for the relatively slight effect of the Three Mile

[133] U.S. Department of Energy, *A Report on a Safety Assessment of Department of Energy Nuclear Reactor: Report of the Crawford Committee,* DOE/US–0005 (Washington, DC, March 1981).
[134] See U.S. Congress, Senate, Committee on Armed Services, Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 100th Cong., 1st sess., October 22, 26, 27, 30, November 3, 1987, 305, on the Crawford Committee, also known as the Nuclear Facility Personnel Qualification Committee. The panel's head, John W. Crawford Jr., was then the deputy assistant secretary for nuclear energy. See also DiNunno, *Ideas for Improving Department of Energy's Safety Management of Nuclear Facilities*, C/3.
[135] DiNunno, *Ideas for Improving Department of Energy's Safety Management of Nuclear Facilities*, C/3.

Island accident on safety activities in the nuclear weapons complex compared to the shakeup it produced in the nuclear industry and NRC. The long-term reason, already suggested, was that the legacy of secrecy that had always prevailed in the defense nuclear complex remained in force, rendering DOE nuclear facilities and DOE safety activities still relatively sheltered from outside scrutiny. Not particularly subject to outside pressure to force remedial action on safety issues, DOE was also temporarily restrained from taking action on its own account because of a significant increase in the demand for nuclear weapons production in the early 1980s. This increased demand began with President Carter's last defense budget, whose request roughly coincided in time with the Three Mile Island accident. The buildup of weapons continued well into the Reagan years, making the early to mid-1980s a period of intense nuclear weapons production. DOE was called upon to expand significantly its output of nuclear materials and weapons, as well as its research and development of nuclear weapons.[137] The buildup of the nuclear arsenal took priority, shifting DOE away both from its originally stronger focus on energy issues and from any significantly increased post-TMI focus on safety issues in DOE's nuclear operations.[138] A Board employee later remarked upon the weapons buildup and its deleterious effect on DOE's performance in health and safety matters, stating,

> The nuclear business is like other industries. They have busy times. They have slack times and I guess it is fair to say that the 1980s, early and mid-1980s, was a very busy time in the weapons production complex.
>
> During busy times, plants concentrated on making their product—in this case weapons components—and deferred other things: maintenance and upgrades and scrap processing.[139]

Although the Reagan administration's weapons buildup contributed to DOE's deferral of remedial action on the kinds of safety issues that various TMI accident analyses highlighted, DOE did not altogether escape external pressures reflecting heightened post-TMI public concerns about nuclear-related matters. In particular, DOE felt the impact of intensified public

---

[136] Interview, Goodman.
[137] On the Reagan administration's buildup and its impact on safe operations in the DOE nuclear complex, see Schwartz, 496–502.
[138] Fehner and Holl, 38–41. The Carter administration's fiscal year 1982 Department of Energy budget ($12.6 billion) and the Reagan administration's FY 1985 budget ($12.8 billion) were similar in amount but differed in priorities. Reagan's budget doubled expenditures for the nuclear-weapons program, while halving spending for energy areas such as conservation and renewable energy research.
[139] *Public Meetings and Hearings, 1995*, *Public Meetings and Hearings, 1995, Before the Defense Nuclear Facilities Safety Board*, vol. I (Washington, DC: Defense Nuclear Facilities Safety Board, 1995), 18.

concerns about nuclear waste disposal and environmental contamination by radioactive wastes. As a result of such concerns, DOE came under increased pressure to subject its own activities at defense nuclear sites to outside scrutiny and external regulation under various state and federal laws. DOE had successfully resisted inroads of external regulation in the past, refusing to acknowledge, for example, its obligations to comply with environmental laws and regulations. However, in 1984 DOE had a setback in litigation in a federal court that challenged its handling of wastes at DOE nuclear facilities.

Environmental activists brought suit against DOE in the Eastern District Court of Tennessee, charging DOE with violating environmental laws in its operation of the Y-12 nuclear weapons component manufacturing plant at the 37,000 acre Oak Ridge Reservation in Tennessee.[140] According to documents made public in 1983, 2.4 million pounds of mercury had been discharged from the plant.[141] In *Legal Environmental Assistance Foundation, Inc, et al v. Hodel*, the plaintiffs charged that DOE, in its handling of mercury and other hazardous materials, had violated the provisions of the Resource Conservation and Recovery Act (RCRA) that applied to the treatment, transportation, storage, and disposal of hazardous waste, as well as sections of the Clean Water Act.[142] In its defense, DOE asserted that Y-12 operations were not covered by the RCRA, because the Atomic Energy Act (AEA) exempted DOE from state regulation. DOE claimed further that the AEA placed authority for waste disposal with DOE and, moreover, restricted the dissemination of data on nuclear materials and weapons.[143]

On April 13, 1984, in a landmark ruling, Judge Robert L. Taylor rejected DOE's arguments, finding in favor of the plaintiffs. The court agreed that the RCRA's hazardous waste disposal regulation applied to DOE at Y-12. The judge waived damages in view of the national defense mission of the Y-12 plant, and of DOE's expressed commitment to remediate the environmental damage at the site.[144] Nonetheless, the court ruling marked a significant change, with its finding that DOE indeed was subject to external regulation in aspects of its operations in

[140] U.S. Congress, House of Representatives, Committee on Science and Technology, Subcommittee on Energy Research and Production and Subcommittee on Investigations and Oversight, *The Impact of Mercury Releases at the Oak Ridge Complex,* 98th Cong., 1st sess., July 11, 1983, 18.
[141] Gerber, 8.
[142] *Legal Environmental Assistance Foundation Inc. v. Hodel,* 586 F.Supp. 1163, (E.D. Tenn.) (1984).
[143] Chapman, 348–49.
[144] See also Mark Holt, *Nuclear Weapons Production Complex: Environmental Compliance and Waste Management,* CRS Issue Brief 90074, updated (Washington, DC: Congressional Research Service, Library of Congress, 1990, 1997), 2, 8–11, http://www.cnie.org/nle/waste-3.html.

nuclear facilities. The ruling determined that DOE had to comply with environmental statutes and regulations administered by EPA and, in effect, granted EPA the authority to regulate DOE.[145] The ruling, while not eliminating DOE's "self-regulating" status, narrowed the scope in which it could operate with purely internal oversight.[146]

In so doing, the ruling paved the way for further impositions of federal and state statutes and regulations on DOE nuclear facilities. Congress, for example, reinforced the trend toward limiting DOE's "self-regulating" status, with the passage of the Superfund Amendments and Reauthorization Act of 1986.[147] The act made clear that sites owned by the government could be considered for inclusion on the National Priorities List, part of the Superfund law listing the nation's most contaminated sites.[148] Such a listing would entail remedial environmental action under the jurisdiction of the states and/or EPA.[149] In addition, DOE, in May 1987, came to an understanding with EPA regarding mixed wastes—low-level radioactive wastes mixed with non-radioactive hazardous chemical constituents—conceding that the RCRA applied to their hazardous components and that mixed-waste disposal would be subject to regulatory oversight by EPA.

Notwithstanding such congressionally and litigation-driven expansion of the reach of external regulations in DOE, the department remained a "self-regulating" entity in many important areas, most crucially, in matters of nuclear safety at DOE facilities.

CHERNOBYL BRINGS HOME THE NEED FOR SAFETY REFORMS AND STEPPED-UP OVERSIGHT IN DOE'S NUCLEAR OPERATIONS

The limited imposition by courts and Congress of external regulation on DOE nuclear operations up to the mid-1980s might have assuaged public and congressional safety and environmental concerns about them for some time, keeping such concerns on a low burner. However, the Soviet Union's Chernobyl nuclear disaster on April 26, 1986, shattered that possibility. That accident, more than the TMI accident, aroused public and media alarm about the

[145] On the shared responsibilities of DOE and EPA, see House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities*, 208.
[146] U.S. General Accounting Office, *Department of Energy: Clear Strategy on Externa1 Regulation Needed for Worker and Nuclear Facility Safety*, GAO/T–RCED–98–163 (Washington, DC, May 1998), 3, http://www.gao.gov/archive/1998/rc98163.pdf.
[147] Pub.L.No. 99–499, 100 Stat 1613, October 17, 1986.
[148] Ackland, 201.
[149] DiNunno, *Ideas for Improving Department of Energy's Safety Management of Nuclear Facilities*, 2/7.

defense nuclear complex and brought home to Congress and DOE the need for serious safety reforms and greatly stepped-up oversight in that side of the nuclear enterprise, as well as the commercial side.

The Chernobyl nuclear power station accident provided a dramatic demonstration of the havoc that a major accident in a nuclear facility could cause. The accident, later characterized by a Belarussian ambassador as "the worst technogenic catastrophe that has ever occurred on this planet," began with a power excursion, followed by an explosion that destroyed the unit 4 reactor and blew off its top.[150] The explosion and resulting fire in the reactor's graphite core released massive amounts of radioactivity. A radioactive plume spread as fallout to European countries as distant as Poland, Germany, Switzerland, Italy, Sweden, and Finland.[151] The consequences for nearby areas, especially Belarus, which received 70 percent of the fallout, were dire in the near term and expected to be severe in the long term.[152] As analyzed later, in Belarus, in the first post-Chernobyl decade, the incidence of thyroid cancer in children rose by 285 times, and Chernobyl-related issues absorbed 25 percent of the government's budget. In Ukraine 270 square miles were contaminated with plutonium-239, and another 9 million hectares contaminated with radioactive residues.[153] Analyses of the accident listed various causes, including operator errors ultimately attributable to poor training and poor management, and to faulty reactor design. Another, more general contributing factor usually cited was the pervasive secrecy in nuclear matters during the Soviet era.

Whatever the exact thrust of the analyses of the disaster's causes, ongoing revelations about the causes and consequences were profoundly unsettling to those with responsibility for safety in the U.S nuclear enterprise, including DOE's defense nuclear operations. The revelations had the effect both of spurring accelerated internal change within DOE in the weapons area and of finally stirring Congress into action on legislative initiatives designed to improve defense nuclear safety. By 1987, numerous proposals for the establishment of an external arrangement for oversight of DOE's nuclear operations were under consideration by Congress.

---

[150] U.S. Congress, Commission on Security and Cooperation in Europe, *The Legacy of Chornobyl, 1986 to 1996 and Beyond,* 104th Cong., 2d sess., April 23, 1996, 3, http://csce.gov/index.cfm?FuseAction=UserGroups.Home&ContentRecord_id=156&ContentType=H&ContentRecordType=H&UserGroup_id=117&Subaction=ByDate&CFTOKEN=53. See also Walker, *A Short History*, 49–51.

[151] See House Energy and Commerce Subcommittee on Energy Conservation and Power, *Nuclear Reactor Safety*, 3; 66–67.

[152] Chapman, 349.

[153] Commission on Security and Cooperation in Europe, *The Legacy of Chornobyl,* 32–34, 44–45, 47.

DOE's Internal Reforms Prior to Chernobyl

With regard to changes within DOE, the fifth secretary of energy, John S. Herrington, both pushed for more rapid implementation of reforms underway before Chernobyl and undertook new ones. Herrington, who had taken office in January 1985 at the start of President Reagan's second term and about a year before the Chernobyl accident, had already taken significant steps toward improving DOE's internal nuclear safety management.[154] For example, in September 1985, responding to a special report that he had ordered, which characterized DOE's ES&H activities as "a disgrace," he consolidated into one headquarters division previously scattered environmental, safety, and health functions.[155] Cognizant of the report's finding that such functions were "widely perceived as having no clout and of being ignored by senior management unless a crisis develops," he ensured their elevation in status and authority by placing the consolidated division, the Office of Environment, Safety, and Health (EH), under the direction of a newly created assistant secretary for environment, safety, and health.[156] In establishing the ES&H office and the new assistant secretary position, Herrington aimed to bolster DOE's mechanisms of internal safety oversight by clearly separating and upgrading the organization responsible for oversight from the line office responsible for actually *achieving* safety in the course of nuclear weapons production, the assistant secretary for defense programs (DP).[157] In effect, he sought a safety oversight body that, while internal to DOE, was not as conflicted as other internal units with carrying out the dual mission of production and safety. The safety responsibilities of the new assistant secretary's office, as later described by John W. Crawford Jr., an inaugural member of the Board, were to:

> (1) independently confirm that safety [was] achieved by the line management organizations,

[154] For a description of Herrington's actions both before and after Chernobyl, see the testimony of Joseph F. Salgado, Under Secretary, DOE, in House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities,* 125–28.
[155] See Fehner and Holl, 41
[156] See Fehner and Holl, 41.
[157] According to later testimony by Senator John Glenn, Herrington, in reorganizing the DOE's ES&H activities, in effect, adopted the advice of several GAO reports in the early 1980s. See the 1983 GAO report, U.S. General Accounting Office, *DOE's Safety and Health Oversight Program at Nuclear Facilities Could Be Strengthened*, RCED–84–50 (Washington, DC, November 1983), for its recommendation of the reorganization of DOE's safety and health program to provide it with more authority and independence. See also the 1981 GAO report, GAO, *Better Oversight Needed for Safety and Health Activities at DOE's Nuclear Facilities*, EMD–81–108 (Washington, DC, August, 4, 1981).

(2) develop safety standards,

(3) and provide "technical assistance" to line organizations concerning governmental, safety, and health matters.[158]

Other pre-Chernobyl actions Herrington undertook in the name of improved safety included ordering detailed technical appraisals of nuclear safety at all of DOE's high-hazard facilities, a major environmental survey of conditions at DOE nuclear facilities, and the revision of DOE orders on safety-related topics, such as the preparation of safety analysis reviews (SAR).[159] In addition, just a month prior to the Chernobyl accident, Herrington began to implement a new government policy of greater transparency concerning the environmental, safety, and health effects resulting from five decades of nuclear weapons production and testing in the nation's defense nuclear reservations.[160] In February 1986, DOE took early steps in what would eventually be a large-scale release of previously unavailable or declassified records documenting "how decades of making and testing nuclear weapons had affected those who worked and lived in the vicinity" of the facilities.[161]

DOE's Internal Reforms after Chernobyl

In addition to boosting initiatives already underway in DOE to increase transparency, and accelerating intradepartmental safety management reforms, Chernobyl also served as the stimulus for undertaking new internal DOE initiatives to improve nuclear safety. The major post-Chernobyl actions on Herrington's part included immediately commissioning a study by the National Research Council, the research arm of the National Academy of Sciences (NAS) and the National Academy of Engineering, to make an independent assessment of the safety of

---

[158] See John W. Crawford Jr., *An Assessment Concerning Safety at Defense Nuclear Facilities: The DOE Technical Personnel Problem*, DNFSB/TECH–10 (Washington, DC: Defense Nuclear Facilities Safety Board, March 1996), 26, http://www.dnfsb.gov/pub_docs/dnfsb/tr_199603.html. As Crawford pointed out, with the establishment of the new EH office, there were two large organizations in DOE Headquarters with key responsibilities for the safety of defense nuclear facilities, including the line organizations headed by the assistant secretary for defense programs (DP). In 1989, a second line organization with safety responsibilities was established, an office headed by the assistant secretary for environmental management (EM).

[159] The technical safety appraisal process was developed from the Institute of Nuclear Power Operations (INPO) and NRC evaluation methods. See *Safety Oversight for Department of Energy Nuclear Facilities*. See also U.S. General Accounting Office, *Environment, Safety, and Health: Status of Department of Energy's Implementation of 1985 Initiatives*, RCED–86–68FS (Washington, DC, March 1986), and U.S. General Accounting Office, *Nuclear Safety: Safety Analysis Reviews for DOE's Defense Facilities Can Be Improved,* GAO/RCED–86–175 (Washington, DC, June 1986), 22, http://archive.gao.gov/d4t4/130648.pdf.

[160] Gerber, 1.

[161] Gerber, 4.

DOE's largest reactors, with particular attention to the lessons learned from the Chernobyl accident. The focus of the NAS study, conducted by a 16-member expert panel, was DOE's defense production reactors—reactors operated to supply the plutonium and tritium needed for nuclear weapons—the N-reactor at Hanford and the K-, L-, and P- reactors at Savannah River.[162] Begun around May 1986, the study's report, *Safety Issues at the Defense Production Reactors: A Report to the U.S. Department of Energy*, was published on October 29, 1987, with interim findings available earlier.[163] The study was highly critical of safety conditions at the reactors, identifying both managerial shortcomings and technical problems.[164]

On the question of the likelihood of a Chernobyl-like accident in U.S. reactors, the NAS study found that the reactors, notwithstanding "acute aging," were not inherently unstable in the same way that the Chernobyl plant was. However, major gaps existed in the understanding of how the reactors would perform in certain kinds of severe accidents that U.S. civilian plants were designed to withstand, for example, a loss-of-coolant accident. The study also found "significant uncertainties" about the ability of the defense reactors—with their filters rather than containment structures—to limit the release of radioactive materials in a major accident. Serious technical deficiencies identified in the study included suspected stress-corrosion cracks in reactors at the Savannah River Site.[165] On management issues, the study found many problems associated with DOE's reliance on its consortium of contractors, in the words of the report, "a loose-knit system of largely self-regulated contractors operating within budgetary constraints imposed by and on

[162] The National Academy of Science's National Research Council later also produced reports on defense nuclear facilities other than the reactors. These reports appeared in 1988 and 1989 on the eve of the Board's startup. The reports raised both safety and environmental concerns. On the environment, the 1989 report stated, "Virtually every facility in the complex has contamination on site, some of it extensive, and many of them have contamination off site as well." On safety, the reports listed the following specific problems, as well as general problems, such as the facilities' age:

- "[T]here are troublesome elements in the fire protection program."
- "[A] pattern of routine use of respirators [to prevent the inhalation of radioactive materials] is an indication of the failure of production, maintenance, and housekeeping procedures."
- "Plutonium exists in the exhaust ducts downstream of the high-efficiency particulate air (HEPA) filters at the plutonium finishing facility at Hanford . . . [and] in an exhaust duct of Building 771 at Rocky Flats."
- "Medical departments are . . .relegated to a reactive role. . . . Medical monitoring and surveillance programs in the complex should be improved substantially."

[163] National Academy of Sciences, National Research Council, *Safety Issues at the Defense Production Reactors*, vii.

[164] Matthew L. Wald, "Weapon Reactors Faulted on Safety," *New York Times*, October 29, 1987.

[165] Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 104. See also Gerber, 5.

the Department."[166] The study pointed out that DOE depended excessively on contractors to identify remedies for safety issues, and provided insufficient central direction concerning safety expectations and standards, as well as too little monitoring.[167] Broaching a theme later emphasized by the Defense Nuclear Facilities Safety Board, the study attributed such problems to an imbalance in the technical expertise of DOE and contractor personnel. As the report stated,

> [DOE] both at headquarters and in its field organizations, has relied almost entirely on its contractors to identify safety concerns and to recommend appropriate actions, in part because [of] the imbalance in technical capabilities and experience between the contractors and DOE staff.[168]

The study summarized its assessment of DOE's management of its aging facilities by saying, DOE "falls short of reasonable expectation in attempting to cope with the mix of production and safety responsibilities."[169]

In addition to commissioning the special National Academy of Sciences study of 1987, a second significant post-Chernobyl action taken by Herrington was to call for the formation of several advisory committees. One was the six-member Roddis panel, specifically formed to ascertain the state of the N-reactor, DOE's largest nuclear materials plant and the only U.S. reactor even superficially similar to the Chernobyl flammable graphite-moderated reactor.[170] The N–reactor, built in 1963 and designed for 20 years of service, was in stand-down status in January 1987 for safety improvements and had to be assessed prior to restart. Another advisory committee, the Advisory Committee on Nuclear Facility Safety (ACNFS), was DOE's answer to one of the recommendations in the National Academy of Sciences study, the recommendation for an independent safety oversight committee—a committee of non-DOE experts—serving as advisors to the secretary of energy on the safety of operations of DOE's nuclear facilities. Chartered by Secretary Herrington in 1987, the ACNFS was a DOE-appointed group of 15 nuclear safety experts largely from outside DOE.[171] This committee, whose members were chosen by the secretary and served part-time, was known as the Ahearne Committee, after its

[166] National Academy of Sciences, National Research Council, *Safety Issues at the Defense Production Reactors*, 80.
[167] National Academy of Sciences, National Research Council, *Safety Issues at the Defense Production Reactors*, vii, 76, 78, 80–82.
[168] National Academy of Sciences, National Research Council, *Safety Issues at the Defense Production Reactors*, 75.
[169] National Academy of Sciences, National Research Council, *Safety Issues at the Defense Production Reactors*, xx.
[170] Fehner and Holl, 43.
[171] The committee was terminated in November 1991. See U.S. Department of Energy, "Terminated Federal Advisory Committees," 3, n.d., http://management.energy.gov/documents/TerminatedAdvisoryCommittees.pdf.

chairman, Dr. John F. Ahearne, a former chairman of the NRC.[172] The ACNFS, whose goal was to provide a degree of independent safety oversight *within* DOE, initiated reviews of a number of the most pressing issues in the complex, for example, the storage of high-level waste at Hanford, unsafe plutonium residues at Rocky Flats, and staff training and qualification, particularly in radiological protection practices.[173] As recommended in the National Academy of Sciences/National Research Council study, most of the committee's work was to be unclassified and publicly available. The study had regarded such transparency as essential to repair the public's confidence in the safety of DOE's nuclear operations.

[172] Interview, A.J. Eggenberger, Board chairman (since 2005; vice chairman, 1989–2005), Washington, DC, July 9, 2008. Secretary of Energy Watkins phased ACNFS out after the Board was fully in operation. See also Fehner and Holl, 50.

[173] Interview, Kenneth M. Pusateri, Board General Manager (1989–2006), Washington, DC, January 3, 2008. Eventually, the Board subsumed the records of the Ahearne Committee.

CHAPTER 2: ESTABLISHMENT OF THE BOARD, 1987 TO 1989

CONGRESSIONAL PUSH FOR EXTERNAL SAFETY OVERSIGHT IN DOE'S NUCLEAR OPERATIONS

As the Advisory Committee on Nuclear Facility Safety was getting underway and the National Academy of Sciences study was in progress, Congress was also mobilizing under the stimulus of Chernobyl to examine safety issues in nuclear facilities and to consider legislating new mechanisms of safety oversight. Although the Chernobyl power station, like Three Mile Island, was a power plant rather than a defense-production reactor, the Chernobyl accident focused congressional attention on the perceived safety problems of both sides of the nuclear enterprise—DOE's nuclear facilities and the nuclear power industry.

In regard to the commercial industry, several committees in the House of Representatives held hearings in 1986 on the future of nuclear power in the light of the Chernobyl accident, noting with dismay "a return to the pre-Three Mile Island business-as-usual mentality" that had taken place by then.[174] The House Energy and Commerce Subcommittee on Energy Conservation and Power found that NRC and DOE officials had told their nuclear safety experts to refrain from discussing the Chernobyl accident with the media and from comparing Chernobyl with U.S. reactors.[175] The NRC also requested the subcommittee to keep secret the details of 151 accidents at nuclear facilities in 14 countries other than the United States and the Soviet Union between 1971 and 1984. Deploring such "policies of public exclusion and conspiratorial silence" about safety problems, several House panels floated proposals for the reform of NRC licensing, the standardization of power plant design, and other safety initiatives.[176] The overall aim of such congressional activity was twofold: "maintaining public confidence through citizen participation, and developing a safer product."[177]

In regard to DOE's nuclear facilities, Congress also came to insist that both public confidence and safety required a definitive break with the legacy of secrecy and congressional

[174] U.S. Congress, House of Representatives, Committee on Energy and Commerce, Subcommittee on Energy Conservation and Power, *Nuclear Reactor Safety,* 99th Cong., 2d sess., May 22 and July 16, 1986, 3. See also U.S. Congress, House of Representatives, Committee on Interior and Insular Affairs, Subcommittee on Energy and the Environment, *Nuclear Licensing and Regulatory Reform Legislation,* 99th Cong., 2d sess., June 26, July 22, 1986.
[175] House, Energy and Commerce Subcommittee on Energy Conservation and Power, *Nuclear Reactor Safety,* 3. See also Bert Chapman, "The Defense Nuclear Facilities Safety Board's First Decade," *Journal of Government Information* 27 (2000): 349, http://docs.lib.purdue.edu/lib research/70.
[176] House, Energy and Commerce Subcommittee on Energy Conservation and Power, *Nuclear Reactor Safety*, 3.
[177] House, Energy and Commerce Subcommittee on Energy Conservation and Power, *Nuclear Reactor Safety*, 4.

inattention. A number of committees became involved in hearings on the state of safety in the weapons complex and on DOE's record of safety management.[178] By the 100th Congress, which was in session from January 1987 through October 1988, Congress began in earnest "to examine the question of whether the responsibility for ensuring the safety of DOE's reactors ought to be removed from the Department and assigned to an independent agency."[179] During this period, both houses of Congress examined a number of legislative proposals to create a mechanism for continuous independent external oversight of safety in the weapons program. The proposals reflected the belief that the adequate protection of public health and safety required the end of continuing reliance on DOE self-regulation—the "fox guarding the henhouse" and "Dracula guarding the blood bank"[180] Among these legislative proposals was S. 1085, the Nuclear Protections and Safety Act of 1987, a bill sponsored by Senator John Glenn (D–Ohio) that ultimately proved precursory to the 1988 enabling legislation for the Defense Nuclear Facilities Safety Board (DNFSB or the Board).[181]

A number of factors besides Chernobyl were significant in precipitating the flurry of legislative activity on nuclear safety oversight during the 100th Congress. One factor was the winding down of the Cold War, which was signaled, beginning in the year after Chernobyl, by political changes in the Soviet Union and nuclear arms control agreements.[182] The period from the summer 1986 meeting between President Ronald Reagan and Soviet General Secretary

[178] On the congressional committees that took up issues involving the defense nuclear complex, see Stephen I. Schwartz, "Congressional Oversight of the Bomb," in Stephen I. Schwartz, ed., *Atomic Audit: The Costs and Consequences of U.S. Nuclear Weapons Since 1940* (Washington, DC: Brookings Institution Press, 1998), 513. After 1977, when nuclear matters ceased to be the province of a single committee, i.e., the Joint Committee on Atomic Energy (JCAE), several dozen committees had occasional say on matters in the weapons complex. However, the JCAE's responsibilities devolved for the most part on two sets of committees in both houses of Congress, the House and Senate Armed Services committees, and the House and Senate Appropriations committees, more specifically their subcommittees with responsibilities related to energy. The appropriations subcommittees handled funding for DOE. During the period of intensified congressional action on nuclear weapons safety in the mid- to late 1980s, other committees and subcommittees played a significant role, most notably, the Senate Governmental Affairs Committee.

[179] U.S. Congress, House of Representatives, Committee on Energy and Commerce, Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities*: *Hearings on H.R. 783, H.R. 2047, and H.R. 3123,* 100th Cong., 1st sess., November 5 and 19, 1987, 2.

[180] See House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities*, 34, for Representative Ron Wyden (D–OR) quoting a constituent.

[181] Senator John Glenn, "The Nuclear Protections and Safety Act of 1987," 133 Cong. Rec. 9431–9436 (1987). Glenn's bill contained four separately titled portions. When reported to the Senate (S. Rep. No. 100–173), they were S.1085 *Title I, Defense Nuclear Safety Board Oversight Act of 1987; Title II, Application of OSHA and NIOSH to DOE Nuclear Facilities; Title III, Mixed Hazardous Waste Amendment Act of 1987; Title IV, Radiation Study Advisory Board Act of 1987*.

Mikhail Gorbachev in Reykjavik, Iceland, to the September 1987 signing of the Intermediate Nuclear Forces treaty, which banned a category of weapons, has been called "the beginning of the end of the U.S.–Soviet nuclear arms race."[183] This waning of the arms race undermined the national security rationale for the secrecy and self-policing that still prevailed in the nuclear weapons complex.[184]

Another reason for stepped-up activity and the emergence of legislative proposals for independent safety oversight in the 100th Congress was that the Senate majority passed from Republican to Democratic hands, giving the chairmanship of a key committee, the Senate Governmental Affairs Committee, to Senator John Glenn, previously the committee's ranking minority member.[185] Glenn, a former test pilot and astronaut, was a Senate leader in nuclear nonproliferation and long conversant with questions about the safety and environmental impact of DOE's nuclear facilities.[186] In attaining the chairmanship of the Governmental Affairs Committee, a standing body with jurisdiction over regulation or regulatory bodies such as the NRC, he was now in a leadership position to move legislation on nuclear safety.[187]

The second committee that shaped the Board's enabling legislation was the Senate Armed Services Committee, which, in its own words, had "exclusive jurisdiction" over DOE's defense nuclear complex.[188] The Senate Committee on Armed Services and, more specifically, its Subcommittee on Strategic Forces and Nuclear Deterrence, were responsible for legislation relating to nuclear weapons, national defense, and nuclear deterrence. With the shift to a Democratic Senate majority in the 100th Congress, the new chairman of the Armed Services Committee was Sam Nunn (D–Georgia), who was amenable to working with Glenn, also an Armed Services Committee member, on legislation related to nuclear safety.

Glenn's actions in the 100th Congress—his initiation of hearings and his introduction of S.1085 on April 23, 1987—were not his earliest actions in connection with safety issues in the

---

[182] Len Ackland, *Making a Real Killing: Rocky Flats and the Nuclear West* (Albuquerque: University of New Mexico Press, 2002), 216.
[183] Ackland, 208.
[184] Ackland, 216.
[185] Glenn was chair of the Governmental Affairs Committee from the 100th through the 103d Congresses, i.e., January 1987 through December 1994, after which Senate Republicans regained the majority.
[186] F.G. Gosling, and Terrence R. Fehner, *Closing the Circle: The Department of Energy and Environmental Management, 1942–1994* (Washington, DC: U.S. Department of Energy, 1994), 81.
[187] Interview, Sherri Wasserman Goodman, Alexandria, VA, September 10, 2008. Goodman was a senior staffer on the Senate Armed Services Committee in the late 1980s and active in the deliberative sessions that ultimately led to the establishment of the Defense Nuclear Facilities Safety Board.

weapons complex. Glenn had become actively concerned about the safety of DOE facilities several years before he unveiled legislation.[189] As early as July 1980, he began commissioning reports from the General Accounting Office on various aspects of safety, health, and environment issues in the weapons program.[190] One consistent message from the reports that he and others requested—21 reports between 1979 and 1987—was the need for greater independence in DOE's safety oversight programs in the weapons complex. The GAO explicitly distinguished the type of oversight it advocated from oversight that remained an internal function within DOE, noting that the latter produced inevitable trade-offs between DOE's programmatic objectives and safety considerations during the budget process—to the detriment of safety. The GAO, noncommittal as to the specific mechanism of outside oversight, advocated "an outside organization, independent of funding by DOE . . . [whether] another federal agency, such as NRC, or an independent review panel not associated with DOE." [191]

In addition to sponsoring GAO investigations of problems in the weapons complex, Glenn pioneered congressional hearings on the subject. He did so at the prompting of nonproliferation experts on his staff, including Leonard S. Spector and Leonard Weiss, an electrical engineer, who was instrumental in formulating the Nuclear Nonproliferation Act of 1978, and related legislation sponsored by Glenn.[192] Glenn also heeded the concerns of environmental activists such as Robert Alvarez, who joined his staff during the 100th

---

[188] S. Rep. 100–232, at 2 (1987).

[189] On Glenn's description of his involvement in defense nuclear matters, see U.S. Congress, Senate, Committee on Armed Services, Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 100th Cong., 1st sess., October 22, 26, 27, 30, November 3, 1987, 57–58, 67–68. When Glenn campaigned unsuccessfully to become the Democratic candidate for president in 1984, he highlighted his nuclear arms control advocacy. He supported, first, a mutual, verifiable freeze on the production and deployment of nuclear weapons; second, reductions in U.S./Soviet nuclear arsenals; third, an end to the spread of nuclear weapons technology by strict enforcement of the nuclear nonproliferation legislation he authored in the Senate; fourth, involvement of all other countries possessing nuclear weapons in the arms control process; and fifth, negotiations on reductions of conventional weapons. See *John Glenn for President 1984 Campaign Brochure: 'Believe in the future again'*, *4president.org*, http://www.4president.org/brochures/johnglenn1984brochure.htm.

[190] Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 210.

[191] U.S. General Accounting Office, *Nuclear Safety: Safety Analysis Reviews for DOE's Defense Facilities Can Be Improved,* GAO/RCED–86–175 (Washington, DC, June 1986), 22, http://archive.gao.gov/d4t4/130260.pdf.

[192] *Nuclear Nonproliferation Act of 1978*, Pub. L. No. 95–242. Weiss was staff director of the Senate Governmental Affairs Subcommittee on Energy, Nuclear Proliferation, and Federal Services from 1977 to 1981 and minority staff director of the same subcommittee from 1981 to 1987. He remained a chief policy adviser to Glenn until 1999. Spector was chief counsel of the subcommittee until the mid-1980s, when he went on to the Carnegie Endowment for International Peace and eventually to DOE.

Congress.[193] Alvarez and others underscored the urgency of the matter of legacy nuclear wastes, as well as the health impact of defense nuclear production, including operations in Glenn's own state of Ohio, at the Feed Materials Production Center in Fernald, Ohio. The Fernald site, a 1,050-acre uranium-processing complex, was shut down in December 1984 "after DOE disclosed that excessive quantities of uranium dust and oxides had been released through the ventilating system in a recent three-month period."[194] During the 99th Congress, which ran from January 1985 through October 1986, Glenn used his position as chair of the Governmental Affairs Subcommittee on Energy, Nuclear Proliferation, and Government Processes to bring to national prominence through hearings the issue of nuclear wastes and cleanup at the nation's nuclear materials production plants. Beginning in 1985, Glenn and his staffer Weiss led the first comprehensive examinations of DOE's nuclear weapons complex, initially launching an investigation of health and safety problems at Fernald.[195] As the hearings revealed,

> [O]ver 230 tons of radioactive material from Fernald had leaked into the Greater Miami River valley during the preceding three decades. The whereabouts of another 337 tons of uranium hexaflouride . . . could not be documented. Thousands of kilograms (kg) of uranium dust had been discharged to the atmosphere and to surface water. Five million kg of radioactive and hazardous (mixed) substances had been released to pits and swamps, permitting percolation into groundwater. Concrete silos containing solid radioactive wastes had vented radon gas. Additionally, about two hundred thousand canisters and barrels at Fernald held mixed and hazardous wastes that had not been identified precisely.[196]

After the first hearings on Fernald, Glenn made a further request of GAO to review health and safety issues at a number of DOE facilities around the country. The resulting 1986 GAO report documented serious safety issues at nearly all of the sites examined.

The actions of Glenn and his staffers proved to be important groundwork for the intensified focus on defense nuclear safety in the 100th Congress in both the House and the Senate. Glenn's bill, S. 1085, and its House counterpart, H.R. 3123, were not the only pieces of DOE nuclear oversight legislation to emerge in 1987, nor the only ones to generate extensive

---

[193] Interview, John E. Mansfield, Board vice chairman (since 2007; Board member, 1997–present), Washington, DC, August 25, 2008.
[194] Michele Stenehjem Gerber, *On the Home Front: The Cold War Legacy of the Hanford Nuclear Site* (Lincoln: University of Nebraska Press, 1992), 6.
[195] Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 57–58, 67–68.
[196] Gerber, 6–7. See also U.S. Congress, Senate, Committee on Governmental Affairs, *Environmental Issues at Department of Energy Nuclear Facilities*, 100th Cong., 1st sess., March 17, 1987, 1–15.

hearings. The other bills and the hearings in which they were debated presented a range of options both in the definition of the type of entity that would provide external oversight and in the level of authority it would have.

In defining the entity, one bill, H.R. 783, proposed putting the defense nuclear complex under NRC jurisdiction and oversight, rather than creating a new body or agency.[197] Other proposals, like S. 1085, envisioned a new oversight entity, but deviated to varying degrees from the approach of Glenn's bill. S. 1085 took the NRC as a model for such features of the oversight body as its composition, its mode of appointment, and its political balance. S. 1085 envisioned a board of multiple members—respected experts in nuclear safety (three members in S. 1085 rather than the NRC's five commissioners), appointment by the president with Senate approval, and party balance (with no more than two board members from one party). By contrast, one piece of legislation that elicited serious debate, H.R. 2047, Defense Nuclear Facilities Safety Agency Act, introduced in the House by Representative Norman Dicks (D–WA), proposed an oversight entity headed by a single administrator, appointed by the president with Senate approval.

More contentious than the type of entity—a board or an administrator-headed agency—that should perform oversight was the question of its level of authority. In the shorthand that developed throughout numerous congressional hearings, the question was whether the oversight entity should be advisory or regulatory in character. For the most part, the proposals that received serious consideration fell short of recommending full regulatory oversight.[198] While a number of environmental activists, including Alvarez and Dan Reicher of the National Resources Defense Council, favored NRC regulation of DOE nuclear facilities, most participants in the hearings, including representatives speaking for the NRC did not.[199] The NRC and others offered a number of objections to using the NRC as the oversight body, including resource constraints and the fact that commercial power reactors differed technically from DOE reactors and other production facilities. The NRC also begged off on the grounds that it had not previously had anything to do with weapons production, and thus lacked the capacity

[197] House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities*, 61–82.
[198] Interview, Richard. A. Azarro, Board general counsel, Washington, DC, August 20, 2008. On various regulatory possibilities, see Glenn Russell George, "Negotiated Safety: Intragovernmental Risk Regulation in the U.S. Nuclear Weapons Complex" (Ph.D. diss., Harvard University, May 1995) (accessed via Proquest).
[199] For the debate about the possibility of the NRC as the oversight body for DOE's nuclear facilities, see House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities*, 166–219.

to address some of the issues of security that such oversight entailed.[200] The commission, according to an NRC spokesman, valued "the clear distinction between military and civilian uses of atomic energy . . . [and] would not want to see that distinction compromised."[201]

Although most proposals for oversight did not advocate a full-blown regulatory regime, the thrust of the bills on the table during the 1987 congressional hearings did favor powers that went well beyond the merely advisory. The sponsors of external oversight bills, including Dicks, Representative Ron Wyden (D–Oregon), and Glenn, as well as their other proponents, were generally adamant that they wanted oversight with "real teeth," rather than just another advisory body—another "toothless tiger"—whose advice could be ignored with impunity by the secretary of energy.[202] The powers of the oversight entities proposed by their bills were, in the words of one hearing witness, "regulatory-like," and of another, "advisory-plus."[203] In Dicks's bill, H.R. 2047, which was referred jointly to the House Armed Services and the Energy and Commerce Committees on April 9, 1987, one feature that represented "real teeth" was the authorization for the administrator to suspend operations or construction at new or existing defense nuclear facilities if he determined "that the health and safety of the public is not reasonably protected."[204] The bill also empowered the administrator to set safety standards on radioactive emissions, rather than merely to provide advice about standards, and required him to report to Congress every three months about DOE's compliance with the standards.[205]

Bolstering the Case for an Oversight Board with Strong Powers

In advancing such strong oversight provisions, the sponsors of bills such as H.R. 2047, H.R. 783, and H.R. 3123 bolstered their case by documenting DOE's failures to protect the environment and the health and safety of workers in, and residents near, DOE nuclear facilities. Proponents of strong oversight powers provided extensive testimony in hearings in various House and Senate committees throughout the 100th Congress, drawing upon a growing

[200] Although the NRC had responsibility for some government-owned facilities, specifically reactors belonging to the armed services, these facilities were used for purposes other than weapons production, e.g., for research and medicine.
[201] House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities*, 175.
[202] House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities*, 33, 56. See also Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 56.
[203] House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities,* 135, 310.
[204] House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities*, 90.

accumulation of damaging evidence about safety, much of it newly unclassified and made available to the public. Examples included recently released official records from DOE archives, personal records of former government officials, interviews with eyewitnesses, the series of GAO investigations, and studies by ad hoc panels, including the NAS review committee and the Roddis panel.[206] The testimony covered various types of safety, health, and environmental issues and deficiencies, such as plant conditions judged to pose catastrophic risks, elevated levels of cancers and other ailments among nuclear workers as shown by epidemiological studies, and disposal practices for nuclear and hazardous waste that had led to widespread contamination both onsite and beyond the boundaries of nuclear weapons production sites.[207]

Citing the Chernobyl accident, many witnesses focused on the possibility of a similar reactor disaster—an explosion or meltdown—and the structural problems and operating conditions that might contribute to it. Problems mentioned included the radioactivity-induced embrittlement of structures in the aging facilities that had led to cracking and radiation leaks. All of the reactors in the weapons complex, as many pointed out, were old—the last defense production reactor, the N-reactor, was completed in 1963—and only the reactors at the Savannah River site had containment vessels.[208] As one expert observed, "none of the military production reactors . . . had the pressurized steel and reinforced concrete containment building required by law for all civilian power reactors."[209] Some witnesses claimed that despite these defects of age and design, the reactors had long been run at potentially unsafe operating power levels and without strict adherence to nuclear material safety procedures or careful monitoring in the interest of production. For example, between 1979 and 1986, four reactors at Savannah River operated at power levels "substantially higher than what the emergency core cooling system

[205] House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities*, 92.
[206] On the increased information sources available by the late 1990s, see Gerber, v–viii.
[207] Evidence of serious safety, health, and environmental problems in the DOE nuclear complex continued to come to light in hearings throughout the 101st Congress, which was in session from January 1989 through October 1990, during the first two years of the administration of President George H. W. Bush. See, for example, a 1989 congressional summary of safety violations, mishaps, and near misses in the weapons complex, U.S. Congress, House of Representatives, Committee on Energy and Commerce, Subcommittee on Oversight and Investigations, *Health and Safety at the Department of Energy's Nuclear Weapons Facilities*, 101st Cong., 1st session, June 1989, Committee Print 101–H.
[208] Ben A. Franklin, "Key U.S. Reactor to Shut 6 Months for Safety Moves," *New York Times*, December 13, 1986, 1.
[209] Kevin O'Neill, "Building the Bomb," in Stephen I. Schwartz, ed., *Atomic Audit: The Costs and Consequences of U.S. Nuclear Weapons Since 1940* (Washington, DC: Brookings Institution Press, 1998), 73.

could handle in an accident."[210] As witnesses questioning DOE's ability to manage risk pointed out, DOE only began reducing the reactors' power levels in late 1986, responding belatedly to the combined pressures of a National Academy of Sciences reactor study recommendation and the scrutiny of the Senate Governmental Affairs Committee.[211] In explaining DOE's delayed action, witnesses concurred, "production has been the overriding measure of performance"[212]

Besides reactors, other facilities flagged for questionable structural integrity and the potential for catastrophic radioactive releases were nuclear waste storage tanks throughout the defense complex. One witness, Alvarez, an aide to Senator Glenn, was particularly concerned about the potential for severe explosions in high-level nuclear waste storage tanks at Hanford, where a large proportion of the complex's millions of gallons of high-level radioactive liquid waste were stored. He feared the buildup of hydrogen gas in the tanks in the event of a failure of the tank ventilation system.[213] Such gas was generated by chemical reactions in the tanks' inadequately analyzed contents.[214] Alvarez noted that the potential for the explosive dispersal of radioactive materials in tanks was by no means hypothetical, mentioning just such a massive storage tank accident in Russia in 1957. The Mayak explosion dispersed enormous quantities of liquid radioactive waste, and contaminated several hundred square miles—an area later characterized as equal to the size of New Jersey.[215] This nuclear accident at Mayak, which killed many and forced the evacuation of 11,000 people, may have released twice the curies of the Chernobyl reactor accident.[216]

In addition to pointing out the potential risk of an explosive dispersal of radioactivity, hearing witnesses presented a record of non-catastrophic but significant radioactive releases and leaks, and cited conditions that had or could lead to the release of radioactivity, such as plant fires and faulty ducts or piping. A "raging," "nearly catastrophic" fire in 1969 in the plutonium-

[210] S. Rep. No. 100–173, at 9 (1987).
[211] S. Rep. No. 100–173, at 11 (1987).
[212] S. Rep. No. 100–173, at 10 (1987).
[213] Interview, Mansfield.
[214] Interview, Mansfield. The potential for a buildup of gas to an explosive level in the waste tanks at Hanford had been known for nearly a decade. Glenn became concerned when he heard that things were out of control at Hanford, specifically that lightly acidic nitric acid (used to control reactions) created ferrocyanide and generated hydrogen that had the potential to create an explosion.
[215] Defense Nuclear Facilities Safety Board, *FY 2008 Budget Request to the Congress* (Washington, DC, February 5, 2007), 4, http://www.dnfsb.gov/budget/budget_fy2008.pdf.
[216]Defense Nuclear Facilities Safety Board, *Strategic Plan: FY 2003–2009* (Washington, DC, November 17, 2003), 3, http://www.dnfsb.gov/pub_docs/dnfsb/rcsp_2003.pdf.

manufacturing building at DOE's Rocky Flats facility, for example, caused major accidental releases, leading to increased exposures to workers and nearby populations.[217]

Direct epidemiological evidence of health risks posed by the complex was as yet available only in limited amounts during the 100th Congress, and some witnesses viewed what was available with skepticism. They noted that DOE, with its near-monopoly on radiation health impacts research, was usually the source of data, and had a conflict-of-interest between its dual mission of developing radiation technologies and assessing their health impacts. Nonetheless, some cited DOE-sponsored epidemiological studies and worker health studies in support of their call for strong external oversight. DOE studies showed elevated risks of dying from cancer and other diseases in 12 groups of DOE radiation workers, e.g., excess death rates from leukemia among Rocky Flats workers exposed to plutonium.[218] Non-DOE studies had similar results, e.g., findings of the Du Pont Company, the contractor that had operated the Savannah River Site since it opened in 1952. Du Pont findings showed excess cases of leukemia among Savannah River Site workers—findings of which a Centers for Disease Control and Prevention (CDC) panel learned in 1983 and made DOE aware.[219] Witnesses testified also to widespread flouting of radiation protection policies in DOE facilities and to recommendations against informing workers if they exceeded official radiation exposure limits.

In addition to the focus on direct human health risks, a major topic in the hearings was DOE's record on environmental protection. Advocates of strong oversight powers acknowledged that environmental damage and health and safety issues were not exactly the same thing from a regulatory standpoint. However, witnesses saw them as "intrinsically related," and considered DOE's environmental carelessness to be indicative of a broader attitude of heedlessness to the negative consequences of nuclear weapons production. A widespread practice in the weapons complex, dating back to World War II, had been to use air, soil, ground, and surface waters as disposal media for massive amounts of radioactive and toxic pollutants. Ohio's Attorney General Anthony J. Celebrezze, Jr., for example, testifying about DOE activities and disposal practices at a uranium-enrichment complex, stated,

> During a ten-year period beginning in 1974, DOE pursued a policy of disposing some of its radioactive and solvent-contaminated waste oil by spreading it on the

[217] Ackland, 3, 86, 143–63.
[218] House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities*, 184.
[219] S. Rep. No. 100–173, at 5 (1987).

> ground and then roto-tilling it into the soil. About 50,000 gallons were disposed in this fashion. [220]

Such practices at that site and elsewhere had left a legacy of severe contamination problems in rivers, streambeds, soils, and underground aquifers. One witness summarized the evidence of contamination by saying, "DOE's record of policing itself is very, very sorry."[221] Many pointed out that such contamination would endure for millennia, and that cleanup, insofar as it was possible, would cost in the hundreds of billions of dollars.[222]

Much of the environmental damage and flouting of nuclear safety principles that was highlighted in the hearings had occurred despite the existence and efforts over the years of numerous advisory boards and panels to assist DOE and its predecessors. Thus, many witnesses advocating strong oversight bolstered their case not only by highlighting the magnitude and pervasiveness of DOE's safety problems, but also by documenting DOE's lack of responsiveness to mechanisms of safety oversight that were "merely" advisory. They cited numerous instances in which the advice of such advisory boards had simply been ignored, for example, the urgent recommendation of the Advisory Committee on Reactor Safety in the late 1950s, which called containment domes at the N-reactor "essential" to contain fission products in case of a severe reactor accident. Another example of long-ignored advice was the 1966 Trumble report, which called for major safety reforms and was kept under wraps for 21 years, until after the Chernobyl accident. Witnesses marshaled such examples to demonstrate that "foot-dragging on safety" would continue to be a problem as long as safety oversight was "toothless."[223]

Debating Glenn's Bill and How a Safety Board's Statutory Mandate Should Read

In the course of 1987, a consensus emerged that some kind of safety board should be established—a board that was continuous or permanent, rather than "ad hoc in nature," as the NAS, Roddis, and other panels had been. By May 1987, even DOE had conceded "the need to institutionalize independent oversight of DOE nuclear facilities."[224] As Under Secretary of DOE Joseph F. Salgado said, "Secretary Herrington took an historical step for the Department of

[220] S. Rep. No. 100–173, at 4–5 (1987).
[221] House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities*, 58.
[222] Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 187.
[223] House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities*, 47.
[224] S. Rep. No. 100–173, at 11 (1987).

Energy. He endorsed the need for an independent advisory body to advise him."[225] The Senate Armed Services Committee, the committee of jurisdiction, was in agreement with DOE's endorsement when it took up debate about the particulars of a safety board in the fall of 1987. As Salgado said,

> The Governmental Affairs Committee, the GAO, and the NAS have all asserted that a safety board is needed to ensure that meeting production requirements does not overshadow the need for safe production. The Armed Services Committee agrees completely with that rationale.[226]

Of the legislative proposals put on the table in 1987, Glenn's version of oversight legislation—specifically Title I establishing a safety board—was the bill that continued to receive examination up to and through 1987 in both the House and Senate. The Senate Governmental Affairs Committee held four days of hearings on Glenn's entire bill between March and June 1987, reporting favorably on it in August and referring it on September 24, 1987, to the Senate Armed Services Committee, which had a five-member overlap with the Governmental Affairs Committee—Senators Glenn, Nunn, Carl Levin (D–Michigan), Jeff Bingaman (R–New Mexico), and William S. Cohen (R–Maine).[227] The Armed Services Committee assigned the safety board title of Glenn's bill to the Subcommittee on Strategic Forces and Nuclear Deterrence, the subcommittee of jurisdiction. Chaired by J. James Exon (D–Nebraska), the subcommittee held five days of hearings in October and November to debate the details of the safety board proposal and what an enabling statute for a safety board ideally should contain. At the conclusion of the hearings on S. 1085 in November 1987, the Armed Services Committee produced an amended version. Along with the Senate amendment, the committee authored the report of the Senate Armed Services on S. 1085, which proved to be the principal Senate committee report on the Board's enabling legislation.

The legislation under discussion in the numerous Senate hearings of 1987, S. 1085, Title I, Independent Nuclear Safety Board Oversight Over Department of Energy Facilities, would amend the Atomic Energy Act of 1954 to establish a Defense Nuclear Safety Board as an

[225] Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 180.
[226] S. Rep. No. 100–232 (to accompany S. 1085), at 9 (1987).
[227] The Senate Governmental Affairs Committee reported out S. 1085 on September 24, 1987 as Senate Report No. 100–173, *Nuclear Protections and Safety Act of 1987*.

independent entity in the executive branch. The Board would have six main functions, as stated by Glenn,

> First, it will ensure that DOE's current health and safety standards are being implemented. Second, it will recommend changes in the content and application of DOE's standards. These recommendations are advisory, not mandatory. Third, it will investigate those events at DOE facilities which the Board determines to be important because of their actual or potential adverse effect on the public's health or safety . . . . Fourth, the board will recommend specific measures designed to reduce the likelihood of such events occurring.
>
> These recommendations must be administratively responded to in specific ways. Fifth, the board will issue periodic unclassified reports with its recommendations, as well as the decision to implement corrective steps at DOE facilities. Finally, the board shall be consulted and make recommendations to ensure that the design, construction, and health and safety standards of all new DOE facilities are appropriate, and that these standards are commensurate with standards that are imposed on comparable private sector facilities.[228]

S. 1085's articulation of the functions of the Board emphasized the tasks of investigation, recommendation, communication with the public, and review of the adequacy of safety standards. In calling for such review, the bill reflected approval of DOE's stated commitment to the goal of "comparability," that is, the goal of holding DOE facilities to the same level of safety as commercial nuclear facilities. Glenn underscored in testimony that the Board would fulfill an advisory, non-regulatory role and that its recommendations would be "advisory" rather than "mandatory" or "binding."[229] The proposed bill did not accord the Board some of the more intrusive or coercive powers proposed in other congressional bills, such as the power to *set* standards and the power to shut down operations or construction in the weapons complex. Glenn explicitly denied that his legislative proposal gave the Board the power to shut down operations, even if it determined some practice or procedure to be potentially injurious.[230] However, Glenn's proposal featured elements that advocates of a strong safety body considered crucial, as GAO Assistant Comptroller General J. Dexter Peach, stated,

> We believe that any oversight approach, to be effective, should have five key elements: independence, technical expertise, ability to perform reviews of DOE

[228] Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities,* 69.
[229] Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 55, 61.
[230] The assurance that the Board could not stop production was crucial to the Senate Armed Services Committee and others with a national security mandate, as the Board's current general counsel, Richard. A. Azzaro, emphasized in an interview, Washington, DC, August 20, 2008.

> facilities as needed, clear authority to require DOE to address the organization's findings and recommendations, and a system to provide public access to the organization's findings and recommendations. The legislation you [Senator Glenn] have submitted creating a Nuclear Safety Board does address each of these elements.[231]

Of the "five key elements" that Peach listed, S. 1085 embodied three in a manner that did not elicit a great deal of debate in the fall 1987 Senate Armed Services Committee hearings from either proponents or critics of the bill as written. The three relatively uncontroversial elements were the requirements for technical expertise, public openness, and onsite review powers. Like the other legislation proposing a safety body, including the legislation ultimately adopted, S. 1085 called for an oversight board that consisted of technical experts. Its members were to be—in the wording of both Glenn's bill and the Board's ultimate enabling legislation—"respected experts in the field of nuclear safety." S.1085 also mandated that the oversight board make its findings and recommendations public, and endowed it with investigative powers and tools, including such tools as the power "to issue subpoenas commanding the testimony of witnesses and the production of evidence."[232]

More controversial than S. 1085's handling of three of the five elements mentioned by Peach was its handling of the remaining two, "independence" and the "authority to require DOE to address the organization's findings and recommendations." Some of the characteristics that could be construed as guaranteeing the Board's independence were unproblematic to hearing participants, for example, the idea that the members of the Board would be appointed by the president rather than by the secretary of energy. Although Secretary of Energy Herrington backed the idea of secretarial appointment, most hearing participants, including critics of S. 1085, accepted its proposed mode of appointment—by the president with Senate approval.[233] They also accepted the premise of S. 1085 that independence meant security of tenure for the Board members for fixed (staggered) terms of office. The members were not to be subject to removal at will by either the secretary of energy or the president.

A worrisome dimension of "independence" that DOE representatives and other critics saw in S. 1085, however, was the leeway that the Board members apparently would have to set

[231] S. Rep. No. 100–173, at 11 (1987).
[232] Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 39.
[233] House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities*, 53.

the safety agenda, i.e., unilaterally to define the safety issues that they would pursue and to define the standard or level of safety they could demand of DOE for a given activity or facility. Some witnesses envisioned that the Board would pursue safety improvements that might be heedless of the secretary of energy's need for production and unconstrained by considerations such as technical feasibility or cost. A related worry for some critics focused on the authority the Board would have, in Peach's words, to "require DOE to address" the Board's findings and recommendations. Some critics envisioned an undue degree of coercive power by which the Board could force the secretary of energy to act in accordance with the Board's will, regardless of his own judgment about the proper balance of safety and national security–driven production.

Such concerns about the Board's independence and authority were the main themes of the fall 1987 hearings in the Senate Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence. Advocates of Glenn's bill, including Glenn, confronted representatives of DOE and the Reagan administration defense establishment, who, while conceding the need for a safety board, were anxious to confine its powers within tighter bounds than S. 1085 seemed to mandate. At the same time, they recognized that DOE and the weapons complex faced an increasingly negative public mood, which only a safety body with a convincing measure of independence and authority was likely to assuage. Restoring public confidence that DOE could operate the weapons complex safely was a *sine qua non* for the ambitions that DOE and the defense establishment still harbored for the complex in late 1987. DOE aimed to restore its greatly diminished production capacity and to modernize it, in order to continue the production of nuclear materials and weapons. At that time, production was in a state of near-collapse. The N-reactor was shut down and the prospect for reopening it was dim, as was the prospect for restoring the production reactors at Savannah River to full power. The Savannah River reactors were the nation's sole source of tritium, an indispensable, but perishable initiator material in nuclear weapons.[234] Short of being able to replenish the stores of tritium, which has a half-life of only 12 years (in contrast to plutonium's half-life of 24,000 years), the nation, it was argued,

[234] House, Energy and Commerce Subcommittee on Energy and Power, *Safety of DOE Nuclear Facilities*, 53. See also Gerber, 4. The Savannah River Site was the nation's sole producer of tritium, the hydrogen isotope that increases the explosive yield of thermonuclear weapons. Decaying about 5 percent a year, it must be periodically replenished in nuclear weapons. The end of the Cold War and the arms control agreements to reduce nuclear arsenals eliminated any immediate need to produce new tritium. To support the nation's enduring stockpile, existing tritium was recovered and recycled, mostly from decommissioned weapons.

would be "unilaterally disarming."[235] Exon, as chair of the subcommittee hearings, summarized the aims and challenges of DOE and its supporters,

> The Department of Energy has a difficult mandate to fulfill in the nuclear area. It must maintain our Nation's ability to produce critical nuclear materials with the schedule set forth annually in the President's stockpile memorandum, yet it operates under the mounting constraint of aging facilities, limited budget and some political hostility to its primary mission.[236]

Those on the Armed Services Committee who argued on national security grounds for refurbishing and modernizing the nuclear weapons complex were cognizant that what Exon termed "political hostility" could jeopardize their aims, making it more difficult, among other things, to argue successfully for the congressionally approved budgetary increases that modernization projects would require.[237] "Political hostility" and public concern had by no means reached their highest point at the time of the hearings in late 1987. A year later, in the last three months of the Reagan presidency, in-depth national media coverage brought home to the public the full magnitude of the safety problems and environmental contamination associated with DOE's nuclear complex. DOE's problems were the topic of numerous stories in major newspapers and television news, including 85 articles in the *New York Times*, 39 on the front page.[238] In 1987 public and media concern about the DOE nuclear complex was growing as the salience of national security arguments for further nuclear arms production was receding. Nuclear arms reduction talks and nuclear arsenal downsizing, underway by the fall of 1987, rendered the need for further production of nuclear materials more questionable. Former Secretary of Energy Herrington was famously quoted as saying "We are awash in plutonium."[239]

In the transitional historical and policy context of 1987, in which modernization of the nuclear complex was still a plausible but not a certain prospect, modernization's advocates were thrown into a somewhat defensive position in addressing how the law should empower the safety

[235] Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 4.
[236] Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 54.
[237] Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities,* 82–83.
[238] George, 67. See also William Lanouette, *Tritium and the Times: How the Nuclear Weapons-Production Scandal Became a National Story*, Research Paper R–1 (Cambridge, MA: Joan Shorenstein Barone Center for the Press, Politics and Public Policy, John F. Kennedy School of Government, Harvard University, May 1990), 7–9.

board. They needed a board sufficiently empowered to improve the public's confidence in DOE's ability to manage the complex safely, but not so empowered as to be able to dictate to the secretary of energy or to veto actions he deemed necessary for the accomplishment of DOE's defense mission. In making their case, they argued that there was no need to go overboard in granting oversight powers, because DOE under Herrington had over several years already demonstrated significant improvement in its responsiveness to safety panels with "mere" advisory powers.[240] In addition, they countered with the argument that the past and present deficiencies in safety management were less dire than DOE's critics made them seem. Such criticism, they said, produced an exaggerated picture of such deficiencies by conflating the environmental and safety records of the DOE complex.

The advocates of the complex's refurbishment readily conceded that the environmental legacy of the complex was egregious and the physical conditions of the plants seriously run-down. Speaking of "the environmental waste problem that has been building up since the Manhattan Project," they said,

> There is no question that the defense nuclear complex's managers made serious mistakes, beginning years ago, in ignoring the long-term implications of disposal practices for radioactive and toxic waste. The magnitude of the problem, although not yet fully documented, is enormous.[241]

In conceding this, modernization advocates anticipated that they would need in the upcoming year to cite the poor condition of DOE facilities to argue for enormous budgetary increases for renovation and cleanup of the nuclear complex. However, they insisted that the admittedly deplorable environmental record of the obsolescent complex should be distinguished from the actual safety record. They cited performance measures, such as rates of incidents, accidents, injuries, lost work days, and radiation exposure regulatory violations to argue that DOE's safety record, as opposed to its environmental record, was not bad, or was even "excellent."[242] DOE had not put the public at excessive risk, and it could claim an improved record in occupational safety, as demonstrated by, for example, a reduction of radiation exposures to workers since

---

[239] Interview, Sherri Wasserman Goodman. See also Keith Schneider, "Nuclear Arms and New Jobs Clash in Idaho," *New York Times,* March 27, 1988, http://query.nytimes.com/gst/fullpage.html?res=940DEEDC1530F934A15750C0A96E948260&sec=&spon=&pagewanted=print.
[240] Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 179.
[241] S. Rep. No.100–232, at 9 (1987).
[242] S. Rep. No.100–232, at 8 (1987).

1974.[243] Thus, the safety board, whose mission was to induce reductions in radiological risk, not environmental cleanup, did not need the degree of coercive power that some critics of DOE wanted. The environmental issues of the complex were already well covered by strong regulatory mechanisms wielded by EPA and sanctioned by the RCRA and other environmental laws. As the report of the Senate Armed Services Committee on S. 1085 stated,

> Environmental matters in DOE—the management of waste operations and the cleanup of existing waste sites—are already heavily regulated by EPA and the states under the Superfund and RCRA legislation.[244]

Such environmental issues did not justify magnifying the powers of the Board beyond the advisory and non-regulatory.

The assurance that these advisory powers would not be "toothless" or a mere "jawboning" exercise lay, according to DOE representatives, in several of the requirements for which the Board's enabling statue would provide. One requirement was that the Board's interactions with DOE be transparent and open to the public. According to Undersecretary of DOE Salgado, public scrutiny was a sufficient constraining power to compel the secretary of energy to take the Board's advice seriously. The public airing of issues and of DOE–Board deliberations would remedy the old problem with advisory committees, namely, that DOE could ignore their recommendations with impunity. Moreover, in addition to the requirement for openness, DOE would be required to respond to the receipt of a Board recommendation in a specified period of time and through a specified series of actions as specified in the statute. The prescribed administrative procedures for a formal response by DOE to the Board, combined with the requirement of openness to the public, obviated the need for the Board to have statutory powers by which it could, for example, mandate that DOE follow its recommendations. The secretary of energy could remain the final decision-maker, retaining the ultimate responsibility to accept or decline advice.

In constantly reiterating that the Board's powers should be advisory only, the intent of DOE and Department of Defense spokesmen before the Armed Services Committee was to stand against the arbitrary and excessively stringent authority that S. 1085, in their reading, allowed the

[243] Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 169.
[244] S. Rep. No. 100–232, at 19 (1987).

Board. In November 1987, as the committee was drafting its amended version of S. 1085, Title I, it listed as particular areas of concern,

> Investigative priorities of the Board, the risk standards to be applied by the Board, and the mechanisms for consideration and disposition of the oversight Board's recommendations to the Secretary of Energy. Other areas of concern include the facilities under the Board's purview and the extension of the Board's responsibility to environmental matters.[245]

With respect to the problems of defining priorities and acceptable standards of risk, the critics of S. 1085 charged that the bill was vague in a way that left the Board free to be unduly strict in identifying the safety issues and risks that required attention. The fear was that the Board could focus on relatively minor safety deficiencies or remote dangers, rather than on matters that posed an imminent danger or "undue risk." Referring to how S. 1085 could be construed, the report of the Senate Armed Services Committee stated,

> The risk of an incident with minor adverse effects, such as an accidental release of small amounts of toxic or radioactive substances, potentially has the same standing as the risk of catastrophic adverse effects, such as an accident on the scale of the Chernobyl reactor disaster.[246]

The concern about the potential for such a broad interpretation of risk was aggravated by the uncertain state of the weapons complex in 1987. The weapons complex was in a deteriorated condition and had innumerable deficiencies upon which a safety oversight body could focus. DOE saw in this situation the potential for Board interference in a key task DOE would face as long as it still had the dual mission of ensuring production and safety. The task was to weigh the tradeoffs between backfits that would improve the safety of old production facilities and building new facilities. DOE needed continually to determine if it was "better to husband limited resources to replace existing facilities rather than continue to make marginal improvements to obsolete plants."[247] The Armed Services Committee did not want a safety body that would effectively preempt the secretary of energy's decision-making responsibility and force a choice of safety upgrades of old plants or their shutdown. Even if the Board itself, made up of serious technical experts, could be counted on to avoid focusing on minor safety issues, the critics of S. 1085 suggested that the bill's vague language could create "a potential field day for outside intervenors," inviting lawsuits from citizen groups that were hostile to the mission of the

[245] S. Rep. No. 100–232, at 3 (1987).
[246] S. Rep. No. 100–232, at 12 (1987).
[247] S. Rep. No. 100–232, at 18 (1987).

weapons complex.[248] Such outside parties, welcoming the continuing closure of DOE's nuclear facilities, "might seek to compel the Board to exercise its full legal mandate and powers."[249] As the committee's report stated,

> Even if the Board does not choose to interpret its mission in these terms . . . third parties might seek to enforce their interpretation of the Board's mandate and duty through litigation.[250]

The committee report stressed the committee's desire for statutory language that would leave no doubt as to the Board's obligation to focus on major safety deficiencies and imminent dangers. It stated,

> It is important that the Board be supplied with a sense of priority, and be focused on significant risks and consequences to public health . . . . The Committee categorically rejects any concept of "zero risk' or minimizing all risk of harm.[251]

As a model for defining acceptable standards of risk, the critics of S. 1085 pointed to the NRC's application to commercial facilities of the concept of "adequate protection of public health and safety," a concept equivalent to DOE's "avoidance of undue risk." As set forth in the Atomic Energy Act and Nuclear Regulatory Commission regulations, the broad adequate protection standard fell short of requiring absolute protection. The committee report stated,

> As applied to commercial facilities, the standard of adequate protection means "reasonable assurance that the health and safety of the public will not be endangered by the operation of the facility." (10 C.F.R. 50.35(c)). Absolute certainty or perfect safety is not required.[252]

The committee endorsed the "adequate protection" standard as the standard to be written into the Board's enabling statute, while acknowledging that the translation of the broad standard into concrete requirements would differ for defense and commercially licensed nuclear facilities to the extent that the facilities themselves differed. The committee stated,

> It is appropriate to require the same general level of safety from DOE nuclear facilities as is required of commercial facilities. The Committee recognizes that specific quantitative and qualitative standards for achieving adequate protection may not necessarily be the same as those applied to commercial facilities, to the extent DOE and commercial facilities are significantly different.[253]

---

[248] Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 318.
[249] S. Rep. No. 100–232, at 18 (1987).
[250] S. Rep. No. 100–232, at 13 (1987).
[251] S. Rep. No. 100–232, at 20 (1987).
[252] S. Rep. No. 100–232, at 24 (1987).
[253] S. Rep. No. 100–232, at 23 (1987).

In endorsing this adequate protection standard, the committee aimed to ensure that the Board's pursuit of safety or risk reduction could be tempered by considerations of cost and technical feasibility. S. 1085 could be interpreted to disallow such considerations in the Board's formulation of its advice about safety. For the committee, once the "adequate protection" standard was satisfied, such considerations could and should come into play. If higher than "adequate" levels of protection were sought, they needed to be justified by a technical or economic feasibility test. Concerned about an insufficient differentiation between serious and minor or remote safety issues, the committee called, for "cost-benefit analyses that might filter out recommendations that are expensive but confer little benefit in terms of reduced risk to the public."[254] Supporting this view of the adequate protection standard, the final Board enabling legislation of 1988 read, "In making its recommendations, the Board shall consider technical and economic feasibility of implementing the recommended measures."

In addition to the concerns about S. 1085's treatment of risk standards and priorities, another major concern of the bill's critics on the Armed Services Committee was its methods for the handling of Board recommendations—the Board's primary regulatory tool—upon their receipt by the secretary of energy. For the critics, the proposed legislation rendered a class of Board recommendations—those dealing with the prevention of "events"—effectively mandatory or binding on the secretary, rather than advisory. In the critics' reading, the secretary could not reject such recommendations without making a case to the president and receiving presidential concurrence in their rejection. This provision for presidential review of secretarial dissents threatened to "permit minor safety issues to be elevated to the President."[255]

As the committee report summarized their view of S.1085's shortcomings taken together,

> The Board is permitted to recommend any measure that the Secretary is unable to prove is not infeasible, regardless of cost, so long as it reduces the chances of even remote events, which could have only negligible adverse consequences for the public health and safety from occurring.[256]

[254] S. Rep. No. 100–232, at 16 (1987).
[255] S. Rep. No. 100–232, at 18 (1987).
[256] S. Rep. No.100–232, at 13 (1987). In a similar vein, Senator John W. Warner (R–VA), during confirmation hearings for the inaugural Board members in late 1989, caricatured as heavy-handed regulation what had been averted with the modification of Glenn's original proposal. Warner said,

> The Defense Nuclear Facilities Safety Board was born in some controversy in 1987. The original proposal would have given the Board the responsibility to apply the absolute highest achievable standards of safety, no matter how small the incremental improvement nor how high the cost to all defense nuclear facilities, including those whose safety was already regulated.

Senator Glenn took exception to this reading of S. 1085. In testimony about its provision for presidential adjudication in case of an unsatisfactory secretarial response, he denied that the provision's intent was to involve the president in minor matters, bypassing the secretary. Rather, he proposed presidential review—"bucking [a disputed matter] up to the President"—as a safeguard against a situation, expected to be rare, in which the secretary and the Board disagreed about a safety matter that the Board deemed important or urgent.[257] The provision for presidential review would give the Board legal recourse, supplementing the other provisions in the Board's enabling legislation that were designed to ensure the secretary take Board advice seriously. Glenn was unwilling to put as much weight as did DOE representatives on the efficacy of the public airing of issues, on the grounds that much of what DOE and the Board needed to discuss remained classified and thus out of the public eye. He held out for presidential review in order to guarantee that a rejection of a Board recommendation by the secretary would not simply end the matter. He saw such review as a means to give the Board "authority to require action on its recommendations or findings."[258] Others saw his provisions for presidential review as needlessly constraining, likely to foster an adversarial spirit in Board–DOE interactions, and possibly counterproductive to the kind of cooperative interaction needed to address highly technical problems in the nuclear weapons complex.

In the end, the Board's enabling legislation softened Glenn's original proposal for presidential review, explicitly limiting the requirement for presidential involvement to circumstances in which a Board recommendation pertained to an "imminent or severe" situation or matter. The committee report spelled out an example of a situation in which the "imminent or severe" provisions of the Board's enabling legislation might be invoked, the case of the Savannah River reactors, which had been discovered to be operating at excessive power levels. In such an urgent case, the Board was charged with notifying the secretary and the president. The president could also become involved if implementing a Board recommendation would be precluded by budgetary constraints or by the necessity "to meet the annual nuclear weapons stockpile requirements."[259] In cases in which implementation was "impracticable" for these reasons, the president could be given a report and the "opportunity to review the determination of

[257] Senate, Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence, *Safety Oversight for Department of Energy Nuclear Facilities*, 315.
[258] S. Rep. No. 100–232, at 21 (1987).

the Secretary of Energy, as appropriate, to ensure that budgetary constraints and materials requirements are properly balanced with safety concerns."[260] In ordinary circumstances, a secretarial rejection of a Board recommendation would not trigger presidential involvement. As articulated in the Board's enabling statute, which echoed the Senate amendment, a Board recommendation would normally be routed to the secretary and then to committees of Congress, specifically, the Senate Committees on Armed Services and Appropriations, and the Speaker of the House of Representatives. If the secretary were to reject a Board recommendation, it would go back to the Board for reaffirmation or revision, and then to Congress.

Beyond the concerns of S. 1085's critics about its proposed mechanisms for the disposition of recommendations and its handling of risk standards, a further concern was the scope of Board jurisdiction that S. 1085 seemed to sanction, in particular, the extension of the Board's jurisdiction to environmental remediation or cleanup. As the committee report noted, "Title I of S. 1085 could be construed as opening the door to the proposed safety board to inject itself in the waste regulator process."[261] The committee argued for confining the Board's mission to the oversight of public health and safety *per se*, while recognizing that the line between safety and health issues and environmental issues was fuzzy and, possibly, liable to ongoing adjustment. The committee report stated,

> The Committee believes that it is both unnecessary and inappropriate to extend a safety board's mandate to include environmental restoration matters. This belief stems not from a view that the Department's environmental problems are unimportant or insignificant in scope; nor does the Committee deny that the distinction between safety issues and environmental issues can in some instances be blurred. The Committee emphasizes, however, that a distinction exists, and that other legislative remedies and oversight of environmental problems are already in existence . . .
>
> Given the existence of a comprehensive regulatory regime, it is not necessary to assign an environmental oversight role to a safety board. For one thing, the technical issues are quite different, requiring different—and additional—expertise within the Board. Second, it would needlessly dilute the focus and mission of the Board. Third, insofar as the Board's basic mission is to ensure that, in satisfying production requirements, the commitment to safety is not compromised, it is hard to discern a rationale for including environmental restoration in the Board's

[259] S. Rep. No. 100–232, at 26 (1987).
[260] H.R. Rep. No. 100–989, at 491 (1988) (Conf. Rep.).
[261] S. Rep. No. 100–232, at 9 (1987).

> charter or for citing environmental problems in the justification for creating the Board in the first place.[262]

The Board's 1988 enabling statute did not expressly include "environment" with the term "public health and safety" in the Board's statutory grant of jurisdiction. The committee allowed, however, that the Board could consider environmental issues related to "on-going production operations" when the Board saw connections with public health and safety issues. Elaborating on this point, the committee report identified "unintended releases" of radioactivity as an appropriate issue for Board oversight, while most environmental restoration and cleanup would be conducted under the jurisdiction of other segments of the government and pursuant to other laws. The report stated,

> The distinction between safety and environmental issues, in the Committee's view, should be that safety includes unintended releases from on-going production operations, which is a concept that would exclude normal waste management operations and remedial actions associated with existing waste storage sites. The Committee stresses that a safety board should not be prohibited outright from crossing that potentially elusive line; the Committee seeks only to clarify its intention that safety of production operations must be the Board's primary concern.[263]

By the time that the Board's enabling legislation was finalized, it further clarified how far the Board jurisdiction reached on issues of storage and waste cleanup of nuclear waste. The Board's jurisdiction was explicitly said to encompass certain DOE "nuclear waste storage facilities," such as high-level nuclear waste tanks at Hanford and Savannah River, but not NRC-licensed facilities, such as the Yucca Mountain repository. The waste tanks were and remained a major focus of concern about "unintended releases," which qualified as a Board issue because of the inextricability of danger to public health and safety and to the environment.

THE BOARD'S ENABLING STATUTE AND LAUNCH

The Senate amendment of S. 1085 addressed to the satisfaction of the bill's critics the main issues that they found problematic in Senator Glenn's original formulation. The amendment was completed with the expectation that substantially similar legislation would be enacted, and the Board set up, in early 1988. However, the amendment languished for some

[262] S. Rep. No. 100–232, at 19–20 (1987).

months, until it was reincarnated without major change as provisions of H.R. 4481. H.R. 4481's provisions establishing the Board, in turn, were incorporated, after discussion and minor changes in conference, into the Department of Defense authorization bill for fiscal year 1989.[264] Public Law No. 100-456, National Defense Authorization Act, Fiscal Year 1989, received final congressional approval from the House and Senate on September 28, 1988, and President Reagan signed into law the authorization act on the next day.[265] Pub. L. No. 100-456, Section 1441, amended the Atomic Energy Act of 1954 by adding a new chapter: "Chapter 21. Defense Nuclear Facilities Safety Board," which created the Board. Capping almost two years of movement through Congress, "the new provisions inserted into the Atomic Energy Act represented the most extensive modification of that statute since the Energy Reorganization Act of 1974."[266]

The enabling statute of the Board that emerged from Congress in late 1988 embodied modifications that S. 1085's critics saw as more conducive than S. 1085 to the development of a consultative, non-adversarial relationship between the Board and DOE.[267] The idea that the Board's primary mission was to *assist* DOE appeared repeatedly throughout the Senate report on S. 1085, the report that elaborated most fully on the intent of Congress in creating the Board. The report spoke of "establishing this institutional mechanism to assist DOE on safety matters."[268] This shift of emphasis in the thrust of the statute to *assisting* DOE reflected a key preference of the Armed Services Committee and its chair, Senator Sam Nunn.[269] Once the shift of emphasis was achieved, much of the remainder of the statute was not far out of line with what Glenn had originally proposed. The Board's enabling statute followed in broad outlines, for example, S. 1085's definition of the Board's makeup and functions. The enabling statute retained S. 1085's specification of technical expertise as a requirement for appointment to the Board. It stipulated a Board made up of five civilians appointed to staggered renewable five-year terms by the president from among U.S. citizens who were "respected experts in the field of nuclear safety

[263] S. Rep. No. 100–232, at 9, 19–20 (1987).
[264] H.R. Rep. No. 100–989 (1988) (Conf. Rep.).
[265] For the full text of this law, see *National Defense Authorization Act, Fiscal Year 1989*, Pub. L. No. 100–456, Title XIV, Part D, 102 Stat 1918, September 29, 1988.
[266] Defense Nuclear Facilities Safety Board, *Report to Congress on the Role of the Defense Nuclear Facilities Safety Board Regarding Regulation of DOE's Defense Nuclear Facilities* (Washington, DC, November 1998), 2, http://www.dnfsb.gov/pub_docs/dnfsb/rc_199811.pdf.
[267] Interview, Mansfield.
[268] S. Rep. No.100–232, at 10 (1987).
[269] George, 115.

with a demonstrated competence and knowledge relevant to the independent investigative and oversight functions of the Board."[270] The statute preserved the elements of independence for the Board, empowering it to set its own agenda, rather than to have its topics of inquiry assigned by the secretary of energy. In defining primary Board functions, the statute identified five, ordering them slightly differently from S. 1085's six. The Board's specific duties and responsibilities were delineated in Chapter 21, Section 312, of the Atomic Energy Act of 1954, "Functions of the Board," which stated, "The Board shall perform the following functions":

> **(1) Review and evaluation of standards.—**The Board shall review and evaluate the content and implementation of the standards relating to the design, construction, operation, and decommissioning of defense nuclear facilities of the Department of Energy (including all applicable Department of Energy orders, regulations, and requirements) at each Department of Energy defense nuclear facility. The Board shall recommend to the Secretary of Energy those specific measures that should be adopted to ensure that public health and safety are adequately protected. The Board shall include in its recommendations necessary changes in the content and implementation of such standards, as well as matters on which additional data or additional research is needed.
>
> **(2) Investigations.**
>
> **(A)** The Board shall investigate any event or practice at a Department of Energy defense nuclear facility which the Board determines has adversely affected, or may adversely affect, public health and safety.
>
> **(B)** The purpose of any Board investigation under subparagraph (A) shall be—
>
> **(i)** to determine whether the Secretary of Energy is adequately implementing the standards described in paragraph (1) of the Department of Energy (including all applicable Department of Energy orders, regulations, and requirements) at the facility;
>
> **(ii)** to ascertain information concerning the circumstances of such event or practice and its implications for such standards;
>
> **(iii)** to determine whether such event or practice is related to other events or practices at other Department of Energy defense nuclear facilities; and
>
> **(iv)** to provide to the Secretary of Energy such recommendations for changes in such standards or the implementation of such standards (including Department of Energy orders, regulations, and requirements) and such recommendations relating to data or research needs as may be prudent or necessary.
>
> **(3) Analysis of design and operational data.—**The Board shall have access to and may systematically analyze design and operational data, including safety analysis reports, from any Department of Energy defense nuclear facility.

[270] Pub. L. No. 100–456, Section 1441(a), 102 Stat 1918, 2076; this new language became chapter 21, Section 311(b) of the Atomic Energy Act of 1954 (42 USC 2011 et seq.).

> **(4) Review of facility design and construction.—**The Board shall review the design of a new Department of Energy defense nuclear facility before construction of such facility begins and shall recommend to the Secretary, within a reasonable time, such modifications of the design as the Board considers necessary to ensure adequate protection of public health and safety. During the construction of any such facility, the Board shall periodically review and monitor the construction and shall submit to the Secretary, within a reasonable time, such recommendations relating to the construction of that facility as the Board considers necessary to ensure adequate protection of public health and safety. An action of the Board, or a failure to act, under this paragraph may not delay or prevent the Secretary of Energy from carrying out the construction of such a facility.
>
> **(5) Recommendations.—**The Board shall make such recommendations to the Secretary of Energy with respect to Department of Energy defense nuclear facilities, including operations of such facilities, standards, and research needs, as the Board determines are necessary to ensure adequate protection of public health and safety. In making its recommendations, the Board shall consider the technical and economic feasibility of implementing the recommended measures.[271]

The statute provided a plethora of means to facilitate the Board's performance of its oversight functions. The Board was authorized to hire up to 100 staff and to contract for additional expertise. To pursue investigations and gather facts, the Board was given broad latitude to conduct inspections and special studies, to hold hearings, and to subpoena evidence and witnesses. It was empowered to establish reporting requirements for DOE. The statute enjoined DOE, along with its contractors, to "fully cooperate with the Board and provide the Board with ready access to such facilities, personnel, and information as the Board considers necessary to carry out its responsibilities."[272] The Board could also secure assistance from other government agencies, from the scientific community and industry, and from public interest groups. At the same time that the Board was given unhindered access to the information it needed to assist DOE, the Board was obliged to establish systems to provide public access to its findings and recommendations, as well as many of its deliberations. The statute emphasized the Board's accountability to Congress, and made provision for the Board to report to it at least annually. In case the statute's provisions proved to be framed too cautiously, and gave the Board insufficient authority, the statute provided for a future review and the possibility of its own

[271] Pub. L. No. 100–456, Section 1441(a), 102 Stat 1918, 2077–78; this new language became chapter 21, Section 312 of the Atomic Energy Act of 1954. See also Defense Nuclear Facilities Safety Board, [First] *Annual Report to Congress* (Washington, DC, February 1991), 3, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/ar_1991.html.

revision.[273] The legislation said that the very question of the Board's value would be revisited in five years, at which time the Board was required to provide an assessment of whether its authority was sufficient, whether stronger regulatory powers, such as enforcement powers, were necessary, and whether the Board had enhanced the safety of operations in the nuclear weapons complex.

Challenges Grow in the Year Preceding the Board's Start-up

With the enactment of the Board's' enabling statute, the stage was set for the first steps in the Board's launch—the selection, nomination, and confirmation of its inaugural members. These activities occupied nearly a year, with the nominations by the new president, George H.W. Bush, in August 1989, Senate hearings and confirmation in October, and the start of operations on October 18, 1989. In the meantime, during the year that transpired for these activities, uncertainties and turmoil related to the nuclear weapons complex escalated on a number of fronts—in Congress, in the media, and at DOE—magnifying the challenges the inaugural Board members would face in their initial operating environment.

In Congress, hearings and investigations by various oversight committees continued in the final several months of the Reagan administration and throughout the 101st Congress.[274] Among the results of these congressional activities was an early proposal to amend the enabling statute of the Board to give it enforcement powers and broaden its jurisdiction. Drafted by Representative David E. Skaggs (D–Colorado) in 1989 and favored by other early House supporters of strong Board authority, such as Representative Ron Wyden, the amendment was debated in a House Armed Services subcommittee.[275] At the confirmation hearings for the Board members, Glenn, who referred to the Board's enabling statute as "a scaled-down version of my

---

[272] Pub. L. No. 100–456, Section 1441(a), 102 Stat 1918, 2080; this new language became chapter 21, Section 314 of the Atomic Energy Act of 1954.

[273] Interview, Mansfield. This provision to revisit the legislation after five years served to assuage Glenn and others, still uneasy about the whether the Board's statutory powers were sufficiently strong.

[274] Schwartz, "Congressional Oversight of the Bomb,"501. The House Armed Services Committee was especially active in investigating safety issues in the DOE weapons complex, with various panels and subcommittees holding 15 hearings in 1989, and an additional large number between 1990 and 1992. Thereafter, congressional interest in the issues slackened greatly.

[275] U.S. Congress, House of Representatives, Committee on Armed Services, Subcommittee on Procurement and Military Nuclear Systems and Department of Energy Defense Nuclear Facilities Panel, *Hearings on National Defense Authorization Act For Fiscal Year 1990—H.R. 2461 and Oversight of Previously Authorized Programs:*

proposal," mentioned his own intention "to continue my legislative efforts to strengthen and expand the role of the safety Board."[276] Besides contemplating amendments, Congress also documented in ever-greater detail the safety and environmental hazards to which DOE's nuclear facilities had exposed the country. For example, the Senate Governmental Affairs Committee produced an historical report, *Early Health Problems of the U.S. Nuclear Weapons Industry and Their Implications For Today*, showing that senior officials responsible for the DOE nuclear complex had been aware of serious public health problems arising from worker exposure to high radioactivity levels. According to the authors of this report, between 1947 and 1954, the AEC knew of such problems at several facilities, most notably, Hanford. The report also claimed that a CDC panel had learned of Du Pont Company findings on excess cancers among workers—excess leukemia rates at the Savannah River Site, increased risk of cancer death due to radiation exposures at the Oak Ridge National Laboratory, and cancer deaths at Rocky Flats that rose with increasing plutonium exposures. The findings included the observation that DOE's long-standing concern over legal liability had significantly inhibited its safety and health research.[277]

The continuing focus of Congress on hazards in the DOE nuclear complex contributed, in turn, to unprecedented media attention, fueling the media alarm that reached the level of a "crusade," as one observer put it, in late 1988 and in the first year of the Bush administration.[278] The trigger for the crusade was a joint House-Senate hearing held a day after the Board's enabling legislation became law.[279] Co-chaired by Senator Glenn and Representative Mike Synar (D–Oklahoma), the hearing released a 1985 Du Pont memo that "offered the first public details

---

Department of Energy Modernization Study and Department of Energy Defense Programs, 101st Cong., 1st sess., February 21, 24, March 13, 20, 21, April 3, 6, 13, 26, May 9, 16, 23, 24, June 6, July 18, 1989, 1955–63.

[276] For the confirmation hearings on Board members, see U.S. Congress, Senate, Committee on Armed Services, *Nominations Before the Senate Armed Services Committee, First Session*, *101st Congress,* March 14, 16, April 5, 18–19, May 3, 4, 16, 18, June 22, July 31, August 3, September 7, 8, 20, October 6, 17, November 7, 9, 20, 1989, 722.

[277] U.S. Congress, Senate, Committee on Governmental Affairs, *Early Health Problems of the U.S. Nuclear Weapons Industry and Their Implications for Today,* 101st Cong., 1st sess. (Comm. Print, 1989).

[278] On heightened media coverage, see Terrence R. Fehner and Jack M. Holl. *Department of Energy, 1977–1994: A Summary History* (Washington, DC: U.S. Department of Energy, November 1994), 50, http://www.osti.gov/bridge/servlets/purl/10106088-mgIkuD/webviewable/10106088.PDF.

[279] See U.S. Congress, House of Representatives, Committee on Government Operations, Subcommittee on Environment, Energy, and Natural Resources, and Senate Committee on Governmental Affairs, *Nuclear Reactor Safety at the Department of Energy's Savannah River Plant,* 100th Cong., 2d sess., September 30, 1988, 1–51, 193–222.

of 30 serious accidents" at the Savannah River Site's nuclear reactors.[280] The environmentalist Alvarez, Glenn's "media-savvy aide," was given the memo in mid-September while preparing a DOE witness for the hearing.[281] After the *New York Times* broke the Du Pont memo story on the front-page in October, the weapons complex and its problems became a major national story, with sustained coverage in major newspapers, and "a drumbeat of coverage" in national news magazines and the network's evening news programs.[282] The predominant angles of the coverage in this media barrage included not only the safety and environmental legacy of the arms race, but also the potential for that legacy to threaten national security by prompting a permanent tritium cutoff that could make maintaining the nuclear weapons stockpile impossible.

Three months into the period of maximum media attention to the nuclear weapons complex, DOE received new nuclear safety–focused leadership with the appointment in January 1989 of Admiral James D. Watkins, U.S. Navy [Retired], as secretary of energy. Watkins, a leader of the nuclear submarine program, brought to the post the Nuclear Navy's stringent and widely respected approach to the safety of operations.[283] He repeatedly declared safety the top priority of DOE's nuclear program and charged that DOE's old "way of doing business" amounted to "trust the contractors." As he characterized the "old way," it was:

> Trust the contractors to carry out all nuclear operations on their own and avoid both direct D.O.E. line management responsibility and accountability and D.O.E. independent internal oversight for safety violations and accidents.[284]

To remedy this "old way," he undertook a major restructuring of DOE's approach to safety management. He established site resident Environment, Safety, and Health (ES&H) inspectors at key DOE facilities, and formed "Tiger Teams" to inspect nuclear facilities. He reorganized DOE, creating in September 1989 a new internal oversight unit, the Office of Nuclear Safety, which was independent of the Office of Environment, Safety, and Health and reported directly to the secretarial level.[285] As Watkins described the office of nuclear safety, it had "independent status,

[280] Lanouette, *Tritium and the Times*, 6.
[281] Lanouette, *Tritium and the Times*, 15.
[282] Lanouette, *Tritium and the Times*, 16.
[283] Ackland, 213–14.
[284] Matthew L. Wald, "Energy Dept. Shift in Safety Faulted," *New York Times*, May 2, 1993, http://query.nytimes.com/gst/fullpage.html?res=9F0CE0DE1E38F931A35756C0A965958260&sec=&spon=&pagewanted=all.
[285] Fehner and Holl, 53–56.

reporting directly and freely to me, to insure that nuclear safety matters could be brought to me and other senior managers in a timely and unfiltered manner."[286]

Under Watkins, DOE also demonstrated commitment to environmental cleanup by establishing the Office of Environmental Management (EM), commonly referred to as the Environmental Management program.[287] The office consolidated responsibility for environmental management activities, including nuclear- and non-nuclear-related cleanup and environmental restoration, waste management, technology development, and facility transition.[288] The creation of the EM office signaled a continuing change in DOE priorities, with greater emphasis on cleanup, as expectations of a sharp reduction in stockpile requirements increased. Watkins underscored the new priority of cleanup when addressing DOE's budgetary needs. He provided startling cost estimates of between $100 billion and $200 billion over several decades for radioactive contamination cleanup, repair, and construction.[289] At the same time, although national policy remained undecided about further nuclear materials production and about plant refurbishment versus new construction, Watkins indicated that safety would not take a backseat to production, when he supported further shutdowns in the chain of weapons production. For example, after a restart temperature spike in August 1989 at the Savannah River Plant's tritium-producing P-reactor, he announced the postponement of any restart until at least September 1990, despite defense establishment concerns about a possible tritium shortage.[290]

Formation of the Board

The greater emphasis on safety of the DOE nuclear complex under Watkins, the continuing media and congressional agitation about its safety deficiencies, and ongoing questions about production and construction needs in view of likely imminent stockpile reductions all shaped the context in which the Board's inaugural members were questioned in their confirmation hearing, sworn in, and undertook their first activities. As the Board's enabling

[286] Wald, "Energy Dept. Shift in Safety Faulted," 1993.
[287] U.S. Congress, Congressional Budget Office, *Cleaning Up the Department of Energy's Nuclear Weapons Complex (*Washington, DC, May 1994), http://www.cbo.gov/ftpdocs/49xx/doc4914/doc26.pdf. See also Gosling and Fehner, 5.
[288] Fehner and Holl, 53–56.
[289] Arjun Makhijani, Stephen I. Schwartz, and William J. Weida, "Nuclear Waste Management and Environmental Remediation," in Stephen I. Schwartz, ed., *Atomic Audit: The Costs and Consequences of U.S. Nuclear Weapons Since 1940* (Washington, DC: Brookings Institution Press, 1998), esp., 384–86. See also Wald, "Energy Dept. Shift in Safety Faulted," 1993.

statute required, all of the five initial Board members were "respected experts in the field of nuclear safety," appointed "from civilian life." They had decades of scientific, technical, and legal experience in the fields of nuclear operations and safety. Together they brought, in the words of Senator Exon, chair at their October 17, 1989, confirmation hearing, "the talent and experience of the Nuclear Regulatory Commission, the Atomic Energy Commission, the former Joint Committee on Atomic Energy, the International Atomic Energy Agency, and our National Laboratories."[291] As a group, they met the statutory requirement that not more than three "be of the same party." Only two stated a party preference, John T. Conway, Democrat, and Andrew J. (A.J.) Eggenberger, Republican.

Conway, named as chairman by the president, in accordance with the Board's authorizing statute, was an engineer and an attorney.[292] He worked from 1956 to 1968 on the staff of the Joint Committee on Atomic Energy, six years as assistant staff director and six years as executive director, and later served as executive vice president with Consolidated Edison Company of New York. He was also involved during the 97th Congress in legislative efforts to establish a permanent repository for nuclear waste. Eggenberger, designated as vice chairman by the president, was a Ph.D. engineer with expertise in nuclear safety and earthquake engineering. He had worked as a private-sector consultant, with clients including the International Atomic Energy Agency. He had served as a seismic specialist and program director at the National Science Foundation. John W. Crawford Jr., a retired navy captain, had served as deputy manager of the Naval Reactors Program under Admiral Rickover and as DOE's principal deputy assistant secretary of energy for nuclear energy. He had expertise in the engineering and construction of nuclear reactors acquired during four decades of government service.[293] In the aftermath of the Three Mile Island accident, he chaired the DOE committee charged with assessing DOE reactor safety, producing a comprehensive safety survey known as the Crawford Report.[294] Herbert J.C. Kouts, a Ph.D. physicist and internationally known nuclear safety expert, had been a director of

---

[290] Gerber, 5.
[291] Senate, Committee on Armed Services, *Nominations*, 723.
[292] Biographical sketches indebted to official biographies published by the Board and DOE; Senate, Committee on Armed Services, *Nominations*, 717–89; and George, 114.
[293] Defense Nuclear Facilities Safety Board, *Eighth Annual Report to Congress* (Washington, DC, February 1998), 1/11, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php.
[294] Senate, Committee on Armed Services, *Nominations,* 725. For the report, see U.S. Department of Energy, *A Report on a Safety Assessment of Department of Energy Nuclear Reactor: Report of the Crawford Committee,* DOE/US–0005 (Washington, DC, March 1981).

the Brookhaven National Laboratory, and had served as chair of the International Safety Advisory Group at the International Atomic Energy Agency. Edson G. Case had served under Admiral Rickover in the Naval Nuclear Propulsion Program, followed by 30 years at the AEC and NRC, where he became director of the Office of Nuclear Reactor Regulation.[295] As Conway recently summarized the nature of the inaugural Board members' backgrounds, all had been involved in either the AEC or the Rickover program.[296]

After receiving Senate confirmation without difficulty, the new Board members were sworn in at the White House on October 25, 1990, officially by the chief clerk in the basement, and unofficially by John Sununu, White House Chief of Staff and a supporter of the Board, along with his assistant, Andrew Card.[297] Senators John Glenn, Strom Thurmond, and J. James Exon were among those present to witness the oath-taking. Conway later wryly observed to Glenn that the swearing in was undoubtedly memorable to him not only because he had been instrumental in creating the Board, but also because Glenn had been mugged that day.[298]

[295] Case died on September 16, 1991. See Defense Nuclear Facilities Safety Board, [Second] *Annual Report to Congress* (Washington, DC, February 1992), n.p., http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php. His successor, nominated in May 1992, was Joseph J. DiNunno. DiNunno had worked 17 years for the Navy Department, including under Rickover in the Naval Reactors program. He then spent 13 years with the AEC, eventually heading the agency's first Office of Environmental Affairs. Finally, he worked for two decades in private industry in a variety of nuclear safety and environmental roles. See U.S Department of Energy, Office of Health, Safety, and Security, "Biography: Mr. Joseph John DiNunno," http://www.hss.doe.gov/deprep/dnfsb/members/jjdinn.htm.

[296] Interview, John T. Conway, Board chairman (October 1989–April 2005), Arlington, VA, March 26, 2008. See also U.S. Congress, Office of Technology Assessment. *Dismantling the Bomb and Managing the Nuclear Materials*, OTA–O–572 (Washington, DC, September 1993), 42, http://govinfo.library.unt.edu/ota/Ota_1/DATA/1993/9320.PDF.

[297] Interview, A.J. Eggenberger, Board chairman (since 2005; vice chairman, 1989–2005), Washington, DC, July 9, 2008.

[298] Interview, Conway. See also U.S. Congress, Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1997 and the Future Years Defense Program*, 104th Cong., 2d sess., March 6, 13, 20, 25, 29, 1996, 71.

CHAPTER 3: THE BOARD'S OPERATIONS IN THE EARLY YEARS

When the inaugural Board members were confirmed and the Board officially began operations in late October 1989, more than one year had passed since the Board's enabling statute had become law. The Board was under intense scrutiny by those who believed that the creation of the Board was insufficient to achieve their goal of independent oversight of DOE defense nuclear operations and facilities. This delay in nominating and confirming the Board members heightened suspicions about the potential effectiveness of the Board. Recognizing this suspicion, the Board members were in agreement that the Board must begin to conduct its health and safety oversight mission in the DOE defense nuclear complex immediately. Moreover, all actions taken by the Board would support the Board's independence from DOE and avoid any appearance of a conflict of interest wherever possible.

Simultaneously, the Board also needed to address the plethora of managerial issues associated with the start-up of an independent federal agency. In its first year of operations, the Board divided its time between reviews of nuclear safety issues at priority sites and building a federal agency from the ground up, giving special attention to hiring staff, acquiring suitable office space, establishing financial operations, and determining an efficient organizational structure for its mission.

THE START-UP OF BOARD OPERATIONS

From the start of operations, the Board members worked together as a team of experts in a collegial manner to insure that the Board presented a united front in pursuing its independent oversight mission. A prime example of their bipartisan and collegial spirit of cooperation was their decision not to have their own personal staff. The Board members relied on the Board's technical, legal, and administrative staff for their information and support needs, saving valuable resources. The Board members were recognized experts in nuclear safety and as such, the need for personal staff was viewed as an unnecessary expense.

Chairman Conway was quick to recognize not only the challenges facing the Board in executing its safety oversight mission, but also the opportunities. As a new agency, the Board did not inherit any staff, organizational structure, or internal regulations governing the conduct of business. Therefore, the Board was free to create a streamlined organization, specifically tailored

to meet its specialized scientific and technical mission, without the encumbrances often associated with traditional government operations, such as vertical layering and duplication of functions. Conway set the standard for having a "no frills" approach to conducting Board business, and in his words, getting the job done by promoting efficiency throughout the organization and maximizing the utility of each employee.[299] The limited resources of the Board were to be focused solely on its mission respecting the adequate protection of public and worker health and safety. Administrative expenses were carefully reviewed for absolute necessity before expenditures were allowed. For example, the Board did not employ government drivers or own/lease executive motor vehicles, and carefully enforced the Federal Travel Regulations, including the restrictions on the use of first class travel.

Adopting the principle of economies of scale for obtaining needed administrative support services, the Board negotiated Interagency Agreements with the U.S. Nuclear Regulatory Commission, the National Science Foundation, the General Services Administration, and the Public Health Service to obtain immediate support for accounting, procurement, personnel, and payroll services. Resources that normally are diverted to fully support these vital administrative functions remained dedicated to supporting the Board's health and safety mission.

Staff recruitment efforts were underway immediately, yielding a skeletal staff at first, with Kenneth M. Pusateri, the first non-Board member, appointed in mid-November as general manager of operations.[300] Pusateri had a proven record of accomplishments in managing the start-up and operation of executive branch agencies, having served in line and staff positions in the U.S. Atomic Energy Commission, the Nuclear Regulatory Commission, and the Department of Energy. He undertook the numerous administrative tasks of a fledgling agency, including the expenditure of funds, personnel matters, and congressional staff interface.[301] In addition to administrative staff, the Board sought quickly to build up its technical staff. The need for competent technical employees was "acute," in view of the urgency of addressing the safety concerns that prompted the Board's creation in the first place. The Board was statutorily

---

[299] Letter to The Honorable Leon Panetta, Director of the Office of Management and Budget, from Chairman Conway, December 1, 1993, 3.
[300] Interview, Kenneth M. Pusateri, Board general manager (1989–2006), Washington, DC, January 3, 2008.
[301] Pusateri served as general manager from November 1989 until his retirement from the Board on June 2, 2006. He was succeeded as general manager by Brian Grosner.

authorized to hire up to 100 permanent staff members, as well as to contract for assistance from organizations and consultants.

To help in the recruitment and leadership of its scientific/technical staff and outside consultants, the Board recruited Dr. George W. Cunningham to serve as the Board's technical director. Dr. Cunningham had previously served as the assistant secretary for nuclear energy in DOE, and also held senior leadership positions in the U.S. Atomic Energy Commission's and the Energy Research and Development Administration's nuclear energy programs. Robert Andersen was recruited from the National Science Foundation to serve as the Board's General Counsel. Andersen had a wealth of experience in environmental law and understood the legal issues associated with scientific research. Richard Azzaro was selected as the Board's Deputy General Counsel. Recruited from the Federal Energy Regulatory Commission, Azzaro was an accomplished trial attorney based on his work in the federal courts and in his mastery of the legal practices associated with the operation of federal regulatory agencies. Joseph Neubeiser was recruited from the Federal Energy Regulatory Commission to serve as Deputy General Manager. His knowledge of logistics and information technology proved to be invaluable to the Board in its quest to rapidly start up operations.

Despite the urgent need for technical staff, the Board encountered serious hiring problems in its first year. The problems were of sufficient magnitude that the Board for a time consisted, as Board Chairman John T. Conway quipped in a 2008 interview, of "all chiefs, and no Indians."[302] The aptness of his remark was reflected in the presence of only 10 permanent technical staffers as of December 10, 1990.[303] During the first year, the Board relied heavily on consultants and contracts for technical expertise.[304]

The Board attributed its "difficulty in obtaining permanent staff" to its lack of the requisite hiring authority to attract first-rate technical and scientific employees. The Board was advised shortly after its startup that, unlike the NRC, it could not hire such personnel outside the rules and procedures that ordinarily apply in federal hiring. That is, the Board was not statutorily exempt from the requirements of Title 5 of the U.S. Code governing appointment of employees

[302] Interview, John T. Conway, Board chairman, October 1989–April 2005, Arlington, VA, March 26, 2008.
[303] U.S. General Accounting Office, *Nuclear Safety: The Defense Nuclear Facilities Safety Board's First Year of Operation*, GAO/RCED-91-54 (Washington, DC, February 5, 1991), 3–4, http://archive.gao.gov/t2pbat7/143684.pdf.
[304] Defense Nuclear Facilities Safety Board, [First] *Annual Report to Congress* (Washington, DC, February 1991), 32, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php.

and classification of employee positions in the competitive service.[305] The Board, as Conway pointed out on a number of occasions, had originally been under the opposite impression, expecting that it would have the same hiring authority as the NRC.[306] The NRC had the excepted service authority that Congress grants to federal programs that require scarce skills or special expertise. In cases of such special need, Congress exempts agency employees from standard classification procedures and salary limitations (subject to an overall pay cap). Such excepted service authority decouples the otherwise obligatory link between an employee's grade level and responsibility to supervise a given number of employees.[307] The AEC enjoyed such excepted service authority, pursuant to the Atomic Energy Act, section 161(d), which recognized the scarcity of technical expertise in the nuclear field and the competition with the private sector for this expertise. The NRC inherited this authority from the AEC, but DOE retained it only in limited form (i.e., for 200 positions)—a development much to the disadvantage of DOE, according to Board member John W. Crawford Jr. and other Board members.[308]

The Board, on finding that its own lack of excepted service authority would hamper its hiring efforts, requested it from Congress. Conway brought up the Board's hiring problems in each of the early congressional hearings in which the Board's activities were scrutinized. Senator Glenn, who stood ready to revisit questions about the Board's legal authority, took up the issue in a Senate Armed Services Committee hearing, directly questioning Board members about whether the Board's enabling legislation needed revision.[309] On the issue of hiring, he asked, "What did we goof on in that enabling legislation?"[310] Both House and Senate Armed Services

[305] U.S. Congress, Senate, Committee on Armed Services, Subcommittee on Strategic Forces and Nuclear Deterrence, *Plans, Progress, and Experience to Date of the Defense Nuclear Facilities Safety Board,* 101st Cong., 2d sess., March 28, 1990, 5.
[306] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 5.
[307] Glenn Russell George, "Negotiated Safety: Intragovernmental Risk Regulation in the U.S. Nuclear Weapons Complex" (Ph.D. diss., Harvard University, May 1995), 123–24 (accessed via Proquest).
[308] John W. Crawford Jr., *An Assessment Concerning Safety at Defense Nuclear Facilities: The DOE Technical Personnel Problem*, DNFSB/TECH-10 (Washington, DC: Defense Nuclear Facilities Safety Board, March 1996), 26, http://www.dnfsb.gov/pub_docs/dnfsb/tr_199603.html. On the scope of DOE's excepted appointment authority, see especially Appendix H, "Statement by Robert M. Andersen, General Counsel, Defense Nuclear facilities Safety Board," H/7–H/10. See also, Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 5 and 35.
[309] See U.S. Congress, Senate, Committee on Armed Services, *Nominations Before the Senate Armed Services Committee, First Session, 101st Congress,* March 14, 16, April 5, 18–19, and May 3, 4, 16, 18, 1989, 722. During the nomination hearing, Glenn said, "I will certainly be paying very careful attention to the establishment of the Safety Board and its performance over the next year. I also intend to continue my legislative efforts to strengthen and expand the role of the Safety Board."
[310] Senate, Armed Services Subcommittee on Strategic Forces, *Plans. Progress, and Experience to Date*, 48.

Committees saw to the needed amendment. In November 1990, Congress granted the Board excepted service authority with the passage of Pub. L. No. 101-510, National Defense Authorization Act for Fiscal Year 1991, the first of a number of amendments over the years to the Board's enabling statute. Pub. L. No. 101-510 amended the Atomic Energy Act of 1954 to authorize the Board to establish the rates of compensation for the Board's scientific and technical personnel.[311] Under this new authority, as Conway later said, thanking the Senate Armed Services Committee, "We are able to hire without going through a lot of red tape and difficulties."[312] The Board, allowed greater flexibility in hiring, could bypass the previously applicable salary restraints of the General Schedule. The Board established instead a five-band, performance-based pay system. The system permitted the Board to offer salaries sufficient to attract permanent staff with special technical expertise—salaries at a GS-16, -17, -18 level—even absent managerial responsibility, through compensation packages that were, by public-sector standards, generous.[313] The development pleased Conway, who said, "We do not want the normal 'manager' type that has to justify his or her salary on the basis that he or she has X number of people reporting to them."[314] The Board also established a performance-based bonus system and a technical intern program, setting itself apart from agencies without excepted service authority.[315]

Another challenge affecting hiring, besides the Board's initial lack of the requisite hiring authority, was the Board's need to avoid potential conflict of interest situations in hiring—conflicts that could compromise the impartiality of advice offered to the Board. The Board's enabling statute called for hiring and contractual arrangements that avoided such situations, for example, those in which the Board's outside technical experts had connections with DOE or DOE contractors in the weapons complex. However, avoiding conflict of interest situations was difficult, insofar as the Board was obliged, especially early on, to make heavy use of contracts for technical expertise, as well as interagency support. This reliance on outside help manifested itself in the allocation of the Board's expenditures in its startup period. The Board's fiscal year 1990 funding availability was $8,865,000, with expenditures totaling $6,956,000. Out

[311] GAO, *Nuclear Safety: The Defense Nuclear Facilities Safety Board's First Year of Operation*, 3–4.
[312] U.S. Congress, Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Years 1992 and 1993,* 102d Cong., 1st sess., April 23, May 9, 17, 22, 23, June 5, 12, 13, 19, 20, 1991, 593.
[313] George, 123–24.
[314] Senate, Armed Services Subcommittee on Strategic Forces, *Plans. Progress, and Experience to Date*, 49.
[315] George, 124.

of these expenditures, contracts amounted to $3.9 million or almost 56 percent.[316] This heavy reliance on contracts was a hurdle to engaging expert help while maintaining the requisite "arm's length" relationship with DOE, because the nuclear experts the Board wanted to use typically had an employment history or connections with DOE or its contractors. As the GAO report assessing the Board's performance in its first year observed,

> [The] nuclear industry is to some extent a closed community; few available nuclear experts are not in some way connected to DOE or its operating contractors.[317]

Conway illustrated the challenge that the Board faced by citing the case of a Board consultant on the Hanford waste tanks whose services the Board had to forgo on finding that a DOE contractor would use his assistance.[318] The challenge of avoiding potential conflicts of interest persisted for the Board at a significant level until it was able, thanks to its new hiring authority, to step up its hiring of permanent staff. Given the sensitivity on this issue, the Board developed and subsequently issued its organizational and consultant conflicts of interest regulations on September 29, 1992.[319]

Apart from staffing difficulties, the second early administrative challenge was locating office space.[320] Even though the Board and DOE agreed at the outset that the Board, as an independent organization, should not share quarters with DOE, the Board was obliged to operate for three months out of two rooms in the basement of DOE's Forrestal Building in Washington, DC. In September 1990, after almost a year of operations and a period in another temporary location, the Board began to carry out its activities from its new headquarters and permanent office space at 625 Indiana Avenue NW, Suite 700, Washington, DC.[321] The space was designed to accommodate the Board's technical, legal, and administrative staff and to provide space for meetings and hearings, as well as the technical library and the public reading room that the Board established in 1991.

During these early start-up years, the Board received the full support of the White House staff in locating suitable office space to conduct Board operations, and in pushing for and

---

[316] DNFSB, [First] *Annual Report to Congress*, 31–32.
[317] GAO, *Nuclear Safety: The Defense Nuclear Facilities Safety Board's First Year*, 26.
[318] U.S. Congress, Senate, Committee on Governmental Affairs, *Accident and Explosion Risks at Department of Energy High-Level Radioactive Waste Facilities*, 101st Cong., 2d sess., July 31, 1990, 41.
[319] Personal communication, Kenneth M. Pusateri, Washington, DC, May 30, 2009.
[320] Interview, Conway.

ultimately receiving excepted service hiring authority. Andrew Card, the assistant to the President and deputy to the chief of staff, played a leading role in ensuring that key support agencies within the executive branch, such as the Office of Personnel Management and the General Services Administration, were sensitized to the importance of the Board's mission and worked with the Board in a cooperative manner.

ESTABLISHING THE BOARD'S OVERSIGHT PROGRAM

Site Visits and Other Fact-Gathering Activities

Upon taking their oaths of office, the Board immediately undertook an intensive program of oversight activities. As Conway said, speaking of the very early period when the Board still consisted of only the five Board members, "We . . . did not want to wait until we were staffed up to begin our safety-related work."[322] In taking up its oversight tasks, the Board simultaneously tackled urgent safety shortcomings in the weapons complex and began to define its tasks and its own manner of proceeding in the accomplishment of its mandate—the mandate to identify safety problems by reviewing facilities, operations, practices, and occurrences, and to evaluate the content and implementation of health and safety standards.

The first practice that the Board inaugurated in pursuit of its oversight responsibilities was that of site visits throughout the weapons complex. Within less than two weeks of its swearing in, the Board used its broad statutory latitude for fact- and information-gathering, and launched an ambitious program of visits to priority DOE sites. These site visits, which became a regular and major part of the Board's safety review efforts, began with an exploratory visit to the Savannah River Site (SRS) near Aiken, South Carolina, from November 7–9, 1989. As Conway reported in the first congressional hearing on the Board's activities, held in March 1990,

> One of the first acts we undertook prior to obtaining staff was for the five members to personally visit and tour the Savannah River site to learn first-hand what health and safety problems existed there.[323]

---

[321] Interview, A.J. Eggenberger, Board chairman (since 2005; vice chairman, 1989–2005), Washington, DC, July 9, 2008.
[322] U.S. Congress, House of Representatives, Committee on Natural Resources, Subcommittee on Energy and Mineral Resources, *Federal Nuclear Facilities Licensing and Regulation Act,* 103d Cong., 2d sess., March 1 and 8, 1994, 229.
[323] House, Natural Resources Subcommittee on Energy and Mineral Resources, *Federal Nuclear Facilities Licensing and Regulation Act*, 229.

He observed that the goal of the initial visits "at each of these locations was basically to orient ourselves to the work being done there." Crawford added, with reference to the Board's pursuit of "knowledge at first hand," "We, the Board, are actually the people that go out and do the spade work and sometimes do so together."[324] In their early tours of site facilities, the Board members familiarized themselves with their physical features and conditions, and observed the manner in which operations were being carried out, all with a view to identifying areas on which the Board would concentrate its reviews and evaluations. The site visits were a means by which the Board furthered its early task of setting oversight priorities—exercising its "best judgment to determine precisely which facilities it [would] oversee," and sharpening its "focus on the important issues with which it [would] be dealing."[325] The Board proceeded to select facilities for visits, and to set priorities in its oversight agenda, on the basis of the urgency and scale of risks and hazards, with cognizance also to the concerns of the relevant congressional committees and of the priorities of DOE in its undertakings in the weapons complex. Mentioning the initial coordination of Board activities with DOE priorities, Conway said in a Senate hearing,

> One of the things we tried to do, Senator, is to set our agenda, set our priorities in concert with the Secretary of Energy.[326]

In the case of the Savannah River Site, the Board's firsthand information gathering was predicated on the expectation that DOE would soon restart the facility's production reactors, the K-, L-, and P- reactors. Although the Board had been created in a period of a nearly complete cessation of production in the weapons complex, the prevailing expectation for the Board's first two years of operations was that the shutdown was still temporary.[327] DOE was giving priority to restarting several critical facilities, most notably, Savannah River's three reactors, as well as certain production buildings at Rocky Flats, and the PUREX facility at Hanford.[328] Thus, the focus of the Board at Savannah River was the activities of DOE and the contractor in preparing

[324] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 38. For a non-Board account of the early site visits, see Bert Chapman, "The Defense Nuclear Facilities Safety Board's First Decade," *Journal of Government Information* 27 (2000): 353–54, http://docs.lib.purdue.edu/lib research/70.
[325] Defense Nuclear Facilities Safety Board, [First Three Months] *Annual Report to Congress* (Washington, DC, February 1990), 5, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php.
[326] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 47.
[327] At the time, in addition, it was expected that new production reactors would be built. DOE was working on them, and the Board's duties included reviewing their design. See Terrence R. Fehner and Jack M. Holl, *Department of Energy, 1977–1994: A Summary History* (Washington, DC: U.S. Department of Energy, November 1994), 48–49, http://www.osti.gov/bridge/servlets/purl/10106088-mgIkuD/webviewable/10106088.PDF.
[328] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 2, 17–18.

for the planned restart of that facility's reactors. Of particular concern was the progress toward restart of the K-reactor—in Board Vice Chairman Eggenberger's words, "a 1952 vintage plant," shut down in 1989 "for major changes in culture and in hardware."[329] The Board began examining safety-related aspects of DOE's upgrades at that facility, paying attention to safety issues that might hold up its restart. Prominent targets of Board scrutiny included DOE's efforts to improve the capabilities and qualifications of the reactor operators. The Board also began to review DOE's evaluations of engineering issues, such as the capability of the reactor to withstand earthquakes, and thermal hydraulic performance in the event of a loss of coolant accident.[330]

Other early site visits took Board members to Rocky Flats, Hanford, and the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico. At Rocky Flats, as at Savannah River, the Board approached the plant with an eye to assessing DOE's resumption activities, specifically, its efforts to ready the plant's plutonium-processing foundry to restart operations. The Rocky Flats visit, postponed from December to allow DOE to complete its own review of resumption activities, took place in mid-January 1990. During the visit, the Board's attention turned particularly to the accumulation of radioactive material in ventilation ducts. In the preceding month, from December 11–12, 1989, three Board members visited the Hanford site, where the Board first began to address the safety question that had been repeatedly brought up by Glenn, including at the Board's confirmation hearing—the question of the susceptibility of certain high-level waste storage tanks to explode. In January 1990, Board members and staff visited WIPP—slated to be the national disposal site for transuranic defense waste and the world's largest deep geologic repository. They examined the waste handling building and repository rooms excavated in a huge salt formation 2,000 feet underground.[331]

During each of the early site visits, the visiting Board members were accompanied by outside expert consultants, who could supplement the Board's own capabilities in its reviews of particular managerial and engineering issues pertinent to safety. The Savannah River contingent,

---

[329] *Public Meetings and Hearings, 1991, Before the Defense Nuclear Facilities Safety Board*, vol. II of II (Washington, DC: Defense Nuclear Facilities Safety Board, 1991), 535 and 545.
[330] DNFSB, [First] *Annual Report to Congress*, 19. See also Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 17–18.
[331] See U.S. Congress, House, Committee on Interior and Insular Affairs, Subcommittee on Energy and the Environment, *Proposals Relating to the Operation of the Waste Isolation Pilot Plant (WIPP) in New Mexico,* 102d Cong., 1st sess., April 16, 1991, 1–5, 182–84.

for example, included experts in the requirements of training and in seismic engineering. After the initial visits to sites by the full Board or a majority of its members, there were numerous "follow-up visits . . . by specialist teams selected and led by Board members."[332] In monitoring the restart activities at Savannah River, the Board, its staff, and outside technical experts in various combinations made more than 100 site visits during the two-year period, 1990 to 1991.[333] By June 1992, as Eggenberger noted in a Senate Armed Services Committee hearing, "if one only considers the Savannah River site, the Rocky Flats site, and the Hanford site, our staff have made 247 visits to these facilities. The Safety Board itself has made 65 site visits."[334] After each of the visits by the specialist teams, the Board's staff summarized their findings in trip reports, which were incorporated into the data files that the Board's staff accumulated on safety issues at the various DOE nuclear facilities. The Board used the trip reports mostly as internal working papers, which served as the basis for briefings by the staff that the Board members periodically requested to inform their deliberations on specific safety issues.

Describing how site visits typically proceeded, Conway said, "Each time we have visited a specific site, we have given advance notice to the Department of Energy and specified the particular items we wished to discuss and review."[335] DOE and contractor personnel at the sites made presentations on the current status and planned activities of facilities. During the first visit to Hanford, for example, DOE officials at the Richland Operations Office and Westinghouse contractors provided briefings on the issue of the high-level waste tanks, as well as on preparations for restarting operations at the PUREX plant, on activities involved with the N-reactor's dry standby status, on work on the Plutonium Finishing Plant, and on ongoing site cleanup activities.[336] At WIPP, DOE and Westinghouse personnel made presentations on the project's history and current management issues.

---

[332] DNFSB, [First Three Months] *Annual Report to Congress*, 5.
[333] Site visits remained a major element of Board oversight. The *Ninth Annual Report to Congress* (Washington, DC, February 2000, 5/2, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php) stated that between "October 1989 through the end of 1998 . . . the board, its staff, and its contractor experts have collectively made 1,398 site visits to DOE's defense nuclear facilities."
[334] U.S. Congress, Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1993* and *the Future Years Defense Program,* 102d Cong., 2d sess., March 18, 24, 27, April 9, 28, May 20, June 3, 11, 1992, 235.
[335] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 38.
[336] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 19–20. See also Chapman, 354.

The Board expressed general satisfaction with the working relationship with DOE when it came to its provision of the means for effective safety oversight, including unhindered Board access to DOE facilities and data. Conway, noting DOE's initial opposition to the creation of the Board, acknowledged that DOE, as charged by the Board's statutory mandate, provided the wide and ready access needed to review safety issues,

> I think the Department of Energy has come around now, and I think we have a good cooperative arrangement with them and we're finding ourselves in a position where any and all information we're requesting, we're getting promptly.[337]

Besides the interactions with DOE officials, workers, and contractor personnel at the sites, the site visits also often involved meetings with concerned members of the public. Actively reaching out to the public, the Board identified, solicited, and met with elected public officials, labor unions, public interest groups, state, federal, and regional officials, Native American representatives, and other interested parties, as well as members of the media. The Board actively sought the participation and input of such parties, as Conway noted,

> We have notified the legislative representative at the Federal and State level at each of those facilities. We have notified in the case of Colorado the Governor because he has shown a particular interest that we were coming. We have informed organizations . . . and the legislative representatives . . . that we would be available to meet with any groups or individuals that wanted to see us while we were at these locations . . . .
>
> We have also notified the press, both the written media and the T.V. media. We have made ourselves available to answer their questions.[338]

Such outreach efforts produced results, as, for example, during the Board's first visit to Rocky Flats. Board members met with Colorado Governor Roy Roemer, Representative David Skaggs (D–CO), labor union officials representing Rocky Flats workers, and representatives from various citizen organizations with environmental and nuclear proliferation concerns.[339]

The Board also solicited input—"comments, technical information, and data"—from interested individual citizens, whether they wanted to speak in announced public meetings held at the Board's discretion in conjunction with the site visits or in more private circumstances. As Conway said,

---

[337] *Public Meetings and Hearings, 1991,* vol. II of II, 22.
[338] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 46.

> Now, obviously when we visit the site . . . [t]hey are classified sites . . . [w]e do not take with us members of the public . . . But back at the hotels where we stay we let it be known who we are, what we are looking for, and anyone that has any information we encourage them to come to us.[340]

The Board's practice of soliciting information from the citizenry included the explicit invitation to meet to confer with the Board in private, as he added,

> We also let it be known that if anyone wants to come and see us and for whatever reason does not want to do it in public, then we will meet with them in private . . . We have encouraged the labor leaders to come to us with any of the problems that they may have and they have done that.[341]

The Board's constant and personal availability to the public came to be popularly characterized with an expression used by Conway, "We are as close to you as your phone." All meetings, as the Board's General Counsel Richard A. Azzaro stated, were "without preconditions except those that would facilitate open and complete communication of the concerns about DOE operations to the Board." The Board made reporting health and safety issues easy and risk-free from reprisal, and the Board quickly gained and kept a reputation for protecting communications and concerned sources. As Azzaro added, "Protecting sources had a singular importance. The Board worked tirelessly and creatively to ensure and enforce confidentiality: through its General Counsel's Office who created special practices and procedures."[342]

In addition to spontaneous outreach in the course of site visits, the Board also convened officially announced public meetings and hearings—the meetings that involved a number of the Board members. The meetings were held at times and locations selected by the Board after careful surveys, to ensure maximum opportunity for attendance and presentation of information to the Board. Conway described one such meeting,

> I will give you Rocky Flats as an example—we rent . . . .a meeting room in the hotel where we are staying. We announce ahead of time that on such and such a date we will be there for anyone who wants to come to that meeting and it is open to the public. We had such a meeting at the Rocky Flats area where it was standing room only and each and every person that came there we gave an opportunity to meet with us and discuss with us their concerns.[343]

---

[339] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 19. See also Chapman, 353.
[340] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 46.
[341] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 46.
[342] Personal communication, Richard A. Azzaro, June 15, 2009.
[343] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 46.

Such meetings served as a two-way communication tool, both conveying information to the public and furthering the Board's investigative process at a site. During calendar years 1990 and 1991, the Board held a total of 15 such public meetings, seven of which were held at or near DOE sites and eight at the Board's Washington, DC, offices.

Interaction with DOE and the Recommendation Process

The site visits that the Board conducted by way of information gathering were central to the Board's performance of its mission to identify safety problems and formulate recommendations and other advisories to DOE on corrective actions. Other bases for the formulation of the Board's advice, according to one Board list, included,

(1) review of documentation concerning particular problems at a site;
(2) review of staff or Board contractor reports;
(3) briefings by DOE officials and DOE contractors; and
(4) deliberation and technical review by the Board.[344]

In furtherance of its mission, the Board could also conduct studies and establish reporting requirements for DOE. In addition, the Board had at its disposal certain more coercive statutory powers that it did not exercise. Such latent investigative capabilities included subpoena power and the authority to hold adjudicatory hearings.[345]

Deploying the various elements of the investigative toolkit that Congress included in the Board's enabling legislation, the Board translated its broad mandate to provide advice on nuclear safety to DOE into two forms of advice—informal communications and the issuance of formal recommendations to the secretary of energy.

The informally proffered advice was a "natural consequence" of the extensive interaction and frequent conversation on specific safety-related technical matters that the Board, its technical staff, and DOE personnel had both at DOE headquarters and at DOE defense nuclear sites. As the Board pursued its reviews and investigations, the members and staff met regularly with DOE officials and field staff, as well as contractor personnel, and engaged in extensive informal information exchange not necessarily related to the development of formal safety recommendations. Such direct, in-depth dialogue and continual mutual feedback, as the Board

[344] U.S. Congress, Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996 and the Future Years Defense Program,* 104th Cong., 1st sess., March 28, April 25, May 2, 16, 18, 1995, 100.

saw it, were indispensable to addressing the technical complexity of the safety-related issues the nuclear complex posed. As a matter of course, such dialogue often yielded informal agreements with DOE. Safety findings and concerns conveyed orally by the Board, based on information provided orally by DOE, were understood as informal recommendations, "often producing . . . self-initiated corrective action." by DOE. As the Board's 1991 annual report put it,

> Board technical analysis and review of safety problems, site visits, observations, and discussions with DOE and its contractors may trigger their initiating further review or corrective action without a formal recommendation even having been contemplated.[346]

The Board welcomed such commitments to corrective action outside of the formal recommendation process, viewing self-initiated corrective action as "a very productive and efficient means of effectuating change" at defense nuclear facilities.[347] One significant aspect of such informality that troubled some observers, however, was that advice transmitted and corrective action undertaken informally could occur without disclosure to the public. Identifying safety problems and effecting changes without the issuance of a formal recommendation to the secretary of energy did not trigger the legislative provision requiring the public disclosure and public comments procedures that applied to the Board's recommendations and the secretary's responses.[348]

Although the Board welcomed corrective measures taken by DOE that preempted formal actions by the Board, the Board also made frequent use, especially in its early years, of its primary tool for gaining the attention of DOE, the formal recommendation. Judging situations on a case-by-case basis, the Board members found that some issues warranted the formulation of

---

[345] George, 133, 163.

[346] Defense Nuclear Facilities Safety Board, [Second] *Annual Report to Congress* (Washington, DC, February 1992) 46, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php.

[347] DNFSB, [Second] *Annual Report to Congress*, 46.

[348] After 1994, the Board issued fewer formal recommendations, placing more reliance on gaining DOE's attention through the issuance of letters that required DOE to report to the Board on matters of concern. For a discussion of the use of these reporting requirement letters, see Defense Nuclear Facilities Safety Board, *Thirteenth Annual Report to Congress* (Washington, DC, February 2003, 1/3, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php):

> The Board's recommendation authority has been used most fruitfully for gaining DOE response to broad, cross-cutting matters that affect much of the defense nuclear complex . . . . In contrast, a mandatory reporting requirement has been an effective tool in compelling DOE to respond in a more expeditious manner to important safety issues. Comparison of the Board's use of these two methods shows a marked shift beginning in 1994 toward much greater reliance on reporting requirements. Prior to 1995, the Board had issued 31 recommendations and 17 reporting requirement letters. For the 7-year period from 1995 through 2002, the Board issued 14 recommendations and 72 reporting requirement letters.

Board advice as a recommendation, in actuality, usually a set of related individual recommendations under one overall title. The Board wielded this tool when a majority of the voting members, exercising their expertise and judgment, determined the facts to support a finding that a recommendation was "necessary" to protect health and safety.

Such recommendations encompassed a wide range of activities and issues in DOE's nuclear complex, and varied widely in scope.[349] Many Board recommendations were site-specific, dealing with relatively narrow technical or operational issues at individual facilities, while many applied more broadly, even complex-wide. Among the Board's early site-specific recommendations were, for example, recommendations 90-7, *Safety at Single-Shell Hanford Waste Tanks*, and 91-2, *Closure of Safety Issues Prior to Restart of the K-Reactor at the Savannah River Site*. Such site-specific recommendations were sometimes occasioned by the identification of a threat or risk or by hitherto unrecognized or underestimated safety problems, e.g., problems in Hanford's double-walled waste tanks. When not confronted with specific immediate risks, the Board "made a special effort to evaluate safety issues that appeared to be generic in nature." It pursued its investigations with an eye to determining whether a practice or event reflected systemic problems affecting other DOE facilities. Examples of generic issues were "lack of training, lack of written procedures, or a lack of formalized disciplined approach to the operation of facilities and the safety of workers."[350] The Board expected that the guidance it offered on such issues for a particular facility would set the stage for corrective actions elsewhere, sometimes without and sometimes with the issuance of further, more broadly framed formal recommendations. Among such early recommendations by the Board that applied broadly were 91-1, *Strengthening the Nuclear Safety Standards*; 91-6, *Radiation Protection for Workers and the General Public at DOE Defense Nuclear Facilities*; and 92-6, *Operational Readiness Reviews*.

In addressing such generic issues, the Board often first issued a recommendation on the topic as it pertained to a specific site, following up later with a more general version.[351] For example, the Board's very first recommendation preliminarily formulated advice on the training

[349] U.S. Congress, Office of Technology Assessment, *Dismantling the Bomb and Managing the Nuclear Materials*. OTA-O-572 (Washington, DC, September 1993), 40, http://govinfo.library.unt.edu/ota/Ota_1/DATA/1993/9320.PDF.
[350] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Years 1992 and 1993*, 609.

and qualification of technical personnel as these pertained to reactor operators at the Savannah River Site K-reactor. The training and qualification issue was later formulated in more general terms in Recommendation 92-7, *Training and Qualification*, which in turn was embraced by an even broader-based Board recommendation, Recommendation 93-3, *Improving DOE Technical Capability in Defense Nuclear Facilities Programs*, on the education, training, recruitment and retention of personnel. The Board's second recommendation, 90-2, on standards at a number of sites, was followed by Recommendation 91-1, *Strengthening the Nuclear Safety Standards Program for DOE's Defense Nuclear Facilities.*

Such subsequent, related recommendations pertinent to multiple sites or the entire complex frequently drew upon the experience gained in implementation efforts prompted by earlier site-specific recommendations. Recommendation 92-6, for instance, which urged improvement of DOE's operational readiness review (ORR) process throughout the DOE complex, drew upon lessons learned from the Board's site-specific monitoring of, and recommendations on, the readiness review process for the restart of Rocky Flats facilities, for the resumption of plutonium-238 processing in the HB-Line at the Savannah River site, and for the start of testing for waste disposal procedures at WIPP.[352] On finding common weaknesses in ORRs at these sites, the Board formulated 92-6 urging DOE to develop effective standards to govern the safety aspects of ORRs complex-wide. The recommendation called upon DOE both to identify the required features of a satisfactory ORR—with guidelines for the selection of ORR teams, the scope of ORRs, and documentation of ORR results—and to specify criteria for determining when an ORR should be performed.[353]

By generalizing and disseminating particular safety advice and gains, the Board sought to promote stepped-up DOE adherence to formal processes and standards. The thrust of many recommendations, as pointed out by Congress's Office of Technology Assessment (OTA), was

---

[351] On this dynamic, see Crawford, esp. H/3, where the Board's first general counsel, Robert M. Andersen, describes the emergence of increasingly broad recommendations on a topic.

[352] On the HB-Line at the Savannah River Site, see Defense Nuclear Facilities Safety Board, *Recommendation 92-3*, *Operational Readiness Reviews for the HB-Line at the Savannah River Site, SC,* 1, http://www.dnfsb.gov/recommendations/srs/rec_1992_03.txt. On WIPP, see Defense Nuclear Facilities Safety Board, *Recommendation 91-3*, *DOE's Comprehensive Readiness Review Prior to Initiation of the Test Phase at the Waste Isolation Pilot Plant (WIPP)*, 1–2, http://www.dnfsb.gov/recommendations/srs/rec_1991_03.txt.

[353] Defense Nuclear Facilities Safety Board, *Recommendation 92-6, Operational Readiness Reviews*, 2–3, http://www.dnfsb.govlrecommendations/all/rec_1992_06.txt. The Board closed this recommendation when DOE eventually revised its Order on Operational Readiness Reviews.

to urge upon DOE greater formality in its practices and processes, whether operator training programs, the conduct of its operations, standards development, or other. As the OTA stated,

> Many DNFSB recommendations and site visits focus on increasing the formality of written procedures and directions in DOE operations and in its training of workers. This emphasis may be a reflection of the background of many DNFSB staff in commercial and naval nuclear reactors.[354]

Whatever the nature of a formal recommendation, when the Board decided that its oversight should take that form, the decision augmented the weight of the Board's advice. In offering advice either formally or informally, the Board exercised authority that effectively went beyond mere advice, while not carrying the full weight of regulatory authority. The U.S. Court of Appeals for the District of Columbia Circuit, interpreting the Board's statutory authority, held that the Board was not "strictly advisory" . . . but rather "decision-forcing" on public health and safety issues."[355] The court described the Board as an agency with decision forcing or action forcing powers, stating,

> The Board does considerably more than merely offer advice . . . It has at its disposal the full panoply of investigative powers . . . and forces public decisions about health and safety.[356]

With the issuance of a formal recommendation, this "action forcing" power was further strengthened by the statutory requirements that such an issuance triggered. Upon issuance to the secretary of energy, the recommendation had to be made public through publication in the *Federal Register*.[357] The recommendation then demanded a response or a report from the secretary according to procedures outlined in the Board's enabling legislation. The secretary was required to respond with acceptance or rejection within 45 days. In the case of "any Board recommendation not accepted by DOE," the secretary had to "to justify rejection . . . in formal reports to cognizant Congressional Committees."[358] In the case of accepted recommendations, s/he had to submit within 90 days an implementation plan, in which s/he committed to corrective

[354] Office of Technology Assessment, *Dismantling the Bomb*, 42.
[355] House, Natural Resources Subcommittee on Energy and Mineral Resources, *Federal Nuclear Facilities Licensing and Regulation Act,* 240.
[356] U.S. Congress, House of Representatives, Committee on Commerce, Subcommittee on Energy and Power, *Legislation to Improve Safety and Security in the Department of Energy*, 106th Congress, 2d sess., March 22, 2000, http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=106_house_hearings&docid=f:64031.pdf.
[357] George, 132.
[358] Defense Nuclear Facilities Safety Board, *Sixth Annual Report to Congress* (Washington, DC*,* March 1996), 25, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php.

actions. The implementation plan for an accepted recommendation, like the recommendation itself, had to be made public through publication in the *Federal Register*.

In the exchanges that occurred between DOE and the Board in the recommendation process, the problem never arose that some framers of the Board's enabling law, notably, Glenn, had feared, namely, that the secretary of energy would resist or reject Board recommendations outright. Over the course of the Board's history, the secretary rejected none of its recommendations, accepting all of them in full. While not mounting the kind of resistance that some had feared, however, DOE had some problems in the early period of the Board's operations in obtaining the Board's approval for its implementation plans. In a number of cases early on, the Board was not fully satisfied with the plans, considering them "not adequately responsive," or insufficiently specific. In those cases, the Board called upon DOE to improve upon its proposed implementation plans, sometimes requiring successive drafts. Recognizing the need for a better understanding of its wishes, the Board worked with DOE during the first years of Board operations to develop an understanding of what the Board judged to be adequate responses and implementation plans. For example, with respect to Recommendation 91-6 on upgrading compliance with DOE's orders, the Board's general counsel, Robert Andersen, took a lead role in the Board's efforts to review DOE's standards. As Crawford said,

> Now, we regarded that [recommendation as] so important that we put our general counsel in charge of the task force of the Board's in eliciting from DOE a really responsive implementation plan.[359]

Drawing upon the experience of such DOE–Board interaction, the Board developed a Board Policy Statement, "Criteria for Judging the Adequacy of DOE Responses and Implementation Plans for Board Recommendations."[360] These efforts helped DOE to develop implementation plans that obtained Board approval with fewer major problems, with the notable exception of the implementation plan for Recommendation 90-2, concerning DOE's standards program. For that key recommendation, Conway remarked in March 1994, "Obtaining a

[359] *Public Meetings and Hearings, 1994, Before the Defense Nuclear Facilities Safety Board* (Washington, DC: Defense Nuclear Facilities Safety Board, 1994), 31.
[360] DNFSB, [First] *Annual Report to Congress*, 11.

satisfactory implementation plan from DOE has proved to be a nearly insuperable task."[361] DOE submitted five versions of implementation plans over 51 months before receiving approval.[362]

Whatever the difficulties DOE had initially with its implementation plans, the recommendation process as a whole—recommendation and plan in response—lived up to its characterization as more than "strictly advisory." The process proved a mechanism that was "action forcing," not because recommendations were binding, but because ignoring them would mean ignoring highly competent technical advice, and doing so in the public eye.

Interfacing with the Public

In the course of carrying out its mission to provide oversight to DOE on safety issues, the Board simultaneously addressed another aspect of its mandate, which was to improve the openness to public scrutiny of DOE nuclear activities and, as a by-product, of the Board's own processes. A major rationale for creating the Board was to restore public confidence in DOE's stewardship of defense nuclear facilities by improving the transparency of DOE's operations. In response to its mandate to restore trust, the Board was committed from the outset to developing a system to provide as much public access as possible to the Board's findings and recommendations about safety issues.[363] As Board General Counsel Azzaro characterized the effort,

> The Board developed a multi-pronged outreach strategy that combined the formal services required by law and informal initiatives and matched them with highly experienced service-oriented personnel. Ever present in all of these efforts was the Board's commitment to meaningful Board availability to concerned members of the public or workers on their safety and health concerns.[364]

As the Board undertook to make good on its obligation to enhance openness in the weapons complex and improve public trust, the issue of transparency was still highly charged for public interest and citizens groups and other interested parties, such as the GAO and relevant congressional committees. Such groups had spearheaded criticism of the abuse of secrecy in the weapons complex. They remained wary of the potential for further abuse of national security

[361] House, Natural Resources Subcommittee on Energy and Mineral Resources, *Federal Nuclear Facilities Licensing and Regulation Act*, 237.
[362] Defense Nuclear Facilities Safety Board, *Fifth Annual Report to Congress* (Washington, DC, February 1995), 79–80, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc/php. See also George, 155.
[363] On the Board's effort to contribute to transparency, see George, 129–33.
[364] Personal communication, Azzaro.

claims to frustrate public access to information about environmental, safety, and health problems in the complex. Glenn gave voice to this wariness at the Board's confirmation hearings, where he expressed determination

> [T]o make sure that we never again drift into the secrecy, and the abuse of secrecy, that occurred in the nuclear weapons complex in the past. We all hid behind this problem, "the Russians are coming, the Russians are coming," "we need more production, we need more production."[365]

He added that the aim of avoiding further cover-up of problems accounted for the inclusion in the Board's enabling legislation of the requirement to adhere to "different aspects of public access law," stating,

> [The inclusion] was not done just to be nasty, It was done because … [e]verything with regard to the nuclear weapons complex had been secret, We got into all this waste problem because it was easier to put it in that pit out behind the plant and not say anything about it for a while. Now is after a while, and we have to deal with it …
>
> [T]hings were covered up that have gotten us into problems that are now going to cost maybe a couple of hundred billion dollars to get ironed out over a 20-year period, something like that, all because of secrecy.[366]

The atmosphere of public distrust that Glenn's words reflected made the Board subject to close scrutiny concerning certain aspects of the way it conducted business, and whether they accorded with the Board's statutory obligations to provide public access. It was against this backdrop of public distrust that the Board undertook to demonstrate its commitment to public information access by developing policies, arrangements for public outreach, and a system to augment the transparency of the health and safety aspects of the DOE nuclear complex. To the degree that the Board members thought was allowed under the Board's enabling legislation, they emphasized communicating with the public through a variety of avenues.

One aspect of the Board's ongoing effort to inform the public was the Board's careful adherence to its statutory requirements for the public disclosure of its recommendations and of the secretary's responses, including commitments to corrective actions. In its annual reports to Congress, the Board regularly highlighted its actions to inform members of the public after the issuance of recommendations, and to receive their comments and incorporate their views in the process of health and safety oversight. As required by law, the Board published the full text of its

[365] Senate, Committee on Armed Services, *Nominations*, 721–22.
[366] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 36 and 38.

recommendations in the *Federal Register* and distributed all recommendations to DOE regional public reading rooms and to its own, once this was established in 1991. Each *Federal Register* notice solicited public comments, and the Board considered all comments received. The Board also announced its issuance of recommendations by mail to numerous individuals and organizations, e.g., congressional committees and representatives, federal and state officials and committees, public interest groups, and interested individuals.

In addition to the required public outreach attendant upon the publication of a formal recommendation, the Board made available voluminous written materials and papers on Board activities, providing extensive technical files for public perusal at the Board's offices in Washington, DC. Indicating the eventual scale of this endeavor, a 1997 estimate put the volume of records available for viewing at 1.75 million pages.[367] Materials included the Board's annual reports and other statutorily mandated reports, the Board's formal recommendations, letters, technical reports, staff reports on visits to DOE sites, bound transcripts of public meetings, transcripts of hearing testimony, and statements of Board policies.[368] Most of this material was made available in electronic form on the agency's Web site (http://www.dnfsb.gov/), including all correspondence from the Chairman, all technical reports, all staff issue reports, and all weekly reports from the Board's site representatives.

In furtherance of the transparency of Board activities, the Board responded to numerous public requests for information and documents under the Freedom of Information Act (FOIA), committing substantial resources and assigned highly experienced personnel to the effort.[369] The Board issued regulations governing the availability of information on Board activities through

---

[367] See Defense Nuclear Facilities Safety Board, *Strategic Plan: FY 1997–2002,* (Washington, DC, 1997), 3, http://www.hss.doe.gov/deprep/1997/bm97s30b.htm. See also Chapman, 375.

[368] On the public availability of the transcripts of meetings, see *Public Meetings and Hearings, 1991,* vol. II of II, 490, which stated,

> Publicly releasable portions of the record will be made available for public inspection after an appropriate review by DOE for classified or controlled nuclear information, and review by the Board for other disclosure exemptions under the Freedom of Information Act. All documents will be handled in accordance with the Board's regulations implementing the Freedom of Information Act.

Although not required by the Government in the Sunshine Act, transcripts were prepared of the open public meetings. These transcripts, along with documents developed for the meetings by the Board and its staff were publicly available.

[369] Pub. L. No. 89-487. See Office of Technology Assessment, *Dismantling the Bomb*, 119. The Freedom of Information Act (FOIA) allows requests for access to government information not made generally available and permits challenges to the denial of such requests. FOIA has an exemption for "properly classified' information, but places the burden on the "owner" agency to justify the withholding of access. FOIA requests are sometimes answered with an unclassified version of the restricted material with blacked-out sections.

the reading room or pursuant to a FOIA request, promulgating the final regulations on May 8, 1991.[370] In its FOIA program, the Board "not only met the letter but the spirit of the law."[371] None of the Board's responses to FOIA requests or a request for public documents was judicially challenged. As Azzaro stated, speaking of the FOIA initiative, its "singular success [was] documented in letters from citizens, public interest groups, members of Congress and testimony before the board and Congress."[372]

Another avenue by which the Board disseminated information to the public was through the written reports and oral testimony that it provided to Congress pursuant to reporting requirements imposed by Congress in the performance of its own oversight over Board activities. Reporting requirements included, for example, the Board's statutorily required annual report provided directly to Congress for each calendar year. These reports were prepared by the Board without any contribution from contractors and were among the materials made available in public reading rooms.[373] Over the years, Congress imposed additional reporting requirements, some as one-time requests and some more enduring. A further means of keeping Congress informed was through testimony by Board members before a number of congressional committees to which the Board was required to report. Depending on the topic under examination, Board members were called upon to testify before the appropriations, armed services, and energy committees of both the House and Senate, as well as an occasional additional committee.[374] The Board members' first congressional appearance subsequent to their confirmation hearing took place five months after the Board's startup, before the Senate Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence.[375]

Public Meetings and Hearings

The Board further demonstrated its commitment to keeping the public informed through its practice of convening meetings open to the public, with advance notice given in the *Federal*

[370] See Defense Nuclear Facilities Safety Board, "Rules Implementing the Freedom of Information Act," 56 *Fed. Reg.* 21259–21266 (May 8, 1991).
[371] Personal communication, Azzaro.
[372] For additional perspectives on the Board and the FOIA program, see *Public Meetings and Hearings, 1991,* vol. II of II, 204; and Office of Technology Assessment, *Dismantling the Bomb*, 120.
[373] Another, similar yearly report provided directly to Congress, the Government Performance and Results Act (GPRA) Report, covered the fiscal year (FY), rather than the calendar year.
[374] Interview, Pusateri. See also Chapman, 375.
[375] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*.

Register, in accordance with Pub. L. No. 94-409, the Government in the Sunshine Act.[376] The Board inaugurated public meetings and open hearings in early 1990, beginning with public discussions in January and February in the vicinity of the Rocky Flats plant near Boulder, Colorado. Such meetings, besides being posted in the *Federal Register*, were advertised in various media venues. Speaking of the meetings, Eggenberger said in a 1992 hearing before the Senate Armed Services Committee,

> An important part of our business is interfacing with the public in the form of public meetings and hearings. To date, we have conducted public meetings and hearings for the WIPP site, the Savannah River site, the Rocky Flats plant, Hanford, and generic issues throughout the complex.[377]

Totaling up the public meetings held by the Board by 1997, a Board strategic plan authored that year reported 29 public meetings in communities near DOE facilities and an additional 29 in Washington, DC.[378] By the end of 2007, the Board had convened 96 public hearings/meetings.[379]

These meetings provided opportunities for interested groups or persons, public and private, to learn and express their views about DOE facilities in informal, open discussions. Many of the meetings were held in communities near the facilities, allowing the Board and other presenters to focus on the safety issues and Board activities of concern to the local communities. The meetings varied in specific purpose and format. The Board experimented with different hearing formats ranging from on the record legislative hearings to the less formal "town meeting."

In some meetings, the Board members and the Board's technical experts heard detailed presentations from and put questions to representatives of DOE, the contractor at the site, and other knowledgeable presenters. Often the aim was to question DOE witnesses on DOE's implementation plan commitments and the progress that DOE and its contractors had made in accomplishing them. For example, in an August 1990 evening hearing in Westminster, Colorado, with 200 people in attendance, DOE and its contractor made presentations on the status of Board recommendations, 90-2, 90-4, 90-5, and 90-6, pertinent to the Rocky Flats plant, and on the secretary of energy's actions following their receipt. The recommendations under discussion at the meeting addressed such issues as the standards applicable to specific buildings, operational

[376] DNFSB, [First] *Annual Report to Congress,* 34.
[377] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1993*, 235.
[378] Chapman, 375.

readiness reviews for the buildings, criticality safety in the ducts, and the systematic evaluation program. Experts brought in by DOE on the operational readiness review each presented on their area of expertise. To ensure that responsible government officials were kept informed, such briefing events often included, by special invitation of the Board, representatives of elected officials and government agencies. Briefings in 1990 on the potential dangers to the public of the Hanford waste tanks, for example, included representatives of the governors of Oregon and Washington, as well as of EPA, GAO, and state environmental agencies.

Such informational meetings served not just to apprise the public of progress in implementing Board recommendations, but also as a vehicle to exert pressure on DOE "to increase DOE's responsiveness to Board safety initiatives and to explore roadblocks to expeditious and competent implementation for accepted recommendations."[380] As the Board stated, "Questioning in public forums creates an atmosphere of accountability—that the Board intends to use every available vehicle to achieve safety progress."[381]

At another kind of public meeting, the Board members themselves made statements to the public in their areas of particular interest, communicating with interested parties about how the Board saw its oversight activities and findings. Typically, as the chairman called each of a series of technical matters for discussion, he identified the lead Board member tracking the review and analysis of that particular matter. For example, Crawford often spoke on operator qualification or on the discipline of operations, Eggenberger addressed the ability of systems to withstand seismic events, and Kouts focused on thermal hydraulic performance, the piping and the emergency cooling capability of the plant, which were relevant to maximum reactor power. In still another public meeting format, the Board's technical staff briefed the Board on particular technical issues, for example, plutonium vulnerabilities throughout the complex.

At most informational meetings, the Board provided the opportunity for spokespersons of organizations and interested citizens to voice their concerns about DOE facilities or Board oversight, and to add to the record. Some meetings, generally evening meetings held in the locale where DOE nuclear facilities were located, were almost solely devoted to the receipt of citizen and community group input.

---

[379] Defense Nuclear Facilities Safety Board, "DNFSB Public Meetings, 1990–2007" (Board document).
[380] George, 205.
[381] DNFSB, *Fifth Annual Report to Congress*, 76.

The feedback that the Board received on its efforts to communicate with the public through meetings and hearings was strongly appreciative, with some qualifications. Representative David Skaggs (D–CO), for example, praised the Board's outreach in public meetings for enabling the citizenry to judge safety questions based on information they could count on—information they saw as from an independent and technically expert source. Long caught up in the contentious issues involving Rocky Flats, he laid out his understanding of what the Board's outreach accomplished, observing,

> This openness is terribly important. It reassures the public that there is really someone independent of the Department of Energy who is overseeing plant operations.[382]

Speaking specifically of activities to prepare for restarts at Rocky Flats, he emphasized the degree to which the Board's presence improved public confidence, stating,

> When the Department of Energy says they are ready to restart Rocky Flats, the public in this state is going to turn to you and to the Ahearne Committee and ask is it really safe. And we will be counting on you to tell us yes or no.[383]
>
> Unless the public is shown clearly that independent observers have checked things out, it will have no reason to believe yet another Department assurance that "things have changed at Rocky Flats."[384]

In addition, Skaggs praised the Board for its prompt disposition of reported concerns, stating, "I am extremely impressed with your speed of getting on top of the issues." Others also noted the efficiency and promptness of the responses to and disposition of the concerns on health and safety issues raised by the public. Azzaro, noting this rapid response to the reported concerns of the public, credited it to the high-level expertise of Board personnel and to the Board's organization,

> Building upon its unique capability in investigations, litigation, integrity in government, administrative law, environmental law, and substantial expertise and technical depth in the sciences, engineering, and nuclear operations, the General Counsel's Office was hard linked to the Technical Director and the General Manager, which facilitated almost immediate disposition of reported concerns.[385]

---

[382] *Public Meetings and Hearings, 1990, Before the Defense Nuclear Facilities Safety Board* (Washington, DC: Defense Nuclear Facilities Safety Board, 1990), 589.
[383] *Public Meetings and Hearings, 1990,* 590.
[384] *Public Meetings and Hearings, 1990,* 594.
[385] Personal communication, Azzaro.

With reference to the Board's outreach practices, the main qualm that Skaggs expressed was that the Board was excessively low key in its approach to advertising meetings and arousing public interest. He urged the Board to step up prior media notification efforts, indicating that greater public interest and pressure would strengthen his hand in seeking government resources for improvements and site cleanup.[386] The urging by Skaggs and others that the Board make its advertising efforts "more prominent and repetitive" met with some resistance by the Board members. In response to the urging to seek more media exposure, Conway stated in a revealing comment, "Unfortunately, it has been my limited experience that the media will show an interest if you are willing to frighten the people."[387] Taking an analytical/technical approach to safety questions, the Board expressed reluctance to play upon people's fears, whatever the benefits.[388]

Although appreciation, such as that expressed by Skaggs, predominated in feedback the Board received on its conduct of public meetings, Board meetings met with some criticism, mostly regarding the scope of discussions and, specifically, their limitation to technical safety matters. Criticism generally focused not on what the Board did in the meetings but on its exclusion of issues as beyond the scope of its jurisdiction. Such issues included broad questions of national security policy or U.S. nuclear policy, such as what nuclear materials or weapons were needed and what nuclear facilities should be built, or environmental questions that clearly fell under the jurisdiction of the EPA. In holding its public meetings, the Board members anticipated criticism for not including such questions on the agenda, and undertook to spell out the limits of the Board's responsibilities. The Board chairman made a practice of beginning meetings with a statement about the Board's jurisdiction and statutory charge. In particular, the Board underscored that its purview was technical questions as to the safety of DOE nuclear operations and not questions of national security policy.[389] For example, speaking about the restart of the K-reactor at Savannah River, Conway said,

> [T]his Board has no legal responsibility of determining what the tritium requirements are or whether or not it's in the Government's . . . security interest to proceed with the opening of the Plant. By law, that is the responsibility of the Department of Energy, the Secretary of Energy, specifically, and the President of

[386] On the activities of Representatives Skaggs in connection with Rocky Flats, see Len Ackland, *Making a Real Killing: Rocky Flats and the Nuclear West* (Albuquerque: University of New Mexico Press, 2002), esp., 205–6.
[387] *Public Meetings and Hearings, 1990,* 599.
[388] Interview, Joseph J. DiNunno, Board member, Annapolis, MD, Septmber 16, 2008.
[389] Interview, A.J. Eggenberger, Board chairman (since 2005; vice chairman, 1989–2005), Washington, DC, July 9, 2008.

> the United States. Our responsibility, as members of this Board, and our staff, our responsibilities are to assure that if and when the Plant is operated that it would not constitute an unreasonable risk to the public.[390]

He added, as he regularly did, that by "public" he meant workers, as well as people beyond site boundaries,

> And when we use the term "public," we included the workers at the Plant. That term, "public," is all-inclusive, off site, on site, workers and non-workers.[391]

The explicit definition of workers as a population of concern for the Board was a jurisdictional decision that Conway had made at the very outset of the Board's operations.[392] As Conway later observed,

> From the time this Board was established, right from the very beginning . . . this Board pointed out that as far as it was concerned, the health and safety of the public, by definition, we included worker within the public and we looked upon the law as requiring that.[393]

Despite the Board's efforts to explain the scope of the Board's jurisdiction as not extending to national security and nuclear deterrence policy, some participants in public meetings were unwilling to lay aside policy questions. Although they commonly acknowledged the technical expertise of the Board members and the thoroughness of their safety review efforts, such participants either did not heed, or did not accept the validity of, the separation of technical and policy questions. A spokesperson for the Energy Research Foundation at a Savannah River meeting, for example, prefaced her challenge of the Board with the statement, "I personally do not enjoy standing up and questioning the assurances of a group of men whose combined experience in the nuclear energy amounts to millions of years."[394] She then went on to explain why she insisted on questioning the need for any tritium-producing reactor, in view of the ongoing U.S. and Soviet arms reductions, rather than confining herself to technical questions on the readiness for restart of the Savannah River production reactor,

> Now we recognize that you don't consider that it's within your purview to consider the national security needs, but it is certainly obvious tonight . . . that many of us consider this to be the most pressing issue; the waste of resources,

---

[390] *Public Meetings and Hearings, 1991,* vol. II of II, 201.
[391] *Public Meetings and Hearings, 1991,* vol. II of II, 201.
[392] Interview, John E. Mansfield, Board vice chairman (since 2007; Board member, 1997–present), Washington, DC, August 25, 2008.
[393] *Public Meetings and Hearings, 1995, Before the Defense Nuclear Facilities Safety Board,* vol. I of II (Washington, DC: Defense Nuclear Facilities Safety Board, 1995), 184.
[394] *Public Meetings and Hearings, 1991,* vol. II of II, 216.

> prioritization, . . .the absence of any meaningful cost benefit analysis here. There is no forum for us to express that, unfortunately. Therefore, . . .we can [only] bring it up in hearings where it is expressly inappropriate, supposedly, like this one. Many of us have to overcome a great reluctancy.[395]

Others at the meeting similarly criticized or strayed beyond the topical boundaries defined by the Board. A private citizen broached the policy issue of the need for the construction of a new reactor, stating a preference for that alternative, if need be, over the restart of "those old decrepit reactors."[396] A spokesperson from an environmental group voiced objection to the readiness review's neglect of the issue of continuing environmental releases of hazardous materials. Such indications of discontent about the limits of the Board's agenda in its public meetings remained a feature of the meetings, notwithstanding the general appreciation of the Board's augmentation of transparency regarding the safety of operations in the weapons complex.[397]

Early Criticisms for Insufficient Transparency in the Board's Operations

More direct challenges to the Board came from parties still not fully satisfied with the openness to public scrutiny that the Board's manner of conducting business provided. Although the Board was assiduous in providing for the public openness of formal recommendations and the actions that followed their issuance, some critics found wanting the transparency of two aspects of Board activity. These were the internal deliberations among Board members and staff as they contemplated the issuance of a formal recommendation, and informal Board interactions with DOE yielding advice that did not culminate in the issuance of anything formal—that is, anything that needed to be made public.

The GAO articulated the latter concern—the concern about the Board's interaction with DOE—in a report requested by the Senate Governmental Affairs Committee on the first year of the Board's operations.[398] In this report, *Nuclear Safety: The Defense Facilities Nuclear Safety Board's First Year of Operation*, the GAO was on the whole very positive in its assessment of

---

[395] *Public Meetings and Hearings, 1991,* vol. II of II, 218. The Savannah River Site was the nation's sole producer of tritium, the hydrogen isotope that increases the explosive yield of thermonuclear weapons. Decaying about 5 percent a year, it must be periodically replenished in nuclear weapons. The end of the Cold War and the arms control agreements to reduce nuclear arsenals eliminated any immediate need to produce new tritium. To support the nation's enduring stockpile, existing tritium was recovered and recycled, mostly from decommissioned weapons.
[396] *Public Meetings and Hearings, 1991,* vol. II of II, 211.
[397] George, 132.
[398] GAO, *Nuclear Safety: The Defense Nuclear Facilities Safety Board's First Year of Operation*, 2–3ff.

the Board and its early accomplishments. However, the GAO took the Board to task for the degree to which its interaction with DOE and its operating contractors took place outside the public eye—in oral communications with DOE, undocumented briefings, and informal meetings. The GAO granted that such informal communications could prompt DOE to take needed corrective action. The report cited as an example DOE's change in its approach, based on its discussions with the Board, to reviewing and ensuring the seismic capability of the Savannah River reactors. The GAO was uneasy, however, that the needed change resulted from behind-closed-doors interaction between DOE and the Board. Such informal interaction limited the public's awareness of the Board members' health and safety concerns and of DOE's actions. According to the report, limiting the public's awareness could also jeopardize the Board's mission of restoring public confidence,

> [T]he public would have little more basis for confidence in the safety of DOE's defense nuclear facilities than it did when overseeing safety and health was an internal DOE function.[399]

Leaving the public without the assurance that the Board was independent in its decision-making, the lack of openness "could convey the impression that the Board is not operating 'at arm's length' from DOE."[400]

The GAO proposed several remedies to ensure the public's awareness of safety issues and its perception of the Board's independence, mainly, that the Board more intensively document all of its safety review activities in ways that would better capture them for the public record and congressional oversight. The GAO urged that the Board keep fuller records of conversations with DOE and information provided orally by DOE, and document all meetings, analyses and informal "commitments and agreements."[401] It also suggested that the Board establish written criteria to specify when findings about safety problems would result in the issuance of a formal recommendation.

In responding to the GAO report, the Board acknowledged the need to develop fuller publicly accessible records of its informal transactions—of its concerns and DOE's position on correcting safety and health problems. However, the Board was less amenable to the GAO report's suggestion that it pursue a more "arms length" relationship with DOE or that it

[399] GAO, *Nuclear Safety: The Defense Nuclear Facilities Safety Board's First Year of Operation*, 25.
[400] GAO, *Nuclear Safety: The Defense Nuclear Facilities Safety Board's First Year of Operation*, 23.
[401] GAO, *Nuclear Safety: The Defense Nuclear Facilities Safety Board's First Year of Operation*, 23–32.

formulate formal criteria for the issuance of recommendations. In defending its methods of operating in relation to DOE, the Board held that curtailment of its informal interaction would be self-defeating. Such curtailment would be at odds with the very kind of cooperative and intensive interaction that the Board considered a most appropriate and productive manner of dealing with highly complex technical issues—as well as a manner of operating fully compatible with independence.[402] As the Board stated in its first annual report to Congress,

> The GAO Report's admonishment to stay "at arms length" with DOE . . . obscures the fact that oversight organizations, including the GAO, IG Offices, and Committees of the Congress, are able to accomplish much of their mission when they work in cooperation with the officials of the agency being scrutinized. The fact that DOE has given the Board open access to its defense nuclear facilities, has frequently briefed the Board extensively on safety problems at sites, and has not resorted to an adversarial relationship with the Board does not mean the Board has failed to maintain its independence or desire to exercise judgment at "arms length." The Board's activities in closely reviewing the programs and practices of DOE and its contractor do not violate the principles of independence of judgment—in fact, our enabling statute demands a level of attention that could not be achieved if Board activities were limited to those that result only in formal recommendations. [403]

The Board's defense of its methods of operating in relation to DOE struck themes that also figured in its defense of its manner of conducting its own internal deliberations. Just as the Board valued its non-confrontational relationship with DOE, it affirmed the value of its internally collegial mode of interacting—interaction amongst the Board and its staff and other experts unencumbered by excessive formality and record-keeping.[404] In affirming its way of working, the Board answered an early challenge to its internal manner of operating, specifically, criticism that its internal workings were beyond public scrutiny. This challenge was more involved than the GAO's mild and never repeated rebuke, in that the challenge took the form of litigation whose final resolution spanned several years. The litigation centered on how open the Board needed to make its own deliberative processes prior to the issuance of a formal recommendation.[405] As Conway stated in the first appearance before the Senate Armed Services Committee five months into the life of the Board, "We have been sued by two organizations that

[402] Interview, Richard A. Azzaro, Board general counsel, Washington, DC, August 20, 2008. See also George, 141–42.
[403] DNFSB, [First] *Annual Report to Congress*, February 1991, 45–47.
[404] George, 115.
[405] George, 133.

have demanded that we have all of our meetings open to the public as we prepare our recommendations."[406]

In early 1990, the environmental groups, the Energy Research Foundation and the National Resources Defense Council (NRDC), challenged the Board's position that it was not an "agency" for purposes of the Sunshine Act and the Freedom of Information Act. These parties initially sought an injunction against Board activities, including site visits, until the Board promulgated regulations implementing these information statutes. The United States District Court for the District of Columbia ruled in favor of the Board on all issues, finding that the Board was not an agency.[407] On appeal, the Court of Appeals for the District of Columbia reversed, ruling that "the Board . . . must be considered an 'agency' within the meaning of both statutes."[408]

Following the Court of Appeals decision, the Board wrote and published a proposed Sunshine Act rule. After receipt of public comments on the proposed rule, the Board promulgated a final rule, which was promptly challenged by the same parties. The challenge focused on a single provision of the Board's rule, which allowed closure of Board meetings involving formal recommendations to the secretary of energy or the president. Oral argument was conducted by the Court of Appeals on November 14, 1991. On July 24, 1992, the court held that the Board's enabling statute permitted closed Board meetings on formal recommendations.[409] The court relied on the express language of the Board's enabling statute that recommendations were to be made public "after receipt by the Secretary of Energy" or the president in appropriate cases.[410] Therefore, the court concluded that the Board's Sunshine Act rule was legally sound.

On October 9, 1992, the Court of Appeals refused a petition for rehearing en banc. Petitioners then sought a writ of certiorari from the United States Supreme Court. On May 17, 1993, the Supreme Court issued an order denying the petition, thus terminating the litigation.[411]

Prevailing in court relieved the Board of pressures to alter its internal manner of operating in ways that it viewed as negative. As the Board understood their legal opponents'

[406] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 4.
[407] *Energy Research Foundation v. Defense Nuclear Facilities Safety Board,* 734 F. Supp 27 (D.D.C. 1990).
[408] *Energy Research Foundation v. Defense Nuclear Facilities Safety Board,* 917 F.2d 581, 585 (D.C. Cir. 1990).
[409] *NRDC/ERF v. Defense Nuclear Facilities Safety Board*, No. 91-1199 (D.C. Cir. 1992).
[410] 42 U.S.C. Section 2286d(a);g(3).

demands, they would have stood in the way of conducting meetings in private, and required advance public notice to be given of deliberations involving more than two Board members, an agenda to be published, and the deliberative meetings to be held in public. As Conway said, if required to "follow the letter of the law under the so-called Sunshine Act," "no more than two of us at any one time could ever meet and discuss something without it being a violation."[412]

The Board members shared the view that their exercise of effective safety oversight required their ability to confer freely amongst themselves and with DOE personnel without formal notification. As the Board members described the advantages of their way of working, they mentioned their capacity to respond quickly to issues as they came up, and their ability to elicit the information they needed from DOE without formal procedures. They also valued their freedom to operate unhindered as a team of experts, delving personally and collaboratively into the technical specifics of issues, sometimes via multiple informal interactions throughout the work day or while touring sites. As Conway said,

> We . . . bring our expertise to bear, and we meet daily and more than once per day as we review the papers, as we discuss among ourselves . . . where we think we have to move and what areas we should focus on. If, as we develop our recommendations . . . we would not be able to work as a collegial group preparing and working on our recommendations … [w]e would have to get staff to do that work.[413]

Board member Kouts elaborated on Conway's points, emphasizing timely action as a benefit of the Board's methods,

> I would reinforce what our chairman has said concerning the ability to meet and act together as a collegial group. This is absolutely necessary for the way we operate.
>
> You have heard various statements made concerning the Hanford waste tanks and the hydrogen problem. This problem came to our attention on one day. We met on it the same day. We got the Department of Energy in to talk to us the next day. We got our consultants in, in between, and we made arrangements to go to Hanford again with an agenda established the next day. All like that. And this would be absolutely impossible if we had to publish notices of our meetings 2 weeks in advance or 1 week in advance with agendas stated.

---

[411] *Natural Resources Defense Council* v. *Defense Nuclear Facilities Safety Board*, 969 F.2d 1248 (D.C. Cir. 1992), cert. denied, 508 U.S.906 (1993).
[412] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 32.
[413] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 32.

> We operate collegially. We work together collegially. We supplement each other's capabilities, and this is precisely why, as we come here before you, our chairman can speak for us.[414]

Conway added that the effect of more rule-bound operations and public notification procedures would be the transformation of the Board into something like a panel of judges, a "quasi-judicial . . . as opposed to a working unit." Without the ability of the Board members to meet freely, he said,

> It would be the staff that would be doing the preparing of the documents, and … and then we would meet like five judges, a judicial group, and listen to staff or someone else present their opinion and recommendations to us, and then make our decisions.
>
> We now are doing the work, and we are working on a daily basis as a team. [415]

For Conway, as well as for the other Board members and staff, any such shift in the direction of a "judicial group" went against the grain. They shared the general view of adjudicative processes as ill suited to technical complexities and to making the kind of substantive technical and scientific judgments that the Board's safety mission required. As they saw it, echoing the sentiments of the Senate Armed Service Committee, adjudicative processes could result in adversarial hearings, in opportunities for judicial appeals by activist groups bent on delaying action, and in an emphasis on legal processes at the expense of identifying and finding substantive solutions to nuclear health and safety issues.[416] The Board members' preferred alternative—in-depth informal dialog and non-confrontational, hands-on proceedings—need not, in their view, compromise either their commitment to transparency or their independence.[417]

[414] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 47.
[415] Senate, Armed Services Subcommittee on Strategic Forces, *Plans, Progress, and Experience to Date*, 32.
[416] Interview, Azzaro.
[417] DNFSB, [Second] *Annual Report to Congress*, 31–34.

CHAPTER 4: TECHNICAL NUCLEAR SAFETY ACTIVITIES OF THE BOARD

As the Defense Nuclear Facilities Safety Board (DNFSB or the Board) confronted and addressed various issues concerning its operating procedures, its technical oversight activities went on at an energetic pace, yielding seven sets of formal recommendations in the first year, and six sets in the second.[418] In conjunction with each of the sets of recommendations, the Board continued to work intensively with DOE on follow-up and to convene numerous public meetings to inform the public.

SITE-SPECIFIC SAFETY OVERSIGHT

In 1990 and 1991, the Board focused primary attention on the Savannah River Site, the Rocky Flats plant; the Hanford, Washington, site, specifically, the waste storage tanks; and the Waste Isolation Pilot Plant (WIPP) in New Mexico. Other sites received attention through the Board's coverage of generic issues and staff/contractor reviews.

Savannah River Recommendations: Readiness for Safe Reactor Restart

The Savannah River Site's production reactors ranked high among the Board's oversight priorities, because of the expected resumption of production activities. As the Board began operations, restart of the site's K-reactor was anticipated to occur in the near term. While in the end, Secretary of Energy Watkins delayed the startup of the K-reactor, not authorizing it until December 13, 1991, the Board, DOE, and its contractors worked under the assumption of a shorter time frame, and the Board spent considerable time from 1990 through 1991 monitoring DOE's progress toward restart.

As the Board members, staff, and consultants continuously tracked restart activities, they also held a series of eight public hearings/meetings, which generally involved the full Board, as well as the Board's General Counsel, Robert Andersen, and the Technical Director, Dr. George

[418] In accordance with a congressional mandate, the Board included a discussion of each year's recommendations in its annual report to Congress. For non-Board descriptions of the Board's early recommendations, see U.S. General Accounting Office, *Nuclear Safety: The Defense Nuclear Facilities Safety Board's First Year of Operation*, GAO/RCED–91–54 (Washington, DC, February 1991), 1–33, http://archive.gao.gov/t2pbat7/143684.pdf; and Bert Chapman, "The Defense Nuclear Facilities Safety Board's First Decade," *Journal of Government Information* 27

Cunningham. The meetings addressed the proposed actions and implementation of the three early recommendations that applied solely to the Savannah River Site, 90–1, on operator training; 91–2, on the process for closing outstanding safety issues; and 91–5, on the power limits question, as well as more broadly applicable recommendations—e.g., on standards and on radiation protection—which had portions pertinent to Savannah River's restart efforts.

The first of the Board's formal recommendations, 90–1, issued on February 22, 1990, called for training and qualifications upgrades of the operating personnel for the three Savannah River reactors.[419] According to the Board, DOE standards for training the reactor plant operators and supervisors were not adequately determined and specified. The Board recommended that DOE determine the qualifications operators must demonstrate before restarting the reactors and modify its training procedures to ensure that the workforce was qualified. In determining the requisite qualifications, DOE was advised to identify any differences between those it demanded and the qualifications prescribed by the NRC for analogous positions in civilian nuclear power plants. DOE was further urged to assess the current state of knowledge of each reactor operator and supervisor—using both written and oral examinations—in order to learn how to reshape the training program to instill the requisite skills for restart. In addition, the recommendation called for the training of operators in the revised procedures that would be sanctioned for normal operations and emergency situations. Finally, the Board called for the provision on an accelerated basis of as-built drawings of safety-related systems and procedures.[420]

The Board received DOE's plan to implement this recommendation from Secretary Watkins on July 13, 1990, and, later, a supplement that remedied a number of plan deficiencies identified by the Board. As stipulated in the final plan, the secretary kept the Board abreast of progress on the implementation of training improvements. DOE effected extensive retraining, focusing on K-reactor personnel, since the K-reactor was scheduled to restart first and, eventually, was the only reactor slated for restart. The Board continually monitored the retraining efforts, considering them critical to operational readiness. As Board member, John W. Crawford Jr., typically the lead Board member on technical personnel issues, pointed out, the Board

---

(2000): 355–62, 347, http://docs.lib.purdue.edu/lib research/70. The following discussions of Board recommendations are indebted to both the Board and non-Board sources.

[419] Defense Nuclear Facilities Safety Board, *Recommendation 90–1, Operator Training at Savannah River Site Prior to Restart of K, L, and P Reactors* (Washington, DC, February 22, 1990), 1, http://www.dnfsb.gov/pub_docs/recommendations/srs/rec_1990_01.txt.

[420] DNFSB, *Recommendation 90–1,* 1.

members, staff, and consultants devoted "more than 300 man hours of direct observation of the operating crews in the plant or the central control room simulator."[421]

Another recommendation issued in conjunction with Savannah River operations, Recommendation 91–2, *Closure of Safety Issues Prior to Restart of the K-Reactor at the Savannah River Site*; issued on March 27, 1991, concerned the process by which DOE would document the resolution or "closure" of safety issues prior to the anticipated restart of the K-reactor. The safety issues requiring resolution were compiled in the Reactor Operations Management Plan (ROMP) issued by the site's contractor. The ROMP identified some safety improvement measures as a precondition for the restart, because they related to the safe shutdown of the reactor in case of untoward events, e.g., a loss of coolant accident, or an earthquake, fire, or flood.[422] Other candidates for safety upgrades were not part of a safe shutdown system and not a potential impediment to restart, but were part of the post-restart safety improvement program. In either case, when progress on a problem culminated in closure of the issue, an issue closure package was drawn up. The Board monitored progress on settling issues in the ROMP partly through review of these issue closure packages. The Board's recommendation called for their improvement through fuller descriptions of the bases for closure claims and urged DOE to perform fuller reviews of the packages and the supporting evidence for the resolution of each issue.[423]

The third Savannah River recommendation, 91–5, grappled with the power limits question for K-reactor operations.[424] The recommendation was issued on December 19, 1991, six days after Watkins's announcement that the K-reactor would restart, resuming operations at 30 percent of what had historically been its full operating power. As the recommendation made clear, the Board concurred in the view that the reactor could be operated at the 30 percent level without undue risk to the public. After reviewing information provided in numerous briefings and documents, including the safety analysis report, the Board judged 30 percent power (720

[421] *Public Meetings and Hearings, 1991, Before the Defense Nuclear Facilities Safety Board*, vol. II of II (Washington, DC: Defense Nuclear Facilities Safety Board, 1991), 541.
[422] *Public Meetings and Hearings, 1991,* vol. II of II, 496.
[423] Defense Nuclear Facilities Safety Board, *Recommendation 91–2, Closure of Safety Issues Prior to Restart of K-Reactor at the Savannah River Site* (Washington, DC, March 27, 1991), 1, http://www.dnfsb.gov/pub_docs/recommendations/srs/rec_1991_02.txt.
[424] Defense Nuclear Facilities Safety Board, *Recommendation 91–5*, *Power Limits for K-Reactor Operation at the Savannah River Site* (Washington, DC, December 19, 1991), 1, http://www.dnfsb.gov/pub_docs/recommendations/srs/rec_1991_05.txt.

megawatts) to be acceptable, provided that the list of identified prerequisite improvements for startup was accomplished. The Board rendered a different judgment about higher power levels,

> The Board is of the opinion that the existing information on the effectiveness of the engineered safety features, especially those that would be relied on in the event of a large loss-of-coolant accident, does not at present support operation at a power level much above the 30 percent value.[425]

The Board added that if higher power levels were contemplated, the assurance of safe operations would require further improvement efforts, starting with more definitive studies on the thermal hydraulic methodology used in analyzing the K-reactor's core cooling performance under unusual conditions,

> The Board considers that justification of any increase in power would require further refinement of the thermal-hydraulic evidence on the cooling capability of the emergency cooling systems under accident conditions.[426]

Further recommended prerequisites for greater power levels included revised accident analysis and the implementation of controls for the models that the contractor developed, with the help of Los Alamos research programs, to analyze accidents.[427]

As the postponed restart of the K-reactor loomed closer on the horizon, the Board shifted its emphasis from highlighting safety-related shortcomings that needed to be fixed to assessing the progress in addressing them, and to assessing the reviews of safety issues performed by DOE and the contractor. As part of this assessment endeavor, the Board held several public meetings at the site in late 1991, to review the safety deficiencies and corrective actions in an open forum. In these meetings, the Board operated with a reduced number of members. Only four Board members were present to question DOE and contractor personnel and to make presentations and field questions, because of the death in September 1991 after a brief illness of Board member Edson Case. Case's successor, Joseph J. DiNunno, nominated in May 1992, was not confirmed until August 1992.

Proceeding as a team of four, the Board focused in these meetings specifically on the operational shortcomings that had to be resolved before restart, while acknowledging that other safety-related improvements would be ongoing, and their progress monitored. In the public meeting convened on December 9, 1991, just before the go-ahead for the K-reactor's restart was

[425] Defense Nuclear Facilities Safety Board, [Second] *Annual Report to Congress* (Washington, DC, February 1992), 11, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php.
[426] DNFSB, [Second] *Annual Report to Congress*, 11.

announced, the Board members asked in detail about preparations for the restart, inquiring both about the formality and conduct of operations and about specific technical engineering issues. The meeting was largely devoted to questioning the team of experts that conducted the operational readiness review (ORR) for DOE.[428] The Board went through a list of issues one-by-one, putting questions to the ORR team and asking that the team members in turn spell out the process by which each issue had been closed. Crawford pointed out that this exercise of spelling out the closure process not only helped the Board in its evaluation of the safety situation, but also served the "knowledgeable public."[429]

As the Board looked in succession at safety-related elements in the ORR team's review, each Board member, as usual, took the lead on particular issues. Crawford, for example, was the lead questioner on training, a critical element in DOE's operational readiness reviews.[430] Reviewing the progress made in training programs, he remarked on substantial improvement,

> Board members, their staff and outside experts have witnessed progressive improvement in discipline, conduct of operations, formality of face-to-face communications and procedural compliance. Understanding by the operating crews of the importance of this operating philosophy and practice . . . [and] this sense of personal responsibility for safe plant operation is a significant improvement over the read-and-do approach that predominated . . . at plant shutdown and it is approaching the level that one customarily finds in a Navy nuclear plant.[431]

Eggenberger inquired closely about the seismic qualification of various systems and components of the K-reactor, and also about a longer-term "phased approach to seismic upgrades."[432] And Kouts focused on thermal hydraulics and reactor piping.[433] In pursuing their point-by-point questioning about safety issues and their handling, the Board members frequently framed questions in comparative terms, using various reference points. Crawford commonly brought up

---

[427] DNFSB, *Recommendation 91–5*, 1.
[428] Interview, John E. Mansfield, Board vice chairman (since 2007, Board member, 1997–present), Washington, DC, August 25, 2008. As Mansfield stated, "In general, the Board considered DOE's conduct of ORRs to be in bad shape."
[429] DNFSB, *Recommendation 91–5*, 1.
[430] Crawford also contributed substantially to the Board's activities in the standards area and paid close attention to radiation protection issues. Personal communication, Kenneth M. Pusateri, Board general manager (1989–2006), Washington, DC, June 16, 2009.
[431] *Public Meetings and Hearings, 1991,* vol. II of II, 541.
[432] U.S. Congress, Senate, Committee on Governmental Affairs, *Accident and Explosion Risks at Department of Energy High-Level Radioactive Waste Facilities*, 101st Cong., 2d sess., July 31, 1990, 39.
[433] *Public Meetings and Hearings, 1991,* vol. II of II, 541.

practices in the Naval Reactors Program as his reference point, and others brought up practices sanctioned by the NRC in the commercial sector.

Speaking generally about the Board's findings in its questioning of DOE and contractor personnel, Kouts remarked on a "turnaround in attitude" among operations personnel since "the beginning of this process of improving the situation at Savannah River."[434] He spoke of "substantial resistance" initially to the change of culture that the secretary of energy had long urged, and remarked,

> At the outset, it was more common to say, "Why are you people bothering us? We've run a safe plant all these years. Why are you trying to change us?" But now you find that, really, people are enthusiastic about the changes that have been made and they feel they are accomplishing something?[435]

The final Board actions on the readiness of the K-reactor to resume operations took place in Washington, DC, where the Board met for further point-by-point examination of the adequacy of the measures taken to correct deficiencies with the potential to threaten public safety. In 1992 the K-reactor operated briefly for the last time, until, in 1993, it was placed in cold standby condition as the nation's tritium source, and, in 1996, in shutdown condition.[436] In 2000 the K-reactor building was converted to K Area Materials Storage Facility.

Rocky Flats Recommendations: Resuming Plutonium Operations

Besides Savannah River, another priority focus of the Board's attention throughout its first two years was DOE's Rocky Flats plant, where plutonium components of nuclear weapons—"plutonium pits"—were produced until the plant's 1989 shutdown for safety, health, and environmental problems.[437] The Board took up its oversight responsibilities at the plant as it moved toward the resumption of plutonium and other weapons-related fabrication activities. According to the plan at that time,

> [A] succession of facilities would be readied for renewed operation, beginning with Building 559 (the analytical chemistry laboratory), and followed by Building 707 and then others. This process was to include systematic upgrading of the quality of operations in each case, including Operational Readiness Reviews by

[434] *Public Meetings and Hearings, 1991,* vol. II of II.
[435] *Public Meetings and Hearings, 1991,* vol. II of II.
[436] Savannah River Site, "Savannah River History Highlights," May 20, 2008, http://www.srs.gov/general/about/history1.htm.
[437] For expansive historical background on Rocky Flats and its problems, see Len Ackland, *Making a Real Killing: Rocky Flats and the Nuclear West* (Albuquerque: University of New Mexico Press, 2002).

> the contractor and by DOE to verify that the desired improvements had been accomplished by line management.[438]

In connection with this restart plan, Congress gave the Board explicit special legal authority, stipulating that no plutonium production facility at Rocky Flats could resume operations without a determination by the Board that public health and safety were adequately protected.[439]

Rocky Flats' resumption of operations activities and the Board's oversight proceeded against a background of serious environmental and safety deficiencies at the site, as well as legal troubles. Several fires had occurred at the plant over the years, most notably, the major fires in 1957 and 1969, which got into the ventilation system and released radioactive contamination. The 1969 fire, the "second largest industrial fire in the United States in terms of dollar value," and eventually prompted fire-safety upgrades across the DOE nuclear complex.[440] By 1989, Rocky Flats was embroiled in legal troubles over environmental violations, with the contractor, Rockwell, under investigation by EPA and the Federal Bureau of Investigation (FBI).[441] This investigation, which lasted five years, found that DOE and Rockwell had failed to produce an adequate waste disposal analysis plan, and failed to store waste with a permit as required by the Resource Conservation Recovery Act (RCRA). They also had failed to maintain an accurate operations record and to provide written notification of incidents requiring a contingency plan.[442] These and other Rocky Flats problems culminated in a June 1992 plea bargain agreement between Rocky Flats contractor, the Rockwell Corporation, and the U.S. Department of Justice.

The charged history of problems at Rocky Flats provided the context of the Board's oversight activities at the site and dictated their intensity. The Board members not only knew that

---

[438] Defense Nuclear Facilities Safety Board, *Recommendation 92–5*, *Discipline of Operation in a Changing Defense Nuclear Facilities Complex* (Washington, DC, August 17, 1992), 1, http://www.dnfsb.gov/pub_docs/recommendations/all/rec_1992_05.txt.

[439] *National Defense Authorization Act for Fiscal Years 1992 and 1993*, Pub. L. No. 102–190, Section 3133, 105 Stat 1290, 1574, December 5, 1991. For discussion of this legal authority, see also a hearing on the proposed Federal Nuclear Facilities Licensing and Regulation Act, U.S. Congress, House of Representatives, Committee on Natural Resources, Subcommittee on Energy and Mineral Resources, *Federal Nuclear Facilities Licensing and Regulation Act,* 103rd Cong., 2d sess., March 1, 8, 1994, 240.

[440] *Public Meetings and Hearings, 1995, Before the Defense Nuclear Facilities Safety Board* (Washington, DC: Defense Nuclear Facilities Safety Board, 1991), 20. See also U.S. Department of Energy, Assistant Secretary for Defense Programs, *Assessment of Plutonium Storage Safety Issues at Department of Energy Facilities* (Washington, DC, 1994), 16.

[441] Ackland, 214–24.

[442] U.S. Congress, House, Committee on Science and Technology, Subcommittee on Investigations and Oversight, *Environmental Crimes at the Rocky Flats Nuclear Weapons Facility,* 102d Cong., 1st sess. ,Vol. 1, executive session: September 10, 11, 17, 18, 23, 24, 25, 30, 1992; public session: September 23, October 2, 5, 1992, 9. See also Vol. 2, September 17, 18, 1992.

they faced the site's numerous safety problems, but also believed that restarts of idled facilities after extended outages demanded special vigilance to ensure safety. Expressing a view often advanced by the Board, its Recommendation 92–5 stated,

> Experience shows that the resumption of operations at a facility that has been idle for an extended period, or the operation of a facility in a new mode created an above-average possibility of mistakes, equipment failures, and violations of safety requirements, all of which could cause accidents.[443]

Of immediate concern at Rocky Flats, as the Board ascertained during its first site visit in January 1990, was the accumulation of radioactive material, mainly plutonium, in the facilities' ventilation ducts and related systems. The Board issued a recommendation, 90–6, *Criticality Safety at the Department of Energy's Rocky Flats Plant, CO*, the third in its string on Rocky Flats, on June 4, 1990, on this debris accumulation.[444] In April 1990, DOE had revealed that some 62 pounds of plutonium had collected in the ducts. The Board's recommendation advised DOE, prior to resuming plutonium operations at the plant, to prepare a written program with commitments to address the problem. The proposed program's immediate objective was to evaluate and mitigate the hazards associated with the ducts' radioactive accumulation and, in particular, to address the risk of a criticality accident, an accident involving sufficient radioactive material to produce a self-sustaining nuclear fission chain reaction. The Board's concern was that the reported 60 pounds of fissile material posed the possibility of a criticality event, with the attendant threat of excessive radiation exposure, particularly to on-site operating personnel. Although DOE and several contractors had examined the criticality safety problem, they had not completed full characterization of the situation or plans for remediation actions.

The Board's recommendation called for an initial reduction of the amount of fissile material in a "prior to resumption" building-by-building duct cleanup, to ensure the prevention of criticality accidents. Stating an assumption of the cleanup, a DOE official at Rocky Flats said, "Under the most conservative assumptions, there can by no criticality event if the total quantity of plutonium involved is less than 400 grams."[445] The longer-term objective of the recommended program was to remove additional duct debris and to minimize the possibility of future

---

[443] DNFSB, *Recommendation 92–5,* 1.
[444]Defense Nuclear Facilities Safety Board, *Recommendation 90–6*, *Criticality Safety at the Department of Energy's Rocky Flats Plant, CO* (Washington, DC, June 4, 1990), 1–2, http://www.dnfsb.gov/pub_docs/recommendations/rfets/rec_1990_06.txt.
[445] *Public Meetings and Hearings, 1990, Before the Defense Nuclear Facilities Safety Board* (Washington, DC: Defense Nuclear Facilities Safety Board, 1990), 577.

accumulation of plutonium deposits in the ducts, "so that we don't get another sixty pounds of the stuff up there in the future."[446] The program was to prioritize specific remediation actions, including duct design and operational changes, and to assess criticality safety for individual lines, systems, and components. The program also needed to include justification of the techniques, modeling, and methodology used to study systems and to estimate gamma ray and fast neutron radiation levels in occupancy areas.[447] In responding to the Board's recommendation, the secretary instituted a debris removal program that involved systematic inspections, sample analyses, the use of a mock-up facility for a cleanup rehearsal, and the development of unique procedures for each duct.

Other important Board recommendations on Rocky Flats concerned operational readiness reviews prior to the resumption of plutonium processing. In the first ORR-related recommendation, 90–4, the Board urged DOE to conduct ORRs at Rocky Flats on a facility-by-facility basis, viewing them as important both to ensure the safety of the restart and to provide a well-documented public record attesting to the preparedness of DOE and the operating contractor safely to resume operations.[448] The Board followed closely the implementation of the ORR process at Rocky Flats, because it was expected to be a source of lessons learned and a model for the conduct of further ORRs. As the Board stated,

> The contractor, DOE, and the Board each recognized that the first ORR conducted at Rocky Flats would establish an important precedent for future ORR's, both at Rocky Flats and other defense nuclear facilities.[449]

On receiving DOE's implementation plan for 90–4, the Board suggested improvements. Subsequently, it found that DOE's ORR for Building 559, "the first building that DOE intends to start up" was conducted prematurely, that is, before known safety deficiencies were corrected or near closure.[450] Because of the status of the Rocky Flats ORR process as a model, the Board insisted that the ORR for the building be performed with close adherence to the implementation plan. To further this end, the Board issued Recommendation 91–4 on September 30, 1991, calling upon DOE to complete the operational readiness review for Building 559 only after

[446] *Public Meetings and Hearings*, *1990*, 595.
[447] DNFSB, *Recommendation 90–6*, 1–2.
[448] Defense Nuclear Facilities Safety Board, *Recommendation 90–4*, *Operational Readiness Review at the Department of Energy's Rocky Flats Plant, CO* (Washington, DC, May 3, 1990), 1–2, http://www.dnfsb.gov/pub_docs/recommendations/rfets/rec_1990_04.txt.
[449] DNFSB, [Second] *Annual Report to Congress*, 7.
[450] *Public Meetings and Hearings*, *1990*, 638.

safety problems were closed or nearly closed and the contractor had issued a Readiness to Proceed Memorandum. DOE's follow-on operational readiness review for Building 559 was completed in January 1992 and the resumption of operations authorized. Considered adequate by the Board, the readiness review addressed the elements that 91–4 had specified as necessary features of a satisfactory ORR. These elements included an assessment of the knowledge levels achieved during operator requalification, an examination of test records and safety systems, verification that plant modifications affecting safety systems were reviewed for any impacts on training and operating procedures, a review of accident analyses, and a description in the ORR team's final safety analysis report of issues still needing resolution before restart.[451]

Besides addressing ORRs, a feature of near-term restart preparations, the Board also recommended another type of review for Rocky Flats, a Systematic Evaluation Program (SEP) to assist planning for longer-term site upgrades of design and operations. The SEP that the Board envisioned resembled a program undertaken by the Nuclear Regulatory Commission in the early 1980s. That program, as the Board noted in its May 1990 Recommendation 90–5, was a means of evaluating older facilities against current safety standards, in order to prioritize and integrate potential plant modifications to assure safe operations. The Board urged that DOE conduct a similar SEP site-wide at Rocky Flats to review systematically outstanding safety issues and to assess the design adequacy and capacity of facilities to provide a reasonable assurance of safety under a variety of conditions. The Board advised that Rocky Flats' SEP address "over about the next four years" the potential effects on structures and equipment of severe external developments, e.g., natural phenomena, such as seismic events and high winds, and the effects of severe internal events, particularly fire. A particular focus was to be the capability of the ventilation systems under severe external and internal events. Additionally, the SEP would consider the basis and procedures for deciding which facilities would be backfitted and on what schedule.[452]

The Board underscored that its intent in calling for this "systematic and integrated" long-term planning mechanism was to ensure that safety-enhancing design improvements "should be

[451] Defense Nuclear Facilities Safety Board, *Recommendation 91–4*, *DOE's Operational Readiness Review Prior to Resumption of Plutonium Operations at the Rocky Flats Plant* (Washington, DC, September 30, 1991), 1–4, http://www.dnfsb.gov/pub_docs/recommendations/rfets/rec_1991_04.txt.

[452] Defense Nuclear Facilities Safety Board, *Recommendation 90–5, Systematic Evaluation Program at Department of Energy's Rocky Flats Plant, CO* (Washington, DC, May 17, 1990), 1–2, http://www.dnfsb.gov/pub_docs/recommendations/rfets/rec_1990_05.txt.

considered in an integrated manner to ensure that a balanced and integrated level of safety is achieved."[453] Integrated review could help ensure, for example, that enhancements of the seismic resistance of safety equipment were balanced in relation to improvements to the seismic capability of the building housing such equipment. In addition, as Recommendation 90–5 stated, "Use of an integrated program also would permit appropriate emphasis to be placed on improving defense in depth as a means for enhancing safety at the plant."[454] Under the concept of "defense in depth," as the Board used it, "Safety is assured through robust systems that use multiple layers of protection such that no single layer is depended upon to ensure safety."[455]

The Board's attention to the Rocky Flats SEP, like its focus on the site's ORRs, had ramifications that ultimately went beyond that particular site. Meant to further the enhancement of safety through design improvements, the Systematic Evaluation Program figured among the approaches the Board recommended to promote design adequacy in an integrated fashion. One Board member, Edson Case, remarked on a potential disadvantage of the SEP, namely, that its implementation could provide an excuse for deferring action on immediate safety issues, and he questioned DOE officials at Rocky Flats accordingly.[456] However, the Board members agreed on the SEP's general value as a mechanism to ensure that changes would not be haphazard and wasteful. The Board later linked the SEP more explicitly with other processes designed to ensure integration in planning, emphasizing, for example, that an effective SEP required a more thorough application of the systems engineering approach. Planning founded on the principles of systems engineering took into account the entire life cycle of a facility, including the phases of design, construction, operation, decommissioning and site restoration. The Board also later became more explicit about the types of studies that needed to be conducted as part of a SEP, for example, studies related to the assessment of seismic capabilities, such as site geologic fault investigations, vibratory ground motion studies, dynamic building analyses, and soil-structure interaction analyses.

[453] DNFSB, *Recommendation 90–5*.
[454] DNFSB, *Recommendation 90–5*.
[455] Defense Nuclear Facilities Safety Board, *Strategic Plan: FY 2003–2009* (Washington, DC: November 17, 2003), http://www.dnfsb.gov/pub_docs/dnfsb/rcsp_2003.pdf.
[456] *Public Meetings and Hearings*, *1990*, 616.

Hanford Recommendations: Nuclear Waste Safety and Waste Characterization

Besides the Board's Rocky Flats and Savannah River activities, which were predicated on the sites' resumption of production, the third major focus of the Board's attention in its early years of operation was DOE's Hanford facility, more specifically, the threats posed by Hanford's tank farm and waste operations.[457] The tank farm consisted of 177 tanks holding in total more than 50 million gallons of radioactive waste. Storage tanks at the Hanford site had been used since 1944 to hold wastes generated by Hanford's plutonium production—both radioactive and non-radioactive hazardous wastes and both liquids and solids.[458] For several years prior to the Board's start of operations, these tanks have been the subject of concern related to leaks, "'events' leading to worker exposure to tank vapors," and ill-defined risks of explosions and accidents.[459] With respect to the leakage, a November 1986 GAO study reported that the tank farm's 149 older, single-walled tanks, built from 1943 to 1964, had leaked approximately 500,000 gallons of high-level radioactive waste into Hanford soil.[460] With respect to explosion risk, debate had been ongoing for some time, notably, in the Senate Governmental Affairs Committee, about the susceptibility of the site's old single-shell high-level waste tanks to spontaneous explosion. It was feared that such an explosion could disperse a large amount of radioactive material to the environment.

When the members of the Board visited Hanford in December 1989 to investigate the waste tank issues, with specific attention to the possible explosion hazard, they were informed of an analysis conducted by the Hanford contractor, arguing that the possibility of an explosion in the tanks was low.[461] Technical experts retained by the Board reinforced this conclusion in March 1990, when they visited the Hanford site to continue the Board's investigation. They found no imminent risk of explosion posed by the single-shell tanks. The uncertainty about the chemical composition of the contents and physical conditions within the tanks were identified as matters of concern requiring further study. In addition, they reported on the problem of slurry growth and

[457] For an in-depth historical account of the Hanford facility and its problems, see Michele Stenehjem Gerber, *On the Home Front: The Cold War Legacy of the Hanford Nuclear Site* (Lincoln: University of Nebraska Press, 1992).
[458] Interview, John E. Mansfield, Board vice chairman (since 2007; Board member, 1997–present), Washington, DC, September 10, 2008.
[459] U.S. Congress, Office of Technology Assessment, *Hazards Ahead: Managing Cleanup Worker Health and Safety at the Nuclear Weapons Complex*, OTA–BP–O–85 (Washington, DC, February 1993), 55.
[460] U.S. General Accounting Office, *Nuclear Waste: Unresolved Issues Concerning Hanford's Waste Management Practices*, RCED–87–30 (Washington, DC, November 1986), http://archive.gao.gov/t2pbat23/131661.pdf. Other sources put the leakage at 1 million gallons of high-level waste.

associated hydrogen generation in some of the 28 double-walled tanks, an issue that had surfaced as a result of questions they had asked—an issue "potentially more serious than the questions related to the single-shell tanks."[462] These newer million-gallon double-walled carbon steel tanks, built from 1967 to 1986, were meant to replace Hanford's single-shelled tanks.

The serious concerns about the Hanford waste tanks prompted the Board to issue the third of its early recommendations, Recommendation 90–3, *Future Monitoring Programs at the Department of Energy's Hanford Site, WA* on March 27, 1990. Proposing a surveillance program, the recommendation called upon DOE to:

- study the chemical reactions in the single-shell tanks that could generate heat, potentially elevating the temperature sufficiently to trigger explosive ferrocyanide reactions;
- develop a program of continuous monitoring to detect conditions in the single-shell tanks that might signal the onset of instability in their contents, e.g., conditions such as rising temperature, physical deformation of the waste surface, or unusual components, such as hydrogen, in the tanks' cover gas;
- provide alarm indicators in the monitoring instruments to signal abnormalities;
- and develop an action plan to neutralize the conditions signaled by the alarms.[463]

The recommendation also made clear that the Board considered as potentially serious the conditions in the double-walled tanks experiencing slurry growth and associated hydrogen generation.

Following the issuance of its first recommendation on Hanford's waste storage tanks, the Board received DOE's implementation plan on August 10, 1990, and found it to be "insufficiently responsive," on the grounds that it did not reflect the urgency of the waste tank situation. The Board stated,

> It did not reflect the urgency that was merited by the circumstances . . . . It also did not appear that the contractor involved had been required to marshal the

[461] Senate, Committee on Governmental Affairs, *Accident and Explosion Risks*, 35.
[462] Interview, A.J. Eggenberger, Board chairman (since 2005; vice chairman, 1989–2005), Washington, DC, July 9, 2008.
[463] Defense Nuclear Facilities Safety Board, *Recommendation 90–3*, *Future Monitoring Programs at the Department of Energy's Hanford Site, WA* (Washington, DC, March 27, 1990), 1–2, http://www.dnfsb.gov/pub_docs/recommendations/hanford/rec_1990_03.txt. The Board held a public meeting on this recommendation at its Washington, DC, headquarters on January 14, 1991.

> managerial and technical resources required, nor to focus those resources on the problem in a measure commensurate with its gravity.[464]

After further site visits and discussions between the Board and DOE staff, the Board issued Recommendation 90–7, *Ferrocyanide Tank Safety at the Hanford Site*, on October 11, 1990, which addressed the same issues in greater detail and pressed DOE to step up its corrective actions. DOE was advised to accelerate its tank-sampling program, to expand its study of the chemical properties and explosive behavior of the tank contents, and to develop an emergency plan in the event of an airborne release of radioactive material from the tanks.[465]

The Board's concern with the uncertain characterization of the heterogeneous contents of the Hanford tanks persisted well beyond the Board's first two years of operations. Recommendation 93–5, issued on July 19, 1993, once again addressed Hanford waste tank characterization studies, citing a newly released DOE audit that found significant weaknesses in Hanford's sampling, laboratory, and core management activities. In Recommendation 93–5, the Board advised DOE to undertake a thorough reexamination of Hanford characterization efforts and a prioritization of the tank-sampling schedules, to expand laboratory capacity for tank sample analysis, and to assess the necessity of all the chemical analyses performed.[466] The Board's persistence in its push for waste characterization in the Hanford tanks reflected the members' view that knowledge of the contents of such tanks both at Hanford and elsewhere was crucial to the mitigation of their dangers in both the short and long run. As the Board stated,

> Characterization is essential for ensuring safety in the near-term during custodial management and remedial activities, and also in the long-term for advancing the development of permanent solutions to the high level waste problems at Hanford.
>
> The wastes in the Hanford tanks differ markedly from tank to tank. Without timely characterization of the wastes, the nature of the risks associated with the tanks cannot be fully assessed and, where necessary, mitigated. Further, until the characteristics of the wastes are known, final methods for monitoring, retrieval, transport, and treatment of wastes now in tanks cannot be realistically planned.[467]

---

[464] Defense Nuclear Facilities Safety Board, [First] *Annual Report to* Congress (Washington, DC, February 1991), 9, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php.

[465] Defense Nuclear Facilities Safety Board, *Recommendation 90–7*, *Ferrocyanide Tank Safety at the Hanford Site* (Washington, DC, October 11, 1990), 1–3, http://www.dnfsb.gov/pub_docs/recommendations/hanford/rec_1990_07.txt.

[466] Defense Nuclear Facilities Safety Board, *Recommendation 93–5*, *Hanford Waste Tanks Characterization Studies* (Washington, DC, July 19, 1993), 1–3, http://www.dnfsb.gov/pub_docs/recommendations/hanford/rec_1993_05.txt. See also Chapman, 359, and Gerber, 254–55.

[467] Defense Nuclear Facilities Safety Board, [Fourth] *Annual Report to Congress* (Washington, DC, February 1994), 32, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php.

The systematic monitoring and characterization of the contents of the waste tanks for which the Board called were a prerequisite for other tank waste remediation activities the Board would address, e.g., stabilization of the wastes for near-term custodial management, preservation of the integrity of the existing tanks, and planning for the construction of new tanks, as well as for the eventual development of permanent waste disposal solutions.[468]

COMPLEX-WIDE SAFETY ISSUES

In addition to the Board's site-specific review activities in its early years, the Board took up generic topics and issued recommendations applicable to most or all sites. Foremost among these were recommendations on the key topical areas of nuclear safety standards, and training and qualification of technical personnel.

Development and Application of Standards Related to Nuclear Safety: Key Problem Area

One of the earliest and most important Board recommendations was 90–2, *Design, Construction, Operation and Decommissioning Standards at Certain Priority DOE Facilities*, issued on March 8, 1990. The recommendation aimed to spur DOE toward an improved standards-based nuclear safety program through the development and revision of nuclear safety standards at selected priority sites, mainly, Savannah River, Rocky Flats, Hanford, and WIPP.[469] Recommendation 90–2 also proved to be the most problematic when it came to getting a satisfactory implementation plan from DOE.

The Board's early and persistent attention to the issue of standards was in keeping with the emphasis given to it in the Board's authorizing legislation. The Board's first statutory duty was to "review and evaluate the content and implementation of the standards relating to the design, construction, operation, and decommissioning of defense nuclear facilities of the Department of Energy (including all applicable Department of Energy Orders, regulations, and requirements) at each Department of Energy defense nuclear facility."[470] The Board shared the

[468] For a general account of tank waste remediation activities at Hanford, see Gerber, 248–58.
[469] Defense Nuclear Facilities Safety Board, *Recommendation 90–2, Design, Construction, Operation and Decommissioning Standards at Certain Priority DOE Facilities* (Washington, DC, March 8, 1990), http://www.dnfsb.gov/pub_docs/recommendations/all/rec_1990_02.txt.
[470] Pub. L. No. 100–456, Section 1441(a), 102 Stat 1918, 2077; this new language became chapter 21, Section 312(1) of the Atomic Energy Act of 1954. For a list of the orders subject to Board oversight in its first years, see U.S. Congress, Office of Technology Assessment, *Dismantling the Bomb and Managing the Nuclear Materials*,

recognition of its congressional oversight committees that "DOE did not have a well-developed set of requirements or a fully functional standards-based nuclear safety program."[471] In its initial work on standards at the four priority DOE facilities, the Board confirmed this recognition of deficiency, finding that standards and requirements to be used for safety reasons had not been established, were highly variable, or were far less specific than corresponding NRC standards.[472]

The first among the Board's recommendations urging DOE to correct the situation, 90–2, set forth three fundamental requirements. The first was to identify the applicable safety standards, DOE orders, technical standards, and other requirements. The Board also recommended that DOE provide its view on the adequacy of the standards. As in the case of other DOE improvement efforts, the Board recommended a comparative approach, stating a number of reasons,

> An important aspect of this standards assessment will be a comparative evaluation between nuclear and other standards used by the DOE for safety purposes and those which are used in the licensing and regulation of commercial nuclear power reactors.
>
> The Board in its review of requirements set forth in DOE's safety related Orders (and more recently Rules) has always used industry-wide regulatory standards as a frame of reference. The Board's reasons for doing so are two fold: (1) The collective experience of the Board and its staff is that compliance with such standards is essential for ensuring protection of public health and safety. (2) Congress has stated its expectation that the Board endeavor to bring nuclear safety at defense nuclear facilities up to the level of the commercial nuclear industry.[473]

Explaining its advocacy of a comparative approach further, the Board mentioned one additional reason in a public meeting,

> The Board has . . . proceeded on the assumption that the public wants to know, very importantly in an assessment of standards, how the standards the DOE . . . has used compare to those that pertain to analogous operations in the domain of

---

OTA–O–572 (Washington, DC, September 1993), 41, http://govinfo.library.unt.edu/ota/Ota_1/DATA/1993/9320.PDF.

[471] Joseph J. DiNunno, "Fundamentals for Understanding Standards-Based Safety Management of DOE Defense Nuclear Facilities," DNFSB/TECH–5 (paper prepared for the Defense Nuclear Facilities Safety Board Public Meeting On Standards-Based Safety Management, Washington, D.C., May 31, 1995), n.p., http://www.dnfsb.gov/pub_docs/dnfsb/tr_19950531.html.

[472] GAO, *Nuclear Safety: The Defense Nuclear Facilities Safety Board's First Year*, 15.

[473] U.S. Congress, Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996 and the Future Years Defense Program,* 104th Cong., 1st sess., March 28, April 25, May 2, 16, 18, 1995, 100.

> commercial nuclear power reactors and other nuclear activities in the commercial domain.[474]

The third action that Recommendation 90–2 urged upon DOE was to determine the extent of the implementation in the field of the identified standards. In response to 90–2, despite difficulties in drafting an acceptable plan, DOE committed to a comprehensive DOE-wide review of nuclear safety standards and to providing reports on progress to the Board. Regarding DOE's plan, especially for the key management tool to document standards, Standards/ Requirements Implementation Documents (S/RIDs), the Board later explained,

> The principal product of implementation was to be a set of facility-specific documents that set forth the applicable standards and requirements for a selected set of DOE's defense nuclear facilities. These were termed Standards/ Requirements Implementation Documents (S/RIDs). The S/RID was to contain those requirements considered necessary and sufficient for ensuring safety in the particular application. These were to be principally extracted from DOE Orders, appropriate standards, NRC guides, and similar sources. The S/RID was envisioned as the basis upon which work controls would be developed and implemented.[475]

Embarking on its promised actions, DOE strengthened its arrangements for managing its nuclear standards program and briefed the Board on its modifications. It also produced a prioritized list of nuclear safety orders needing upgrading or development, noting that the process would be "arduous,"

> The first set of Orders chosen for priority development includes: Personnel Selection and Training, Conduct of Operations, Occurrence Reporting, Safety Analysis Reports, Technical Safety Requirements, Unreviewed Safety Questions, Radiation Protection, Maintenance Management, and Quality Assurance. The process for issuing these upgraded Orders and Rules includes review by all Department of Energy elements that would be affected including DOE Field Offices, review by the Department's operating contractors, and finally, approval by the senior nuclear managers of the Department . . . . It is not unusual to receive 800 or more comments on a revised Order or Rule.[476]

DOE's implementation effort lagged behind the pace to which DOE committed in its implementation plan, prompting the Board on May 20, 1991, to write a stern letter to Secretary

---

[474] *Public Meetings and Hearings*, *1990*, 610.
[475] Defense Nuclear Facilities Safety Board, *Recommendation 95–2, Safety Management* (Washington, DC, October 11, 1995), http://www.dnfsb.gov/pub_docs/recommendations/all/rec_1995_02.html. The recommendation superseded Recommendations 90–2 and 92–5.
[476] *Public Meetings and Hearings, 1991, Before the Defense Nuclear Facilities Safety Board*, vol. I of II (Washington, DC: Defense Nuclear Facilities Safety Board, 1991), 482.

Watkins on the inadequacy of the effort with respect to all three of the Board's recommended actions. In its ongoing review of DOE's response to the Board's recommendation to assess the adequacy of standards, for example, the Board found that DOE has evaluated only two, and "then in only a limited and non-specific fashion,"

> These assessments appear to be quite superficial in content and in general convey the impression that a thorough review of even this limited group of Orders has not been undertaken. Finally, no criteria for determining the adequacy of Orders in general has been presented.[477]

The unimpressive content and pace of DOE's efforts on standards identification, assessment, and implementation provoked "continuing frustration" on the part of the Board, and prompted it to issue a number of additional recommendations in this key problem area, beginning with 91–1, *Strengthening the Nuclear Safety Standards Program for DOE's Defense Nuclear Facilities*.[478] Dated March 7, 1991, this recommendation applied broadly to all DOE defense nuclear facilities. It urged, among other things, improvement of the process by which DOE developed and implemented nuclear safety standards through upgrades of the standards development infrastructure "at Headquarters, in the field, and at contractors."[479] The Board also continued to issue recommendations addressing specific standards topics, e.g., 91–6, which urged DOE to compare its radiation protection standards to commercial industry standards, and 92–6, which called upon DOE to develop standards on operational readiness reviews.[480]

As DOE pursued its upgrades of standards and the standards development program, it made measurable progress in circumscribed spheres. As the Board noted, specific facilities managed to identify applicable DOE orders and ensure compliance as part of the operational readiness review process.[481] However, just the task of identifying requirements was formidable. At Rocky Flats, for example, just one element of the larger Standards Program—the Historic

---

[477] U.S. Congress, Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Years 1992 and 1993,* 102d Cong., 1st sess., April 23, May 9, 17, 22, 23, June 5, 12, 13, 19, 20, 1991, 615.
[478] DNFSB, [Second] *Annual Report to Congress*, 17.
[479] *Public Meetings and Hearings, 1991,* vol. I of II, 485.
[480] Defense Nuclear Facilities Safety Board, *Recommendation 91–6, Radiation Protection for Workers and the General Public at DOE Defense Nuclear Facilities* (Washington, DC, December 19, 1991), http://www.dnfsb.gov/pub_docs/recommendations/all/rec_1991_06.txt; and *Recommendation 92–6, Operational Readiness Reviews* (Washington, DC, August 26, 1991), http://www.dnfsb.gov/pub_docs/recommendations/all/rec_1992_06.txt.
[481] Defense Nuclear Facilities Safety Board, *Fifth Annual Report to Congress* (Washington, DC, February 1995), 79, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php. With reference to standards on ORRs, the *Fifth Annual Report* acknowledged adequate progress by DOE, stating, "In response to several Board recommendations, DOE has now developed and issued a nuclear safety order on operational readiness which, when properly used, is an

Building Standards Program—involved a considerable effort, as a manager with the contractor, EG&G Rocky Flats, Inc., reported,

> The Historic Buildings Program consisted of a broad "sweep" to identify source documents that were used as a design basis for the nine plutonium facilities . . . This sweep included selective searches of AEC/ERDA/DOE files; and of permanent federal record storage including project files; and, discussions with construction contractors, and RFP staff and retirees. The report, which has been submitted to the DOE, found reasonable records for buildings constructed since 1970 (Buildings 371 and 374) and weak records for buildings constructed between 1952 and 1970 (Buildings 771, 774, 776, 777, 779, 707, and 991). No decommissioning standards were identified.[482]

In the face of such challenges in a single standards-related task at one site, DOE continued to have difficulties in its far more comprehensive task of identifying, assessing and implementing standards complex-wide. DOE was long unable to produce an acceptable implementation plan, managing to do so only with a fifth draft of the plan in November 1994—a draft produced only with "the assistance of the [Board's] own Technical Director and General Counsel in order to get progress."[483]

After several years in which DOE continued to develop and implement facility-specific Standards/Requirements Identification Documents (S/RIDS), the Board closed Recommendation 90–2, consolidating the schedule for their issuance with Recommendation 94–5, *Integration of DOE Safety Rules, Orders, and Other Requirements*.[484] This recommendation urged DOE to continue issuing S/RIDS, while integrating them into a clear, coherent, and consistent standards-based nuclear safety program. In early 1996, after again addressing DOE standards in the still broader Recommendation 95–2, *Safety Management*, the Board notified DOE that 90–2 commitments would remain in effect until the ultimate disposition of outstanding actions were addressed in DOE's implementation plan for 95–2.[485]

---

effective tool for ensuring adequate protection of public health and safety prior to startup or restart of nuclear facilities."

[482] *Public Meetings and Hearings, 1991,* vol. I of II, 492.

[483] John W. Crawford Jr., *An Assessment Concerning Safety at Defense Nuclear Facilities: The DOE Technical Personnel Problem*, DNFSB/TECH–10 (Washington, DC: Defense Nuclear Facilities Safety Board, March 1996), 15, http://www.cnfsb.gov/pub_docs/dnfsb/tr_199603.html.

[484] Defense Nuclear Facilities Safety Board, *Recommendation 94–5, Integration of DOE Safety Rules, Orders, and Other Requirements* (Washington, DC, December 29, 1994), http://www.dnfsb.gov/pub_docs/recommendations/all/rec_1994_05.txt.

[485] DNFSB, *Recommendation 95–2*. The *Fifth Annual Report* offered a number of observations on progress on Recommendation 90–2, including: "(1) both Secretary Watkins and Secretary O'Leary have committed the Department to a requirements-based safety program; (2) DOE has made some progress in moving towards a

As the Board continued to press DOE in its standards effort, it attributed the Department's slow pace and difficulties to a number of causes, some very long-standing and some more recent. A near-term potential hindrance of concern to the Board was DOE's decision under Admiral Watkins to transition from the use of the Orders system to the "promulgation of nuclear safety requirements through rulemaking"—a process that tended to be time-consuming.[486] DOE adopted this approach after the Price-Anderson Amendment Act of 1988 (Pub.L. No. 100–408) gave DOE new authority to impose penalties on its indemnified contractors for violations of nuclear safety requirements when these requirements were promulgated in accordance with the Administrative Procedure Act (Pub.L. No. 89–55). The Board acknowledged the benefits that DOE anticipated from the transition to notice and comment rulemaking, namely, "uniform, enforceable requirements and . . . greater opportunities for public input into the process for establishment of requirements."[487] However, the Board repeatedly urged DOE, including in 94–5, not to allow this transition to delay or relax the ongoing effort to upgrade requirements and to incorporate them into the terms of management and operations (M&O) contracts. [488] As 94–5 advised,

> Impending developments should not be taken as cause for a slow-down on compliance efforts or the upgrading of applicable requirements now in Orders and contracts.[489]

Among more long-standing hindrances to the timely upgrade of standards were, as Crawford said in a hearing, "a mentality and a culture that had tended to deprecate the need for standards."[490] A continual theme of the Board was that DOE had long manifested an "expert-based" culture, rather than a '"standards-based" culture. That is, DOE relied for the achievement of safety on the expertise of individuals, rather than on standards that provided a definite and

---

requirements-based safety program; (3) unrelenting attention by the Board caused DOE to achieve an adequate level of compliance with standards before restarting several facilities shut down for safety reasons . . . . (5) a great deal of work remains to be done, both to erect a complete, adequate set of safety requirements for DOE's diverse operations and to implement these requirements at the field level."

[486] DNFSB, *Recommendation 94–5*. See also DiNunno, "Fundamentals for Understanding Standards-Based Safety Management."

[487] DNFSB, *Recommendation 94–5.*

[488] U.S. Department of Energy, *Annual Report to Congress, Department of Energy Activities Relating to the Defense Nuclear Facilities Safety Board: Calendar Year 1995*, DOE/S–0115 (Washington, DC, March 1996), II–3. By the end of 1995, the conversion of nuclear safety directives to rules had produced four rules, with eight others in process.

[489] DNFSB, *Recommendation 94–5.*

[490] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1993*, 243.

uniform set of explicit expectations. DiNunno touched upon this reliance on expertise, when publicly questioning a readiness review team member about the basis for his judgments about order compliance in a facility. DiNunno observed,

> I am left with the feeling that I'm relying on your judgment as an expert. And I am not diminishing that in any way, but it isn't quite as regularized and criteria-based as we are stressing in an order compliance review.[491]

This expert-based culture that the Board confronted in DOE was deeply ingrained, particularly at Los Alamos, Lawrence Livermore, and Sandia National Laboratories. The laboratories' high concentration of scientists and engineers, as opposed to production personnel, contributed to their disinclination to be bound by standards.

Notwithstanding the resistance to change at the laboratories, Conway made the case there as elsewhere for a shift from an "expert based" culture, making explicit one key reason in a public discussion of a review of order compliance at Los Alamos. He connected the need to establish a "standards-based" culture in the weapons complex with one aspect of "technical personnel problem"—the dearth and ongoing loss of technical expertise as the DOE nuclear complex downsized.

> One of the concerns that this Board has had, and we've expressed it in recommendations to the Secretary, is that particularly now with the encouragement by the laboratory for many of your personnel to take early retirement, we are losing much of the experience that the lab has had over the years, where you were able to operate facilities because of the technical know-how and experience of personnel.
>
> But as new people come in, new technicians come in, without having the mentoring of the older experienced personnel, we're liable to lose some of that technical capability. The only way we know . . . to assure ourselves . . . is to have certain standards, requirements and orders that are complied with and procedures to do so.
>
> So that's one of the reasons that this board is giving a great deal of attention to the need to have written procedures and that they be rigidly adhered to.[492]

In short, the Board viewed the establishment of a standards-based nuclear safety program as a means to ameliorate to a degree the loss of unique technical know-how in the weapons complex.

---

[491] *Public Meetings and Hearings, 1994*, *Before the Defense Nuclear Facilities Safety Board* (Washington, DC: Defense Nuclear Facilities Safety Board, 1994), 85.
[492] *Public Meetings and Hearings, 1994*, 39.

The Board's Concern for Technical Personnel Quality in the DOE Nuclear Complex

Although the Board always underscored the benefits of standards-based operations, it also regularly emphasized that standards could be effective only if there were trained and qualified, technically competent personnel to use them. In all of its early annual reports, the Board flagged the "technical personnel problem" as the "most important and far-reaching problem affecting the safety of DOE defense facilities."[493] As with the Board's sustained involvement in urging DOE to discharge its commitments in the standards area, the Board applied persistent pressure on DOE to upgrade the technical qualifications of personnel throughout the DOE nuclear complex. In addressing the technical competency issue, the Board sometimes referred to the technical levels of both DOE personnel and the workforce in contractor organizations. More often, the Board's advice was directed to strengthening the technical capabilities of DOE personnel specifically, as those responsible for directing the work of contractors, including their training initiatives.

The Board issued a succession of recommendations on various aspects of the technical competency issue, beginning with the Board's very first recommendation calling upon DOE to upgrade the training and qualification of operating personnel at Savannah River. The Board acknowledged progress achieved at Savannah River. Crawford, for example, who brought from his leadership position in the Naval Reactors Program a strong interest and expertise in personnel matters, applauded DOE's initiatives to provide reactor operators with technical primers modeled on educational materials in the navy nuclear program. He also approved of the oral examinations that DOE instituted to supplement written tests in its assessment of operator knowledge.[494] However, the Board was disappointed in its expectation that training successes in the restart efforts at Savannah River would prompt DOE to take similar technical personnel initiatives elsewhere. As Crawford recalled,

> The Board soon discovered that DOE had not profited from the lesson it should have learned at K-Reactor. As other facilities at the Savannah River Site were being readied for operation, the Board repeatedly found it necessary to use its own personnel to make sure that operators were properly trained and qualified. The

[493] DNFSB, *Recommendation 93–3*, *Improving DOE Technical Capability in Defense Nuclear Facilities Programs* (Washington, DC, June 1, 1993), 1–4, http://www.dnfsb.gov/pub_docs/recommendations/all/rec_1993_033.txt. See also George, 137.
[494] *Public Meetings and Hearings, 1991*, 100–101.

> Board was spending too much time doing work that was DOE's responsibility, but which DOE was not doing due to a lack of qualified technical personnel.[495]

After the Board had a chance to observe the actions undertaken in response to its first recommendation, it followed up with the broader generic Recommendation 92–7, *Training and Qualification*, which dealt with training and qualifications programs complex-wide.[496] The recommendation found that technical personnel and supervisors at the facilities often lacked sufficient understanding of the fundamentals of engineering, chemistry, nuclear physics, and radiation protection to operate safely. At the same time, as at Savannah River's K-reactor, the tools to appraise operator understanding consisted largely of unchallenging written examinations. The Board urged that DOE take corrective measures, including the expansion of senior management's involvement in nuclear safety training at all levels in DOE and contractor organizations, and the strengthening of organizational units responsible for training and qualification.[497]

A third key recommendation on the personnel problem, Recommendation 93–3, *Upgrading DOE Technical Capability*, focused exclusively on raising the "in-house" technical capability of the DOE organizations responsible for safety in the nuclear complex—both the line and oversight organizations operating both at headquarters and in the field. The recommendation called upon DOE to establish as a primary agency goal the attraction and retention of exceptional scientific and technical personnel. Such strengthening of technical expertise within DOE was one of the primary congressional assignments for the Board, as the Senate Conference Report that accompanied the Board's enabling legislation stated: "The Board is expected to raise the level of technical expertise in the Department substantially."[498] Congress recognized, as had other evaluators, that DOE lacked sufficient technical capabilities to provide effective management of contractor personnel in the weapons complex. Many pointed to an imbalance between DOE and

---

[495] Crawford, 24.
[496] Defense Nuclear Facilities Safety Board, *Recommendation 92–7*, *Training and Qualification* (Washington, DC, September 22, 1992), 1–2, http://www.dnfsb.gov/pub_docs/recommendations/all/rec_1992_07.txt.
[497] DNFSB, *Recommendation 92–7*, 3–4. Line and oversight positions involved with nuclear safety were found in the office of the assistant secretary for defense programs (DP) and in the offices of the assistant secretaries for environmental management (EM) and for environment, safety, and health (EH). In 1992 a reorganization consolidated oversight and enforcement of nuclear safety functions within EH, placing the oversight of DOE field offices and contractors in the hands of DOE employees outside of line management.
[498] S. Rep. No.100–232 (to accompany S. 1085), at 20–21 (1987).

the contractors, in which the latter's superior technical capabilities forced DOE to place "inordinate reliance on contractor intentions and capabilities"[499]

The origins of this DOE–contractor disparity in technical skills lay in the past, in the division of functions between DOE's predecessor organization, the AEC, and the contractors. As Crawford explained,

> The technical aspects of programs and activities were, for the most part, handled by the AEC's laboratories and industrial contractors. Government organizations confined their activities mostly to contractual, budgetary, and administrative matters.[500]

Carrying forward this traditional division of functions, Crawford observed, "DOE did not build up the cadres of strong technical capability "in-house" to the degree needed to provide effective technical line management direction and guidance."[501] He added, "Without an equivalent level of technical competence, DOE managers cannot effectively engage in technical dialogue with their laboratory and contractor counterparts."[502] He contrasted the unequal DOE–contractor relationship with the situation that prevailed in "the Naval Reactors organization,"[503]

> The U.S. Navy, under Admiral Rickover . . . had a small, but superb . . . cadre of people, well educated technically . . . always in a position of ascendancy vis-à-vis the contractors. We were never, ever dependent for technical choices by deferring to Westinghouse or General Electric or whomever . . .you have to have interior, in-house capability.[504]

In the terminology that Admiral Rickover had used, the strong technical qualifications of personnel in the Naval Reactors Program allowed the navy to perform as a "demanding customer" vis-à-vis its participating contractors. For Crawford and others on the Board, DOE needed to build similar technical strengths, in order similarly to act as a demanding customer.

After the issuance of 93–3, the Board complained of insufficient progress on the commitments that DOE made in response to it and other admonitions about the technical personnel problem. The Board ascribed DOE's personnel problem, in part, to the DOE's lack of excepted appointment authority for technical personnel. As Crawford said,

---

[499] DNFSB, [First] *Annual Report to Congress*, 30.
[500] Crawford, 3.
[501] Crawford, 3.
[502] Crawford, 6.
[503] DNFSB, [First] *Annual Report to Congress*, 30.
[504] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1993*, 246.

> In a market of limited numbers of highly competent nuclear technology personnel, it has long been evident that government agencies have difficulty hiring and retaining such personnel under the Civil Service System.[505]

The Board urged DOE to seek from Congress, as the Board had earlier successfully done for itself, a legislative change granting DOE additional hiring authority. The Board's general counsel, Robert M. Andersen, described the actions taken by the Board on DOE's behalf, stating,

> Obtaining this legislative change for DOE took many months and the combined efforts of the Board and some within DOE . . . some DOE officials were reluctant and slow to initiate action. The Chairman of the Board met with the Secretary of Energy, officials in the Congressional Affairs Office, and the Assistant Secretary of Energy for Human Resources on numerous occasions to try to jump start the proposal. Mr. Conway used every opportunity to testify before Congress regarding the need for DOE excepted appointment authority and the Board's successful use of its excepted authority in attracting fully capable people to staff positions.[506]

Andersen added that he and the Board's general manager, Kenneth M. Pusateri,

> Slowly overcame opposition to the proposal within DOE, the Office of Management and Budget, and Office of Personnel Management. A draft legislative proposal was prepared and given to DOE.[507]

With the Board's assistance and "prodding," as Crawford put it, DOE sought and was finally granted expanded excepted service personnel authority. Congress increased DOE's excepted service authority, effective in 1995, from 200 to 400 technical personnel positions. DOE's corrective actions on the technical personnel problem, however, continued to disappoint the Board. Among other things, DOE failed to use of its augmented hiring authority "aggressively and effectively" to raise the technical expertise of its staff.[508] Crawford's overall assessment, seconded by the rest of the Board, of DOE's corrective action on the technical personnel problem was blunt, "DOE's efforts to attract and retain highly technically competent scientists and engineers . . . have been unsuccessful."[509]

---

[505] Crawford, 26.
[506] Statement of Robert M. Andersen, General Counsel, Defense Nuclear Facilities Safety Board, Public Meeting, January 23, 1996, http://www.dnfsb.gov/pub_docs/dnfsb/tr_199603_09.html. Also included as Appendix H in Crawford, H/1–H/17.
[507] Statement of Robert M. Andersen, in Crawford, H/7–H/8.
[508] Crawford, 26.
[509] Crawford, 26.

CHAPTER 5: POST–COLD WAR REDIRECTION OF THE DEFENSE NUCLEAR COMPLEX AND IMPLICATIONS FOR THE BOARD'S WORK

DOWNSIZING AND MISSION CHANGE IN THE COMPLEX: NEW DUTIES FOR THE BOARD

For the first several years that the Board was in operation, Board recommendations and Department of Energy (DOE) implementation plans had been predicated upon resumption of production at a number of major sites in the DOE nuclear complex. In the course of 1992, however, a different trajectory for those sites and the entire complex became clear. The abrupt declaration of the end of the Cold War in November 1990 and the dissolution of the Soviet Union in late 1991 had already signaled a rapid reduction in U.S. nuclear weapons stockpile requirements and a sharp curtailment of the processing of nuclear materials. Then, in late 1992, the Senate's ratification of the historic Strategic Arms Reduction Treaty (START I), and congressional passage of a moratorium on nuclear weapons testing, brought about the cessation of the production and testing of nuclear weapons.[510] With these changes, the mission and activities of DOE's weapons complex shifted sharply away from its primary mission for nearly half a century, weapons production and testing.[511] The new mandate of the DOE nuclear weapons complex in regard to weapons was to manage the remaining weapons stockpile, to dismantle thousands of surplus nuclear weapons, and to pursue alternatives to the testing of nuclear weapons, while maintaining testing capability. DOE also faced the tasks of bringing many sites and facilities to a safe shutdown condition and of preparing decaying and contaminated facilities for decontamination and decommissioning (D&D). As Board Chairman John T. Conway noted,

[510] A. Costandina Titus, *Bombs in the Backyard: Atomic Testing and American Politics* (Reno: University of Nevada Press, 1986), 144. When the Soviet Union dissolved into 15 republics in December 1991, the Soviet nuclear stockpile was dispersed among four of the successor states—Russia, Ukraine, Belarus, and Kazakhstan. The United States and the four nuclear states entered into the first Strategic Arms Reduction Treaty (START I), which reduced the U.S. inventory of intercontinental nuclear weapons from roughly 12,000 to 9,000 and the combined former Soviet force from 10,000 to 6,500. On the testing moratorium, see Titus, 146, and Jonathan Medalia, "Nuclear Testing and Comprehensive Test Ban: Chronology Starting September 1992," *CRS Report for Congress*, Order Code 97–1007 F, Updated June 9, 2005 (Washington, DC: Congressional Research Service, Library of Congress, 2005). The moratorium on testing, initially for nine months, was enacted on October 2, 1992, in the form of an amendment to the Energy and Water Development Appropriations Act (Pub.L. No. 102–377). The United States conducted its last U.S. test in 1992, just before START I and the testing moratorium became effective. Extended several times during the Clinton administration, the moratorium remained in effect throughout the Clinton presidency, as President Clinton unsuccessfully pushed the Senate, with its Republican majority after 1994, for ratification of a comprehensive test ban treaty.

"Such nuclear materials processing as [would] still be done would be to convert residue, semi-processed materials to more stable chemical forms for safe storage."[512] DOE's new tasks entailed a mammoth cleanup of the radioactive contamination that had accumulated over 50 years—a cleanup projected to require decades and hundreds of billions of dollars.[513]

Broadened Board Jurisdiction and Activities

The realignment and downsizing of the weapons complex and the change in DOE's mission shifted the focus of the Board's oversight away from the now abandoned restart activities at various production facilities. However, as the decision to halt production eliminated some weapons-production activities from the Board's purview, the Board acquired new responsibilities related to nuclear weapons oversight. Concurrently with the transition from the Cold War production system in the weapons complex, Congress broadened the scope of the Board's jurisdiction, with the passage of the National Defense Authorization Act for Fiscal Years 1992 and 1993 on December 5, 1991.[514] Congress amended the Board's authorizing statute, adding the assembly, disassembly, and testing of nuclear weapons to the Board's health and safety responsibilities. With this amendment, the Board acquired new safety oversight responsibilities for the Nevada Test Site, and for the Pantex facility in Amarillo, Texas, where most of the newly expanded activities of weapons dismantlement would take place. With this broadened jurisdiction, the Board's mandate included most nuclear weapons facilities and activities, with the exception, still, of the navy's nuclear programs.[515] To accommodate the

---

[511] Terrence R. Fehner and Jack M. Holl. *Department of Energy, 1977–1994: A Summary History* (Washington, DC: U.S. Department of Energy, November 1994), 94–95, http://www.osti.gov/bridge/servlets/purl/10106088-mgIkuD/webviewable/10106088.PDF.

[512] U.S. Congress, Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996 and the Future Years Defense Program,* 104th Cong., 1st sess., March 28, April 25, May 2, 16, 18, 1995, 98.

[513] Since the late 1980s, numerous estimates of cleanup costs had appeared, usually placing the costs in the $100–$150 billion range. In 1996, in response to a congressional charge, DOE produced a report on costs, which proposed the figure of $227 billion. See U.S. Department of Energy, Office of Environmental Management, *1996 Baseline Environmental Management Report: Executive Summary* (Washington, DC, July 1996), http://www.em.doe.gov/bemr/pages/bemr96.aspx.

[514] *National Defense Authorization Act for Fiscal Years 1992 and 1993*, Pub.L. No. 102–190, 105 Stat 1290 (1991).

[515] Interview, John W. Crawford, Jr., Rockville, MD, September 21, 2008. Crawford ascribed the exemption of the navy's nuclear programs from Board oversight largely to the navy's record of, and reputation for, strong safety management.

Board's added responsibilities, which would substantially increase its workload, Congress raised the Board's statutory personnel ceiling from 100 to 150 full-time employees.[516]

The addition of weapons-related activities to the Board's jurisdiction involved the Board in the safety aspects of nuclear weapons dismantlement. As a result of the national commitment to nuclear weapons reduction, approximately 2,000 weapons per year were slated for dismantlement, mostly at Pantex, but also at the Y–12 plant at Oak Ridge, Tennessee, with input in both cases from the national weapons laboratories.[517] The Board's increased responsibilities also included safety oversight of activities involved in the maintenance of the smaller nuclear weapons stockpile and in preparations to expand the storage of strategic fissionable materials retrieved from dismantled weapons—e.g., weapons-grade plutonium and enriched uranium. Finally, the Board took up additional tasks related to stockpile stewardship, which involved increased activities by the weapons laboratories carried on as an alternative to nuclear weapons testing.

In addition to the new duties associated with its expanded jurisdiction in the weapons arena, the Board acquired augmented responsibilities having to do with the expansion of DOE's remediation of nuclear residues, wastes, and other legacies of the nuclear arsenal buildup.[518] The Board was already engaged in considerable efforts to address the threats posed by such wastes and residues of production, most notably, in its push at Hanford to remedy the uncertain characterization of the radioactive wastes in the storage tanks, and in its initiatives at Rocky Flats to address radioactive materials accumulated in ventilation ducts.[519] However, with the higher priority now given to waste stabilization and cleanup/decontamination throughout the complex, the Board's mandate in the area of the residues of nuclear materials production became even

[516] For additional amendments to the Board's authorizing legislation, see *Energy Policy Act of 1992* (Pub. L. No. 102–486, 106 Stat 2776, Oct. 24, 1992), and *National Defense Authorization Act for Fiscal Year 1994* (Pub. L. No. 103–160, 107 Stat 1547, Nov. 30, 1993).
[517] U.S. Congress, Office of Technology Assessment, *Dismantling the Bomb and Managing the Nuclear Materials*. 42–49, OTA–O–572 (Washington, DC, September 1993), http://govinfo.library.unt.edu/ota/Ota_1/DATA/1993/9320.PDF.
[518] For background on nuclear waste and environmental remediation as viewed in 1994, see U.S. Congress. Congressional Budget Office, *Cleaning Up the Department of Energy's Nuclear Weapons Complex* (Washington, DC, May 1994), http://www.cbo.gov/ftpdocs/49xx/doc4914/doc26.pdf.
[519] For an extensive non-Board, non-DOE account of cleanup issues at Rocky Flats, see Len Ackland, *Making a Real Killing: Rocky Flats and the Nuclear West* (Albuquerque: University of New Mexico Press, 2002), esp., 203, 220–42.

more encompassing.[520] The Board's oversight responsibilities extended to all of the major sources of radiological threat throughout the DOE defense nuclear complex, including waste tanks apart from Hanford's, deteriorating reactor fuel in storage basins, and radioactive materials left in production lines. In addition, the Board's purview included the decontamination and decommissioning of facilities—activities that were expected to grow as DOE reconfigured the complex, consolidating and shutting down certain facilities, e.g., at Fernald, the Mound Laboratory, Savannah River, and Hanford.

Cutoff of Defense Production, Heightened Safety Challenges Requiring Board Oversight

The Board regularly noted that the changed mission and downsizing of the weapons complex had a significant impact on the Board's safety-related activities, shifting their focus. At the same time, the Board members also frequently pointed out that this shift of focus would not entail any reduction in the need for safety oversight or in the technical challenges that ensuring safety entailed. For example, as Chairman John T. Conway said in congressional testimony, "It is tempting to conclude that the reduction of weapons production activities at DOE facilities means that safety oversight can be reduced."[521] However, as he added on another occasion,

> The reduction of weapons production activities at DOE facilities does not mean that safety management and oversight can be reduced. The reality is that independent technical oversight continues to be needed in order to ensure that both the workers and the public are adequately protected.[522]

Indeed, far from diminishing safety problems requiring technical solutions, the new situation in the DOE complex magnified safety challenges. Conway said,

> With the shut down of many DOE facilities, the conditions and hazards being faced by DOE are potentially more urgent and present a more serious safety problem than when the facilities were in operation.

---

[520] On DOE's view of the cleanup task, see Fehner and Holl, 87–88. See also Titus, 157–59. As Titus recounts, under the Energy and Water Development Act for 1992, Congress created the Defense Environmental Restoration and Waste Management Account to specify the level of funding for the cleanup program. Additional accounts were set up in 1998 and 1999 to expedite the remediation of 113 contaminated sites—all but 10 by FY 2006. The 10 sites, the largest and most contaminated, were slated for long-term remediation not to be completed until 2070, at an additional estimated cost of $147 billion.

[521] U.S. Congress, Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1995 and the Future Years Defense Program,* 103rd Cong., 2dt sess., February 8, March 2, 3, 8, 9, 15, 23, April 20, 1994, 920.

[522] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 99.

Conway elaborated on the heightened risks involved in the processes of "shutting down," explaining,

> Many technical issues arising from the DOE's change in mission have never been addressed before; others involve operations and processes that are new to the nuclear weapons industry. For example:
>
> - As a facility is deactivated and decommissioned, the workers are subjected to more hazardous conditions than during operation. The workers will come into closer contact with radioactive materials, enter portions of facilities that were not intended to be occupied and will face other unexpected conditions.
> - The aging and degradation of equipment that is at the end of its design life will present increasing hazards as safety systems become unreliable and break down more frequently.[523]

He further observed in another hearing,

> Simply put, the process of "shutting down" many defense nuclear facilities compounds existing hazards involving handling and storing nuclear materials with additional hazards associated with cleaning up the facilities. If safety systems are not properly maintained, and other precautions are not taken, these facilities can pose an increasing risk to worker and public health and safety. . . . .
>
> Workers are more likely to come in contact, often unexpectedly, with radioactive and chemical materials that have been inaccessible for many years.
>
> Dismantling a defense nuclear facility can actually increase the risk of dispersal of radioactivity through material degradation, natural phenomena, fires, or accidental nuclear criticality. . . . .
>
> The potential for detonation, fire, and corrosion hazards may increase as chemical compounds become unstable through time. Some existing radiological hazards may become worse as daughter radionuclides emitting more penetrating radiation accumulate (for example, americium) . . . .
>
> Also, cleanup operations are rarely as routine or predictable as production operations.[524]

In underscoring the increased hazards posed by the termination of weapons production in the DOE complex, Conway and the other Board members also typically pointed to the aggravation of risks that stemmed from the continuing "erosion of technical capability"—the significant losses of technical personnel who had experience in operational safety-related issues.

---

[523] U.S. Congress, House of Representatives, Committee on Appropriations, Subcommittee on Energy and Water Development, *Energy and Water Development Appropriations for 1996*, 104th Cong., 1st sess., January 31, 1995 (statement of John T. Conway, "Possible Restructuring of the U.S. Department of Energy"), 919–30.

[524] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 98–99.

SAFE MANAGEMENT OF A REDUCED NUCLEAR WEAPONS CAPABILITY

In surveying the heightened safety challenges associated with the cessation of weapons production in the DOE complex, the Board identified weapons-related activities newly under its jurisdiction—specifically large-scale dismantlement operations—as among the most potentially risky and thus among the most pressing priorities for Board oversight.[525] The sheer magnitude of the task of dismantling some 20,000 weapons at the rate of 2,000 per year contributed to the potential hazardousness of dismantling operations.

Recognizing the urgency of ensuring that dismantlement posed no "undue risk" to health and safety, the Board inaugurated a new practice—starting at the main dismantlement site, Pantex—of maintaining permanent on-site field representatives at certain high-priority sites. In initiating this practice, the Board built on the precedent of the Nuclear Regulatory Commission (NRC), which maintained on-site inspectors at licensed nuclear plants.[526] The Board provided for a field presence first at Pantex—with two full-time representatives—and later at Hanford, Savannah River, Los Alamos, and other sites. The Board's technical field representatives were charged with providing continuous feedback both to DOE site managers and to Board managers in Washington, DC. Weekly site representative reports and conference calls augmented the information from the field already regularly provided by technical staff trip reports.

The intensified scrutiny of Pantex operations that the on-site representatives allowed supplemented the Board's usual information-gathering practices for safety reviews. In conducting its technical reviews of weapons operations at DOE's assembly, disassembly, and testing sites, the Board and staff reviewed available Tiger Team reports on health and safety issues at the sites, hired additional expert consultants with nuclear weapons expertise, and made numerous site visits, with most effort focused on Pantex, and some visits to the Y–12 plant and the Los Alamos National Laboratory.[527] In the reviews for these sites, as well as the Nevada Test Site, the Board identified a need for improvement in numerous broad safety-related controls that it had addressed in previously issued recommendations. The Board found deficiencies in such

[525] For general background on the dismantlement mission, see Arjun Makhijani, Stephen I. Schwartz, and Robert S. Norris, "Dismantling the Bomb," in Stephen I. Schwartz, ed., *Atomic Audit: The Costs and Consequences of U.S. Nuclear Weapons Since 1940* (Washington, DC: Brookings Institution Press, 1998), 326–52.
[526] Glenn Russell George, "Negotiated Safety: Intragovernmental Risk Regulation in the U.S. Nuclear Weapons Complex" (Ph.D. diss., Harvard University, May 1995), 153 (accessed via Proquest).

multi-site safety issues as the utilization of standards, safety analysis, the operational readiness review process, and training and qualifications programs. As the Board had found elsewhere, it saw a strong need for improvement in these areas and pressed these sites to institute more formality in their conduct of operations. Particularly in view of ongoing losses of technical personnel at the sites, it urged DOE to move from a system that was relatively "expert-based" to a system more driven by formal conduct of operations.

Toward Improving Safety of Weapons Disassembly: Standards and Procedural Reviews

Some issues emerged as of particular concern at the dismantlement sites. At Pantex, the Board focused on the status of safety analyses and criticality analysis and requested the production of reports on criticality safety, as well as on radiation control practices. The Board also faulted DOE's guidelines on explosive safety, finding them insufficiently attentive to the potential for radioactive material releases in the event of accidents in the disassembly cells.[528] The Board recommended that criticality experts at Pantex participate in the Nuclear Explosive Safety Study Group (NESSG) that approved all weapons assembly/disassembly procedures.[529] At the Y–12 plant, the Board identified inadequate compliance with orders/standards, especially in radiological control practices, but also in the operational readiness review (ORR) process, training, and contamination control practices.[530] The Board requested a report from DOE evaluating the technical adequacy of radiological control practices at Y–12 compared with DOE and consensus standards, and a second report on plans to address long-standing problems of compliance with DOE orders.

Drawing upon the findings of its various reviews, the Board issued one formal recommendation specifically applicable to dismantlement facilities, Recommendation 93–1, *Standards Utilization in Defense Nuclear Facilities.*[531] This recommendation noted the discrepancy in nuclear safety requirements/standards between facilities that produced and processed fissionable materials, and those such as Pantex that assembled, disassembled, and

---

[527] Office of Technology Assessment, *Dismantling the Bomb*, 49–50.
[528] Office of Technology Assessment, *Dismantling the Bomb*, 49.
[529] Office of Technology Assessment, *Dismantling the Bomb*, 49.
[530] Office of Technology Assessment, *Dismantling the Bomb*, 51.
[531] Defense Nuclear Facilities Safety Board, *Recommendation 93–1, Standards Utilization in Defense Nuclear Facilities* (Washington, DC, January 21, 1993), http://www.dnfsb.gov/pub_docs/recommendations/all/rec_1993_01.txt.

tested nuclear weapons. The Board recommended that DOE review its nuclear safety orders and directives, develop a plan to make nuclear safety assurances comparable at both types of facilities, and give priority to a site-wide compliance review at Pantex.

Board activities at Pantex and other dismantling facilities involved the observation of, and intervention in, the processes of preparing to dismantle specific weapons systems. The Board sought a review process improvement that would entail, among other things, regularizing the practice of consulting with the laboratory weapons experts prior to the initiation of disassemby or dismantlement for a particular weapon type. As the designers of all U.S. nuclear weapons, DOE's three national weapons laboratories—Lawrence Livermore, Los Alamos, and Sandia—constituted "a unique source of information about the nuclear weapons slated for dismantlement."[532] The national laboratories, together with DOE management, had the responsibility for developing the standard operating procedures for nuclear weapons dismantlement at Pantex, with the laboratories having final approval authority.[533] However, the Board found that the optimal use was not being made of laboratory expertise either in the formulation of procedures or in the oversight of procedural compliance. As Conway said,

> We have made some suggestions to improve on the analyses needed to prepare for a particular weapon that has to be disassembled. We have a group of experts reviewing the entire method by which DOE and the contractor at Pantex prepare for a particular disassembly procedure.
>
> We found that initially they were not bringing in laboratory personnel who had helped design the weapons and who had intimate knowledge of the weapons. They were not bringing them in as the procedures were being drafted and written as to how the personnel were to take the weapons apart.
>
> We then recommended that they not move ahead with disassembly of any specific weapon until bringing in the specific laboratory personnel that designed that weapon, and have those personnel that helped design the weapon participate in writing the disassembly procedures, and in effect, saying the disassembly procedure is not a problem.[534]

The Board found fault with the overall safety attitude during dismantlement operations, noting excessive latitude for disassembly technicians to use their judgment when an operation was not proceeding as expected. Alarmingly, changes to the procedures were sometimes made without

[532] Office of Technology Assessment, *Dismantling the Bomb*, 43.
[533] Office of Technology Assessment, *Dismantling the Bom*b*,* 43.
[534] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1995*, 939.

the involvement of the cognizant weapons design laboratory.[535] The Board urged and eventually saw improvement in the attitude about preparing for unanticipated difficulties. As Conway said,

> Initially, we were told, well, if we run into a problem, we will bring in the laboratory personnel. They would not have known beforehand if they were going to have a problem. You have to have this knowledge ahead of time. We have got the laboratory people intimately involved now.[536]

Advocating the increased involvment of laboratory personnel in disassembly and dismantling operations, the Board was instrumental in persuading DOE to expand the "qualification evaluation" procedure, the third of three review procedures for approving dismantlement operations. The first review was the operational readiness review (ORR) conducted by a team of contractor engineers to ensure that the necessary equipment and procedures to begin dismantlement were in place.[537] The second review, an operational readiness evaluation (ORE), was a critique of the ORR conducted to confirm readiness. The third procedure, the Qualification Evaluation for Dismantlement Release (QED), was an additional review by national laboratory design engineers to verify the DOE critique, the correctness of disassembly procedures, and the proper handling of safety considerations. The Board sought the expansion of this procedure on finding persistent shortcomings in the safety aspects of DOE's ORR/ORE process for particular weapons systems at Pantex.[538]

Knowledge Preservation: Mitigating the Loss of Safety Expertise in Weapons Operations

After urging stepped-up involvement by national laboratory personnel to enhance the safety of specific disassembly operations, the Board made a broader recommendation concerning such personnel and other technical experts involved with weapons-related operations throughout the DOE complex. The Board called upon DOE to institute processes to retain access to and document the unique capabilities of individuals with experience in certain critical operations.

---

[535] See John W. Crawford Jr., *An Assessment Concerning Safety at Defense Nuclear Facilities: The DOE Technical Personnel Problem*, DNFSB/TECH–10 (Washington, DC: Defense Nuclear Facilities Safety Board, March 1996), 4, http://www.dnfsb.gov/pub_docs/dnfsb/tr_199603.html. Crawford said of disassembly operations, "The procedures, while based on those provided by the weapons laboratory personnel, who are the technical experts for weapons operations, were being changed by personnel at Pantex *without having the changes reviewed and approved by the weapons laboratory*.

[536] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1995*, 939.

[537] Office of Technology Assessment, *Dismantling the Bomb*, 43.

[538] Office of Technology Assessment, *Dismantling the Bomb*, 43.

The Board was concerned about safety implications of the losses of technical personnel and skills from DOE and its contractors, because the safety of many critical processes depended too heavily on the informal knowledge of the individuals currently involved—technical knowledge that was often inadequately documented. With the downsizing of the DOE nuclear complex, the reduction of the nuclear stockpile, the hiatus in testing, and budget pressures, the problem of the loss of unique weapons and testing knowledge stood to grow worse.[539]

Speaking generally of the cadre of technical experts and the need to preserve their knowledge, Conway remarked, "It is a dwindling group. Unless we can tap that capability now, it will disappear on us." He elaborated on the consequences of the loss, stating, "As experienced operating personnel leave, the knowledge of facility designs and contents erodes, reducing the margin of safety."[540] He made the further points that the losses were worsening with the downsizing of the weapons complex, and that an eroding skill base had especially serious consequences for the safety of weapons-related activities, especially disassembly and testing. As he stated in a Senate Armed Services Committee hearing on April 25, 1995,

> The Board has been concerned with the loss of unique talents from DOE and its contractor organizations caused by the downsizing of the defense nuclear complex. This concern is particularly acute for the weapons laboratories and the facilities involved in the assembly, disassembly, and maintenance of weapons, where budget pressures and other constraints are leading to the severe erosion of the talent pools upon which much of the weapons program has depended.
>
> We have also been a strong supporter of maintaining technical competence within the laboratories. We were concerned that we were losing some of that technical competency, and particularly with the retirement of many of the weapons personnel that have intimate knowledge about design of weapons . . . .[541]

Conway mentioned Board action to ameliorate the erosion of technical expertise, including the issuance of Recommendation 93–6, *Maintaining Access to Nuclear Weapons Expertise in the Defense Nuclear Facilities Complex*,

> We made recommendations on how we can utilize the personnel that have this knowledge, even though they are retired, to bring them back and make sure we can get their knowledge down and documented for future laboratory personnel.

---

[539] Defense Nuclear Facilities Safety Board, *Recommendation 93–6, Maintaining Access to Nuclear Weapons Expertise in the Defense Nuclear Facilities Complex* (Washington, DC, December 10, 1993), http://www.dnfsb.gov/pub_docs/recommendations/all/rec_1993_06.txt.

[540] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 108.

[541] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 93–94.

> We are fearful that this technical competence may be evaporating. . . . I do not want to see those laboratories lose their capabilities.[542]

Recommendation 93–6 urged DOE to inaugurate a formal process to document and archive the collective knowledge that might otherwise be lost as facilities were closed and technical personnel retired. In particular, the Board called upon DOE to identify the critical skills and unique knowledge needed for particular operations, especially operations of two types, the dismantlement of weapons and nuclear explosives testing. In connection with disassembly, the recommendation emphasized the need to develop and document procedures for the safe disassembly or modification of all remaining types of weapons systems while personnel with the requisite expertise were still available and while scattered records could still be retrieved. The sites targeted with this advice included the weapons dismantling site at Pantex, the Oak Ridge Y–12 plant, and the national weapons laboratories. Accepting the Board's recommendation, DOE initiated programs at these sites to obtain and record from departing and retired personnel undocumented technical information that would enhance the technical knowledge of future personnel. The Board's advice also spurred DOE sites to step up their archiving of engineering records.[543] The Knowledge Preservation Program of Y–12, for example, completed in four years, established an electronic archive containing full-text-searchable transcripts of 239 one-to-two-hour-long interviews with current and retired employees. The interviews documented key safety knowledge of the employees, as well as historical process knowledge for diagnostic and upgrading purposes.[544]

In connection with weapons testing—specifically testing at the Nevada Test Site—the Board offered similar advice on retaining and documenting expertise in case testing were resumed. Although nuclear testing was under a moratorium, Conway noted in hearing testimony that the lifting of a moratorium on testing would not be unprecedented.[545] Recommendation 93–6 called for the identification of the skills needed to conduct nuclear testing operations safely, a review of personnel losses at the Nevada Test Site and the nuclear weapons laboratories, and the

---

[542] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 93.
[543] Kevin O'Neill, "Building the Bomb," in Stephen I. Schwartz, ed., *Atomic Audit: The Costs and Consequences of U.S. Nuclear Weapons Since 1940* (Washington, DC: Brookings Institution Press, 1998), 92.
[544] Best Manufacturing Practices Center of Excellence, *Department of Energy, Oak Ridge Operations (National Nuclear Security Administration–Y–12), Oak Ridge, TN* (Information: Knowledge Preservation Program, January 18, 2007), http://www.bmpcoe.org/bestpractices/internal/oakri/oakri_113.html.

establishment at each site of archiving and knowledge capture programs.[546] The Board considered the capture of this information from the test site and laboratories vital to DOE's capability to avoid safety problems in the event of future testing and, more generally, in the stewardship of the weapons stockpile, now the primary mission of the weapons laboratories.

Board Support for Criticality Studies at the National Defense Laboratories

In addressing the retention of technical expertise at DOE weapons-related sites, including the laboratories, one particular aspect of the issue singled out by the Board was the need to retain capabilities at the laboratories to conduct criticality experiments. The Board viewed basic scientific knowledge about criticality as crucial for the safe conduct of many activities in the weapons complex —any activities involving, or potentially resulting in, a sufficient concentration of radioactive materials to produce a self-sustaining nuclear chain reaction. In the performance of its oversight duties, the Board encountered frequent nuclear criticality safety risks and deficiencies.[547] For example, during routine site reviews at the Oak Ridge Y–12 plant in 1994, the Board observed violations of criticality safety limits in storage vaults that were sufficiently serious to prompt the issuance of a formal recommendation specifically addressing the problem at the site.[548]

Despite the concerns about the potential of accidental criticality events throughout the complex, however, the budget cutting that accompanied the downsizing of the weapons complex and President Clinton's deficit-reduction efforts threatened the resources and capabilities that the laboratories devoted to experimental criticality studies. In 1993 the Board was apprised of DOE's impending closure of the last nuclear criticality experimental facility, located at the Los Alamos National Laboratory.[549] In response, the Board issued Recommendation 93–2, *The Need*

---

[545] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 103.

[546] DNFSB, *Recommendation 93–6,* 2–4.

[547] Defense Nuclear Facilities Safety Board, *Fifth Annual Report to Congress* (Washington, DC, February 1995), 20, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/ar_1995.html.

[548] Defense Nuclear Facilities Safety Board, *Recommendation 94–4, Deficiencies in Criticality Safety at Oak Ridge Y–12 Plant* (Washington, DC, September 27, 1994), http://www.dnfsb.gov/pub_docs/recommendations/all/rec_1994_04.txt. See also Defense Nuclear Facilities Safety Board, *Status of Highly Enriched Uranium Processing Capability at Building 9212 Oak Ridge Y–12 Plant*, DNFSB/TECH–9 (Washington, DC, December 8, 1995), http://www.dnfsb.gov/pub_docs/dnfsb/tr_19951208_or.html.

[549] Defense Nuclear Facilities Safety Board, *Eighth Annual Report to Congress* (Washington, DC, February 1998), 1–10, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/ar_1998.pdf.

for Critical Experiment Capability, which urged DOE to take actions to retain facilities and criticality engineering expertise to perform general-purpose criticality experiments. Such experimentation was needed to improve the scientific basis for calculating margins of safety against runaway nuclear reactions.[550] As Conway said, speaking of the laboratories and the threatened end of experimental criticality studies,

> Many of the recommendations we have made are to strengthen the laboratories. One, in particular, we found out that through lack of money they were going to have to close down their capability of doing criticality studies. We thought that was wrong. One of our major recommendations was to assure that adequate funding would go on for their continued work in criticality studies[551]

In response to Board Recommendation 93–2, DOE altered course, and formed a Nuclear Criticality Steering committee to reinvigorate the program of experimentation in nuclear criticality, identifying the Los Alamos Critical Experiments Facility (LACEF) as the research facility to be used for it. The Board advocated continuing support for the facility and, in furtherance of safety in the complex, proposed to monitor DOE's use of critical experiment capability.

The Board Weighs in on the Defense Laboratories and Stockpile Stewardship

Besides supporting retention of the capabilities for criticality research in the DOE defense laboratories, the Board made a broader push to strengthen the laboratories, both through its advocacy for their activities and continued funding and through safety oversight of the laboratories' research and development operations. The Board argued for the continuing crucial role of the defense laboratories, notwithstanding the change in their mission that accompanied the changed mission of the nuclear complex.[552] The laboratories were no longer engaged in the design and development of new nuclear weapons. However, they had augmented research responsibilities relevant to safety throughout the complex, including duties in relation to the maintenance of the nuclear stockpile, which still consisted of more than 5,000 warheads.[553] The

[550] Defense Nuclear Facilities Safety Board, *Recommendation 93–2, The Need for Critical Experiment Capability* (Washington, DC, March 23, 1993), http://www.dnfsb.gov/pub_docs/recommendations/all/rec_1993_02.txt.
[551] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 101.
[552] U.S. Department of State, Bureau of Arms Control, "The Stockpile Stewardship Program," http://www.state.gov/www/global/arms/factsheets/wmd/nuclear/ctbt/fs_991008_stockpile.html.
[553] U.S. Department of Energy, Los Alamos National Laboratory, "Weapons Stewardship Presents New Challenges for National Labs" (Los Alamos, NM, 1996).

laboratories had increased responsibilities vis-à-vis the stockpile, because, in the absence of underground nuclear testing, laboratory research offered an alternative means to assure the reliability and safety of the nation's remaining weapons. Prior to the testing suspension in 1992, testing was the chief means to evaluate and certify nuclear warheads.[554] Absent testing, Congress and the Clinton administration agreed to the Stockpile Stewardship Program, a science-based program administered by the national laboratories, to provide basic knowledge to support "life-extending" operations for weapons.[555] In such operations, the weapons and components retained in the now smaller and aging stockpile underwent surveillance and periodic disassembly, refurbishment, reassembly, and re-certification.[556] In assessing the reliability and safety of the weapons so handled, the Stockpile Stewardship Program drew upon past nuclear test data, computer modeling, experimentation, and simulations.[557]

The Board's exercise of safety oversight over the stewardship activities of the laboratories entailed a number of special challenges. Among them were the heightened risks the laboratories' activities posed. These activities involved special hazards associated with the nuclear explosive activities, and with experiments involving co-located high explosives and nuclear material.[558] This co-location created the potential for explosive dispersal of radioactive materials or inadvertent nuclear detonation. In addition, the highly educated workforce exhibited a special reluctance to submit to the discipline of standards-based operations. The Board acknowledged some legitimacy in the laboratories' sense of their uniqueness, and proposed to address it in reviews of standards, stating,

> [The] Board has recognized that there can be considerable differences between the conduct of R&D activities by skilled scientists and engineers in laboratories, and "production" activities of less skilled workers . . . . A review effort [is] presently underway by the Board to determine whether there may be a more appropriate subset of requirements for the management of safety of research and

[554] See U.S. Government Accountability Office, *Nuclear Weapons: Annual Assessment of the Safety, Performance, and Reliability of the Nation's Stockpile*, GAO–07–243R (Washington, DC, February 2007), 1, http://www.gao.gov/new.items/d07243r.pdf. GAO explains that certification is the process by which the weapons laboratories establish that a particular nuclear warhead meets the military's required operational specifications.
[555] See GAO, *Nuclear Weapons*, 1. With the passage of the *National Defense Authorization Act for Fiscal Year 1994*, Pub. L. No. 103–160, Section 3135 (1993), "Congress directed DOE to establish the Stockpile Stewardship Program."
[556] U.S. Department of State, Bureau of Arms Control, "The Stockpile Stewardship Program."
[557] On the Stockpile Stewardship Management Program, see U.S. Congress, Senate, Committee on Governmental Affairs, Subcommittee on International Security, Proliferation, and Federal Services, *Safety and Reliability of the U.S. Nuclear Deterrent,* 105th Cong. 1st sess., October 27, 1997, 1–12.
[558] Defense Nuclear Facilities Safety Board, *Strategic Plan: FY 2003– 2009* (Washington, DC, November 17, 2003), http://www.dnfsb.gov/pub_docs/dnfsb/rcsp_2003.pdf.

> development activities other than those now in DOE Orders, which are slanted more toward production and utilization facilities. . . . [T]he Board recognized that requirements in Orders had to be fitted to the specific facilities and sites.[559]

However, the Board chided the laboratories for persisting in their resistance to cooperate in the Board's efforts to upgrade standards,

> While the weapons laboratories have had the opportunity to help define the safety related requirements that are applicable to their activities they have not expeditiously moved to do so . . .
>
> In general, the Board has found DOE nuclear safety requirements reasonably consistent with comparable requirements used to regulate the commercial nuclear industry.
>
> The Board would be pleased to see the laboratories operate to such standards. The problem is that they historically have viewed such requirements as undue restraints. The record is replete with examples where safety practices at the weapons laboratories do not meet commercial industry standards.[560]

Despite the difficulties of gaining full "buy-in" by the laboratories to standards-based operations, the Board remained a supporter of the laboratories' work as the source of "a better predictive understanding of the safety and reliability of weapons." Against the threat of budget cuts for the laboratories, the Board advocated bolstering their scientific and engineering resources and infrastructure, calling for "continuing support for specific national laboratory facilities that will be essential for support of the stockpile stewardship mission." The Board wanted more, not less, reliance on the laboratories and "the untapped potential resident in [their] scientists and engineers,"

> The Board . . . believes that the existing knowledge and skill base at the laboratories could be better used today to help solve problems that exist throughout the complex.[561]

The Board urged greater involvement of the laboratories not only in weapons-related activities, but also in "the monumental task of dealing with the radioactive and hazardous wastes at [DOE's] former nuclear weapons production sites and national laboratories."[562] The Board

---

[559] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 105.
[560] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 106.
[561] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 105.
[562] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 104.

saw potential for more research in the laboratories not just on such topics as how to safely dismantle specific weapons, but also on how best to stabilize and package various fissionable materials for safe storage. As the Board noted in congressional testimony,

> For example, the Board has strongly encouraged DOE to bring to bear the considerable expertise at Los Alamos in stabilization of plutonium residues . . . The potential for the national laboratories to conduct such research and development is beyond argument.[563]

NUCLEAR MATERIALS STABILIZATION AND SAFE STORAGE: GROWING BOARD FOCUS FROM 1994

The hazards posed by the remnants of weapons production—surplus "special nuclear materials" stored in an interim fashion and residual wastes—became a top priority for the Board's attention with the end of the Cold War, a priority on a par with weapons-related hazards.[564] The post–Cold War end of weapons production brought to the forefront the urgent risks associated with the huge inventory of such remnants of production—principally unencapsulated plutonium left in various forms in processing lines, high-level radioactive and hazardous waste in storage drums and tanks, and corroding spent radioactive fuel elements in water-filled reactor basins and storage pools.[565] The Board, with its safety mission, was especially appreciative of the "serious near-term safety issues" associated with these unstable nuclear materials and asserted forcefully, "We have material that is in unstable form that should be stabilized," lest it lead to an "inevitable spread of radioactive contamination."[566] However, the Board labored to persuade DOE of the immediacy of the need to put the materials in a safe and stable condition. Davis Hurt, an expert on the Board's technical staff on the "materials problem" and safe storage, recalled some complacency on DOE's part, stating in 1995,

---

[563] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 104.

[564] The term "special nuclear material," as defined in the Atomic Energy Act of 1954 (as amended) means 91) plutonium, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the Commission, pursuant to the provisions of section 51, determines to be special nuclear material, but does not include source material; or 92) any material artificially enriched by any of the foregoing, but does not include source material.

[565] For background, see Arjun Makhijani, Stephen I. Schwartz, and William J. Weida, "Nuclear Waste Management and Environmental Remediation," in Stephen I. Schwartz, ed., *Atomic Audit: The Costs and Consequences of U.S. Nuclear Weapons Since 1940* (Washington, DC: Brookings Institution Press, 1998), 353–94.

[566] U.S. Congress, House of Representatives, Committee on Appropriations, Subcommittee on Energy and Water Development, *Energy and Water Development Appropriations for 1996*, 104th Cong., 1st sess., January 31, 1995 (statement of John T. Conway, "Possible Restructuring of the U.S. Department of Energy"), 917, 919–30.

> At the time these issues were first raised . . . a year-and-a-half ago, it is fair to say that the Department did not agree that these problems were severe or urgent, some of them anyway . . . Agreement that the problem is bad is getting better, but actual action on it is still leaving a lot to be desired.
>
> I think there has been a tendency on some people's parts in DOE to think that storage is a simple thing, that you produced the plutonium, you separated it from the spent fuel, you have made components out of it. Those were difficult things and storage is a simple thing, maybe not even requiring much thought.[567]

Conway was also unimpressed with the urgency that DOE initially displayed in addressing the problems of stabilizing and storing radioactive waste. Speaking of tank sampling and waste characterization efforts at Hanford, he said,

> At the rate they were going, it would have been 100 years before they would have characterized what was in the tanks, and you have to do that before we can even get to the point of how we are going to treat the waste.[568]

The Board's alarm about the unstabilized legacy materials, particularly plutonium wastes, and its desire to convey its concern to DOE prompted the Board to order the first in its series of technical reports, a series consisting of three dozen reports by 2009. Board staff released the in-depth report, *Plutonium Storage Safety at Major Department of Energy Facilities*, in April 1994. The report, whose principal authors were Davis Hurt and the Board's technical director, Dr. George W. (Woody) Cunningham, described technical issues and safety vulnerabilities associated with the special nuclear material and the radioactive production residues and waste existing in drums, tanks, process lines, and storage facilities throughout DOE's nuclear complex.[569] The report also discussed standards for stabilizing and storing plutonium materials. On its release, the report elicited more than 500 requests for copies, suggesting the magnitude of public, if not DOE, concern with the radioactive remnants of weapons production.

The Board judged that the pace of DOE's planned actions for dealing with the materials problem did not reflect its urgency. Drawing on its staff report and other investigations, the Board formulated one of its most important formal recommendations, Recommendation 94–1, *Improved Schedule for Remediation in the Defense Nuclear Complex*. Issued on May 26, 1994,

---

[567] *Public Meetings and Hearings, 1995, Before the Defense Nuclear Facilities Safety Board*, vol. I of II (Washington, DC: Defense Nuclear Facilities Safety Board, 1995), 17–19.
[568] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1995*, 937.
[569] Defense Nuclear Facilities Safety Board, *Plutonium Storage Safety at Major Department of Energy Facilities*, DNFSB/TECH–1 (Washington, DC, April 14, 1994), http://www.dnfsb.gov/pub_docs/dnfsb/tr_19940414.html.

94–1 was the Board's first set of recommendations concerning the overall problem of surplus nuclear materials and residual waste. The recommendation urged DOE to accelerate the remediation of surplus fissionable and other radioactive material, calling upon it to establish a program to characterize, stabilize, and provide for its safe longer-term interim storage—storage of some 50 years. At issue were thousands of kilograms of unstable residues—plutonium in troublesome forms, solid and liquid, and some 2,100 metric tons of corroding spent fuel stored in basins at various sites, especially the basins at Hanford, but also the Savannah River Site and the Idaho National Engineering Laboratory.

In Recommendation 94–1, the Board identified what it considered to be the highest-priority health and safety risks posed by the legacy of radioactive materials, listing the top stabilization and storage concerns for stepped-up action according to a prioritization scheme based on risk characteristics. As Conway said of 94–1 and its risk-based prioritization,

> We have in our Recommendation 94–1 identified what this Board believes to be the most hazardous from the point of present danger to the workers at the plants because much of the material is in an unstable form.[570]

In Recommendation 94–1, the Board specifically advised: "that an integrated program plan be formulated on a high priority basis, to convert within two to three years the materials," —especially plutonium metal that is in contact with, or in proximity to, plastic—"to forms or conditions suitable for safe interim storage." The Board also called upon DOE to expedite efforts to remove and properly store degrading spent fuel from their storage pools. The recommendation added that DOE's plan "will require attention to limiting worker exposure and minimizing generation of additional waste and emission of effluents to the environment." It stated further that the plan "should include a provision that, within a reasonable period of time (such as eight years), all storage of plutonium metal and oxide should be in conformance with the DOE standard on storage of plutonium." In addition, 94–1 recommended the establishment of a research program reliant on the national laboratories "to address alternate processes to be used in safe conversion of various types of special nuclear materials to optimal forms for safe interim storage and longer term disposition."[571] Finally, 94–1 stated that DOE's plan for stabilization of

[570] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 95.
[571] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 105.

special nuclear material should be founded on systems engineering, drawing on the integrated use of facilities and capabilities at all of DOE's sites.

In responding to 94–1, DOE committed to a schedule of actions to accomplish the stabilization and safe packaging of a broad spectrum of radioactive and chemically unstable residues and transuranic materials.[572] On receiving DOE's plan in 1995, the Board devoted considerable time that year to follow-up activities, including four public meetings. These meetings involved briefings to the Board at its headquarters conducted by its technical staff on plutonium storage issues and on spent nuclear fuel problems, a briefing at Rocky Flats on historical accidents involving plutonium and the storage of plutonium metals, oxides, and liquids, and a briefing at Savannah River on the safe handling of spent nuclear fuel. The briefings addressed the magnitude of the materials problem, the reason it had reached its acute level, and the prospect for further deterioration absent immediate corrective action. The briefings also addressed possible technical solutions to the preparation of materials, the preparation of storage containers, plans for the surveillance of stored materials, and, for the longer term, plans to upgrade or construct facilities to process materials for long-term interim or permanent storage, e.g., through vitrification.

In the briefings, a number of presenters explained that the materials problem became severe when the sudden cutoff of weapons production nearly at its peak had frozen a great deal of material in the manufacturing pipeline or, in the case of spent fuels, left it in basins longer than planned. When weapons production was intensive, the plutonium-rich materials in the production lines were, as Cunningham put it, "recovered on a short turn-around time so that the plutonium would be available for weapons production."[573] However, the production cutoff ended this recycling through the production facilities. At the same time, because the cutoff was expected to be short term, the in-process material was left in a state not suitable for storage of any duration. As Hurt said,

> They buttoned up the plutonium as best they could in a very hasty fashion not realizing of course . . . that over five years later these materials would still be in the same places. Plutonium was left in forms that were not stable, not intended for long-term storage. Packaging was ad hoc, not carefully recorded . . . and not suitable to multi-year storage.[574]

[572] The secretary of energy accepted Recommendation 94–1 in late-August 1994, and DOE submitted an acceptable Implementation Plan in February 1995.
[573] *Public Meetings, 1995,* vol. I of II, 12.
[574] *Public Meetings, 1995,* vol. I of II, 17–19.

For spent fuels, as the Board's staff report stated, a similar change in normal handling practices occurred when production abruptly stopped, with similarly negative consequences for safety,

> When weapons production was at its peak, in-basin residence time of irradiated fuel elements was relatively short—only long enough to permit the short-lived volatile and gaseous fission products to decay and radiation levels to drop to the point that the fuel elements could be handled with less danger to the workers and less radiation damage to processing chemicals . . . .
>
> When production was stopped in the late 1980s, the spent fuel elements remaining in the fuel storage basins were simply left in place. Longer in-basin residence times . . . promote greater penetration by basin water and resultant corrosion.[575]

Board technical staff members detailed the near-term safety consequences of these changes in materials handling for the Board in early 1995, with Hurt speaking on plutonium residues and J. Kent Fortenberry speaking on spent fuel vulnerabilities.

Hurt, the lead author on the Board's technical report, stated that the material of concern included "20,000 or so kilograms of separated unencapsulated plutonium, observing, "It surprises a lot of people that there is so much material in the pipeline—so much material that was removed from the irradiated fuel, but not yet fabricated into weapon components." He added that he was speaking mostly about Rocky Flats,

> We believe that Rocky Flats has the worst problems . . . by a large margin. Rocky Flats has the most plutonium. They have the most types of problems. They have the most serious problems, we believe, in terms of risk to life and limb of workers as a minimum. They also have we think the least capability for dealing with those problems in the near future.

In outlining the risks that these materials posed, he began with the worst-case scenario—the type of incident that had occurred as a result of major fires in the past—a scenario involving off-site releases of radioactive contamination,

> The thing we fear the most is a massive fire that breaches the containment of the building either by burning the thing down or completely knocking out the ventilation system.[576]

Short of large-scale off-site releases, the materials posed numerous other risks, as documented in DOE occurrence reports. Often the packaging—much of it involving

[575] Defense Nuclear Facilities Safety Board, *Review of the Hanford Spent Nuclear Fuel Project*, DNFSB/TECH–17 (Washington, DC, October 1997), 2-1, http://www.dnfsb.gov/pub_docs/hanford/tr_199710_hd.pdf.

plastic—was "now decomposing and producing hydrogen," which built up pressure inside drums and other storage containers. Improperly stored plutonium was known for "catching on fire, setting other things on fire, off-gassing . . . even causing small chemical explosions, explosions of flammable gasses."[577] Hurt mentioned, "Containers that rupture, containers that have fires in them and are found burned out afterwards, even flashing and sparking as containers are opened." He added, "These kinds of incidents are becoming more common," and pointed to a recent incident "where a drum of plutonium-bearing waste exploded, scattered debris around, and contaminated the two workers standing nearby."[578] Other on-site risks included criticality accidents and worker exposure from leaks, as Hurt noted,

> A sizeable amount of this material is concentrations that could go critical . . . . Criticality safety is the most serious concern just because a criticality accident would probably be fatal in a plant like that. There was a near accident two or three months ago [that] illustrates Mr. Crawford's point about . . . poorly trained operators.
>
> [An operator] was draining solution. . . . Luckily there wasn't quite enough solution in the line . . . but he was filling bottles with solution that was in the criticality danger range and he was putting these bottles side by side in the glove box. That is what I would say is a near miss.
>
> The lines are mostly overhead [with] people walking back and forth under the lines . . . . Leaks and line ruptures are frequent events. Plutonium solution gets dripped and sprayed around. They haven't sampled most of this material since 1989.
>
> The tanks are in an area that is operated manually. People turn valves and read sight glasses with their faces right up against these tanks.[579]

Serious hazards of a somewhat different variety attended spent nuclear fuel storage, as described by Kent Fortenberry, the Board's technical staff lead on the K-East Basin at Hanford. Fortenberry listed,

> Chronic leakage, seepage, seismic vulnerability which can lead to more catastrophic leakage, and also lead to structural damage of the fuel and, possible criticality conditions as, for instance, superstructure falls into these basins.[580]

---

[576] *Public Meetings, 1995,* vol. I of II, 22.
[577] *Public Meetings, 1995,* vol. I of II, 20.
[578] *Public Meetings, 1995,* vol. I of II, 24.
[579] *Public Meetings, 1995,* vol. I of II, 51–52.
[580] *Public Meetings, 1995,* vol. I of II, 120.

He added, remarking on the remediation difficulties posed by these conditions, "As the fuel continues to degrade and deteriorate, it becomes more difficult to handle. In some cases, it becomes difficult to stabilize."[581] The failure to stabilize severely corroding fuel elements posed risks not only to workers involved in surveillance and cleanup, but also to the environment. In the case of Hanford's K-East and K-West basins, which received all the spent fuel from Hanford's N-reactor, leakage could threaten the Columbia River, only a few hundred yards away.[582] Such leakage, already detected for a time from K-East, could become catastrophic if the structural integrity of the basins were severely compromised, e.g., by an earthquake, not an implausible event at Hanford.

This litany of hazards stood to grow continually worse, as all associated with the Board emphasized. Cunningham summarized the situation,

> As a result of stopping production, DOE is now faced with handling material of unknown characteristics that is improperly packaged and that can only degrade and become a worse problem the longer there is inaction by DOE.[583]

Board member Dr. Herbert J. C. Kouts concurred, adding that the continuing loss of technical personnel compounded the urgency of corrective action on nuclear materials hazards,

> The longer this takes before it is done, the greater the problem that will occur, not only because of greater deterioration of facilities, but because of greater loss of information among the people who are going to have to do the work.
>
> We know of numerous cases of body burden from plutonium by people who have been affected by accidents . . . by containers that have ruptured, by gloves that have ruptured in glove box operations, by minor fires . . . . the longer the time passes before things are done, the greater the problem is going to be.[584]

Given the severity of the materials problem and deteriorating storage conditions, the Board saw delay as a safety issue of concern and gave high priority to pressing DOE to meet its obligations under its implementation plan for 94–1. The Board acknowledged improvement in DOE's commitment to corrective actions, but still deplored the slow pace with which DOE accomplished the remediation of various nuclear materials hazards. Kouts commented on this slow pace, mentioning how progress was hampered by sheer built-in difficulties of the tasks,

[581] *Public Meetings, 1995,* vol. I of II, 120–21. See also Gerber, 246.
[582] On the K-East and K-West basins, see Gerber 244, 246–47.
[583] *Public Meetings, 1995,* vol. I of II, 12–13.
[584] *Public Meetings, 1995,* vol. I of II, 300.

including the necessity for the workers always to take time-consuming radiation protection measures,

> We have noticed . . . when we have gone through the facilities . . . very extensive operations . . . on radiation protection that consume a lot of time and we have been told that the normal useful amount of time they get out of the shift worker in these facilities is something like three hours per shift.[585]

Another serious obstacle to rapid progress—one expected to hamper the removal of fuel elements from basins—was sludge at the bottom of the basins.[586] As Conway said, speaking of his encounter with the problem at Hanford in 1993,

> Once you start moving fuel, you stir up the bottom, and it gets very cloudy. The amount of sludge and dirt in the bottom of these basins was worse than I had ever seen any other place. In fact, the first time I went into that basin with another Board member, I had never been in a more dirty place . . . . I had never been in a place before where I had to take off every stitch of clothing I had on before I went in because I couldn't wear anything out that I wore in there.[587]

Notwithstanding such inherent hindrances to materials stabilization, the Board viewed the technical challenges involved as generally surmountable and pressed DOE for progress on its especially critical commitments. Notable among these commitments was the removal of the deteriorating spent fuel from Hanford's K-East Basin, in Conway's words, "one of the worst tanks at any site."[588] Board pressure was the catalyst that prompted DOE to develop the Spent Nuclear Fuel Project, a key element of the implementation plan for Recommendation 94–1. The project was a comprehensive plan for the expeditious removal of the deteriorating spent nuclear fuel stored in the K-reactor basins, the stabilization of the fuel by suitable processes, and its placement in dry interim storage on-site pending its ultimate disposition. The Spent Nuclear Fuel Project was predicated on an aggressive schedule, in keeping with the urgency it deserved—fuel retrieval between 1997 and 1999. As the Board later said of the project in a follow-on

[585] *Public Meetings, 1995,* vol. I of II, 55.
[586] On the challenge of sludge, see Gerber, 247–48.
[587] U.S. Congress, House of Representatives, Committee on Commerce, Subcommittee on Oversight and Investigations. *Department of Energy's Hanford Spent Nuclear Fuel Project*, 105th Congress, 2d sess., May 12, 1998, 111.
[588] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1995*, 937.

recommendation to 94–1—Recommendation 2000–1, *Prioritization for Stabilizing Nuclear Materials*—"Progress toward remediation seemed adequate for a time."[589]

In the same source, Recommendation 2000–1, the Board also gave a generally positive assessment of some stabilization initiatives apart from the Spent Nuclear Fuel Project. In the Board's judgment, "A great deal [was] accomplished in meeting the safety objectives set forth in Recommendation 94–1, particularly with regard to those materials that constituted the most imminent hazards." The Board listed numerous corrective actions that DOE had implemented successfully. In connection with storage, DOE had mitigated the most immediate and greatest hazards, such as the packaging of plutonium metals and oxides in contact with plastic that had the potential to generate hydrogen gas. DOE made progress in removing plutonium from potentially dispersible solutions and storing it as more stable metal or oxides. Relocated materials were repackaged in more robust and better researched storage containers, mitigating issues of leakage and easing surveillance risks. Additionally, DOE made progress on cleaning out highly contaminated buildings.[590]

The Board recognized DOE's work on the handling of conditions and situations the Board had identified as imminent risks. The Board acknowledged notable progress on near-term corrective actions for "high-risk items," and some easing of the immediate concerns that had prompted the issuance of Recommendation 94–1. As Dr. A.J. Eggenberger recalled when he was serving as the Board's acting chairman,

> We asked . . . that actions be taken to stabilize those materials which caused the most risk to the people and to the workers . . . .They did that up to a point. They did the high-risk items.[591]

Eggenberger added the proviso, however, that DOE showed weakness in its ability to prioritize corrective actions beyond the short-term. The Board anticipated this problem even as it issued 94–1, citing among other causes for the problem the sheer enormity of the remediation task facing DOE. At one point, the GAO mentioned 7,000 facilities, which included only those destined for decommissioning and decontamination upon the completion of shutdown activities

[589] Defense Nuclear Facilities Safety Board, *Recommendation 2000–1, Prioritization for Stabilizing Nuclear Materials* (Washington, DC, January 14, 2000), http://www.dnfsb.gov/pub_docs/recommendations/all/rec_2000_01.pdf. See also Gerber, 241.
[590] DNFSB, *Recommendation 2000–1, Prioritization for Stabilizing Nuclear Materials*.
[591] U.S. Congress, House of Representatives, Committee on Energy and Commerce, Subcommittee on Oversight and Investigations, *A Review of Ongoing Management Concerns at Los Alamos National Laboratory*, 109th Cong., 1st sess., May 5, 2005, 46.

over the next 30 years.[592] The monumental stabilization task confronting DOE put a premium on establishing priorities among the risks to address. The task also demanded—for sustained momentum—longer-term planning about the operational capabilities that needed to be preserved, upgraded, or newly provided in order to accomplish stabilization. Finally, the task required the integration of activities and resources within sites and across sites. In emphasizing the need in DOE for a longer and wider view, the Board often held up one particular example as a serious planning mistake—the decommissioning of the PUREX plant at Hanford in 1990. This closure had long-lasting and broad ripple effects, because it deprived Hanford of the capability of chemically processing its irradiated uranium fuel on-site. The spent fuel "was left stranded" in the seismically vulnerable and leak prone K-East and K-West storage basins.

The planning failure represented by the PUREX closure was the kind of mistake that the Board targeted in its inclusion in 94–1 of a particular subrecommendation, the advice on adopting a systems engineering approach. The Board anticipated that the major stumbling block and challenge for DOE in carrying through on the commitments made under 94–1 would lie in sustaining the effort and accomplishing actions that required longer-term planning. Expecting this challenge, the Board advocated a systems approach, a point that Conway highlighted in a 1996 Senate Armed Services Committee hearing,

> Recommendation 94–1 stated that DOE's plan for stabilization of special nuclear material should be founded on systems engineering, drawing on the integrated use of facilities and capabilities at all of DOE's sites.[593]

Elaborating, he said, "We have thousands of facilities out there,"

> Eventually, you have to decide, as for the systems approach, what we are going to do with that particular facility or material you get out. It is a major problem . . . . So, it is a matter of selecting on a priority basis. The Board can suggest you do it on a priority basis—what is the most hazardous right now?
>
> . . . We have to take a look at each and every one of the sites and set priorities. I start first with the priority of the current danger, and that is the stability of some of the material that is out there. This is something one of our recommendations addresses, 94–1, that the Department of Energy determine at each of its locations what is the most dangerous materials right now that we have to stabilize . . . Then we have to . . . set a priority at each site . . . through a systems approach of what

[592] U.S. General Accounting Office, *Department of Energy: Cleaning Up Inactive Facilities Will Be Difficult,* GAO/RCED–93–149 (Washington, DC, June 1993).
[593] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 105.

> we . . . clean up. Then each site having done that, there has to be some way that headquarters can look at each of the various sites and then set priorities among the sites. But that has to be done by people who are technically competent to do this. It has to be done in [that] way that no matter what the political flack may be.[594]

Conway was asked by a Senator on the committee, "Now, is that being done? . . . . Is the statute recommending that that is the direction we need to go in?" Conway replied,

> The answer is, no, it is not being done properly as of now. We are still in the stage of trying to set priorities from the point of individual sites and particularly with regard to priorities of their most dangerous materials and situations out there now.[595]

[594] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 108.
[595] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1996*, 95–96.

CHAPTER 6: INTEGRATION: THE BOARD'S WATCHWORD FOR THE LONGER TERM

After the fifth year of operations, the Defense Nuclear Facilities Safety Board (DNFSB or the Board) shifted gears in its oversight activities for the second time, albeit with a less clearly demarcated adjustment than the reorientation at the end of the Cold War. The Board's second shift of focus involved a greater emphasis on assisting the Department of Energy (DOE) to improve the *integration* and longer-term coherence of its safety-related efforts in the DOE nuclear complex. As the Board stated in 2003 in its *Thirteenth Annual Report to Congress*,

> A review . . . shows that in the early years, the Board focused on ensuring that safety standards and DOE's technical competence were adequate, while at the same time trying to ensure that operational safety issues were dealt with expeditiously. Once adequate safety standards were in place, the Board focused more explicitly on DOE's safety management activities, on continuing improvement in conduct of operations, and on ensuring the integration of safety principles into design, construction, and decommissioning activities.[596]

The Board's second shift of focus followed its fifth-year self-assessment of its accomplishments and shortfalls in improving nuclear safety, and reflected the Board's judgment about how to make further progress in its safety mission.

The Board conducted a fifth-year self-assessment in fulfillment of a statutory obligation laid out in the legislation that created the Board. Congress required the Board to include in its fifth annual report "an assessment of the degree to which the overall administration of the Board's activities are believed to meet the objectives of Congress in establishing the Board," as well as the Board's "recommendations for continuation, termination, or modification of the Board's functions and programs . . . ."[597] In responding to the requirement to weigh the Board's effectiveness, the Board mentioned considerable success in gaining DOE's cooperation and in furthering its resolution of safety issues, particularly narrower, site-specific issues. In the fifth year review and other self-assessments, the Board also affirmed its success in getting DOE to take corrective action on the many imminent risks exposed or aggravated throughout the

[596] Defense Nuclear Facilities Safety Board, *Thirteenth Annual Report to Congress* (Washington, DC, February 2003), 1–3, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php.
[597] Defense Nuclear Facilities Safety Board, *Fifth Annual Report to Congress* (Washington, DC, February 1995), n.p., http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php. In 1994, in preparation for the fifth-year self-assessment, the Board held nine public hearings to solicit the views of interested persons on the Board's effectiveness and possible changes to the Board. Eight of the hearings were held near DOE defense nuclear facilities.

complex after the shutdown of weapons production. The main frustration that the Board identified around the time of the fifth-year review, however, was the slowness with which DOE implemented the commitments it made in response to Board recommendations, particularly the commitments concerning the Board's two most crucial complex-wide recommendations, the recommendations on standards and on the technical personnel problem—Recommendation 90–2, *Design, Construction, Operation and Decommissioning Standards at Certain Priority DOE Facilities*, and Recommendation 93–3, *Improving DOE Technical Capability in Defense Nuclear Facilities Programs*. Speaking of the problem of the timeliness of DOE's issue resolution, the Board said,

> The primary difficulty the Board has encountered in the first five years is not with obtaining requested safety information, identifying significant safety problems requiring DOE attention, developing recommendations, or having the Secretary of Energy accept them. Those functions of the Board have been successfully executed in accordance with Congressional objectives. The problem centers on subsequent inaction and failure to implement recommendations and corrective measures in a timely manner.[598]

In considering this problem of the inadequate pace of DOE's corrective actions, the Board's diagnosis was not that the Board lacked the requisite statutory powers to enforce action or was otherwise misconceived. When called upon, as in the fifth-year review, to address its powers, the Board remained a steadfast defender of existing oversight arrangements and of the adequacy of its "action-forcing" authority. Rather than through statutory changes, the Board saw promise for improved timeliness and completeness of DOE's corrective actions through the increased integration of DOE's safety-related activities, and the more consistent application of the principles of systems engineering and other tools by which the huge array of safety-related tasks facing DOE could be prioritized and more efficiently structured.

The Board's strategy to assist DOE further did not entail a retreat from the Board's ongoing efforts to urge the resolution of previously identified safety issues and the acceleration of earlier initiatives. The Board continued to press DOE for improvement on the disparate corrective actions thus far agreed upon, especially in the problematic areas of personnel and standards. However, the Board also sought to assist DOE in establishing frameworks—structured ways of proceeding—in which to recast piecemeal actions as part of more comprehensive efforts and longer-term strategies to ensure safety in the weapons complex. One key Board initiative

along these lines was the Board's promotion of a concept and approach, Integrated Safety Management (ISM), for integrating actions to mitigate different kinds of hazards—nuclear, chemical, and physical—affecting different sectors—the public, workers, and the environment—in a more comprehensive picture.

INTEGRATED SAFETY MANAGEMENT (ISM): ESTABLISHMENT, FOLLOW-UP

Integration became the Board's watchword for how to achieve more timely safety issue resolutions and more thorough safety improvements complex-wide when the Board issued Recommendation 95–2, *Safety Management*, in 1995, "one of the most encompassing" of the Board's recommendations.[599] As the Board later described the recommendation, it "encouraged DOE to build on the successes gained" in implementing two key recommendations issued earlier, Recommendation 90–2, on standards, and Recommendation 93–3, on the technical personnel problem.[600] Building on these successes, DOE was urged to "develop safety management programs for its defense nuclear facilities that integrated public protection, worker safety, and environmental protection into the work process."[601] In the words of Board member Joseph J. DiNunno,

> The major thrust of this recommendation was to bring the many safety-related directives, implementation efforts, and related new initiatives into a more cohesive, integrated, and effective safety management program, with clearer lines of responsibility and authority defined for its execution.[602]

ISM evolved from Recommendation 95–2, from DOE's 1996 implementation plan for 95–2, and from a technical report authored by DiNunno, DNFSB/TECH–16, *Integrated Safety Management,* which amplified the recommendation with a detailed discussion of what could be accomplished through ISM. ISM was a safety management program that provided a structured

---

[598] DNFSB, Fifth Annual Report to Congress, 69.
[599] Defense Nuclear Facilities Safety Board, *Recommendation 95–2, Safety Management* (Washington, DC, October 11, 1995), http://www.dnfsb.gov/pub_docs/recommendations/all/rec_1995_02.html. The recommendation superseded Recommendations 90–2 and 92–5.
[600] Defense Nuclear Facilities Safety Board, Report to Congress on the Role of the Defense Nuclear Facilities Safety Board Regarding Regulation of DOE's Defense Nuclear Facilities (Washington, DC, November 1998), 10, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc_199811.html.
[601] U.S. Congress, House of Representatives, Committee on Commerce, Subcommittee on Energy and Power, *Legislation to Improve Safety and Security in the Department of Energy*, 106th Congress, 2d sess., March 22, 2000, 17, http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=106_house_hearings&docid=f:64031.pdf. Also, http://www.dnfsb.gov/pub_docs/dnfsb/ts_20000322_multi.pdf.

way to make safety planning an integral part of the planning and execution of work activities at all levels. DiNunno, who authored the technical report and was instrumental in the development of ISM, also described it as a means to circumvent the "stovepipes" that had developed historically to handle various aspects of safety in the weapons complex.[603] Instead of multiple, unintegrated programs—e.g., separate protective programs for the public, for workers, and for the environment—ISM represented an attempt to provide a single safety management program. Through ISM, a structured, comprehensive approach to performing work safely, the Board encouraged DOE to identify good practices developed for each of the sectors to be protected—the public, workers, and the environment—as well as the major types of hazards—nuclear and non-nuclear—and to effect these practices as an integrated system in which safety controls were incorporated in advance in every activity.[604]

The basic tenets of ISM, as stated in DOE's 1996 Implementation Plan and captured in DOE Policy 450.4, *Safety Management System Policy*, included five core safety management functions.[605] Often cited by Board members, these commonsense but crucial functions were to:

- define the scope of work,
- analyze the hazards,
- develop and implement hazard controls,
- perform work within controls, and
- provide feedback and continuous improvement.

ISM also institutionalized guiding management principles that constituted the basis for a safety-conscious and efficient organization, including:

- line management responsibility for safety,
- competence commensurate with responsibility, and
- identification of safety standards and requirements appropriate to the task at hand.

In a March 2000 congressional hearing, during which Board Chairman John T. Conway described progress in the implementation of ISM by contractors, he characterized features that would mark the system's implementation:

---

[602] Joseph J. DiNunno, *Integrated Safety Management*, DNFSB/TECH–16 (Washington, DC: Defense Nuclear Facilities Safety Board, June 1997), iii, http://www.dnfsb.gov/pub_docs/dnfsb/tr_199706.pdf.
[603] DiNunno, Integrated Safety Management, 3/15.
[604] Defense Nuclear Facilities Safety Board, *Strategic Plan: FY 2003–2009* (Washington, DC, November 17, 2003), 8, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rcsp_2003.pdf.

- site-wide nuclear safety requirements, mutually agreed upon by DOE and contractor(s) as applicable to the work performed,
- establishment by the contractors of manuals of practices reflecting the requirements established,
- safety planning as an integral part of work planning,
- safety and hazards analysis with safety measures tailored to the hazards of the operations involved,
- qualification and training of personnel commensurate with safety responsibilities assigned, and
- assessments and feedback for improvements performed.[606]

During the tenure of Secretary of Energy Hazel O'Leary, DOE committed to establishing the ISM system for an initial group of 10 operational defense nuclear facilities.[607] Her successor, Secretary Federico Peña, made the implementation of the concept a requirement for all of DOE's highly hazardous activities, nuclear and non-nuclear, in the complex.[608] In 1998 Secretary Bill Richardson voiced strong support for ISM, calling in 1999 for its implementation at every DOE facility in the DOE nuclear complex by September 2000.[609] The commitment to ISM was to be met at each site through the implementation of an Integrated Safety Management System, which would include functional area safety management programs such as radiation control, hazard analysis, configuration management, electrical safety, training, and others. The programs were typically to be set forth in the contractors' manuals of practice.

The Board closely tracked the field implementation of ISM, holding some 10 public meetings between 1997 and 2001 to address DOE's progress and to solicit the feedback that was crucial to continuous improvement in both safety and efficiency. In the March 2000 hearing, Conway offered his view of the Board's accomplishments in assisting DOE in its safety practices, pointing in the main to achievements related to the implementation of ISM.

---

[605] Interview, John E. Mansfield, Board vice chairman (since 2007; Board member, 1997–present), Washington, DC, August 25, 2008. See also Defense Nuclear Facilities Safety Board, *Ninth Annual Report to Congress* (Washington, DC, February 1999), 2-3, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php.

[606] House, Commerce Subcommittee on Energy and Power, Legislation to Improve Safety and Security in the Department of Energy, 18.

[607] On Integrated Safety Management, see the U.S. Department of Energy, Office of Health, Safety and Security (HSS) Integrated Safety Management (ISM) Web Site: http://www.hss.energy.gov/healthsafety/ism/. DOE's Office of Health, Safety and Security was created in the summer of 2006.

[608] DNFSB, *Ninth Annual Report to Congress*, 2-3. Peña, the eighth secretary of energy, who served from March 12, 1997 to June 30, 1998, also issued DOE Policy 450.6, *Secretarial Policy Statement: Environment, Safety and Health*.

[609] Defense Nuclear Facilities Safety Board, *Tenth Annual Report* (Washington, DC, February 2000), 2-2, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php.

> In our Tenth Annual Report to Congress issued in February 2000, the Board noted significant progress by the DOE in upgrading its safety management program and practices at defense nuclear facilities . . . . Using its action forcing powers, the Board has been able to help reorient DOE's safety program and to set it on a course that:
>
> - Places more reliance on standards that define good practices and less reliance upon expert-based safety management;
> - Makes work planning and safety planning an integrated process;
> - Treats public, worker, and environmental protection as an integrated process;
> - Treats radioactive and nonradioactive hazards in an integrated fashion in establishing controls; and
> - Tailors safety measures to the hazards involved.[610]

One concrete indicator of the progress made in implementing ISM was the number of authorization agreements executed between DOE and its contractors specifying the contractor's proposed means for conducting work safely. The Board introduced the concept of authorization agreements—similar to Nuclear Regulatory Commission (NRC) licenses for commercial nuclear facilities—in a technical report authored by DiNunno in 1995, *Fundamentals for Understanding Standards-Based Management of Department of Energy Defense Nuclear Facilities.*[611] Such agreements, as viewed by Board member John E. Mansfield, were designed to counter an old problem, namely, "while DOE had good standards, they were not written into contracts as contractually binding requirements." [612] Authorization agreements included the contractor's commitments, which were contractually binding, to conduct specified work activities in accordance with specific terms and conditions. The Board's *Ninth Annual Report to Congress* described the benefits of such agreements or sets of control measures, stating,

> Authorization agreements (similar to the licenses of commercial nuclear facilities) greatly facilitate the identification, implementation, and maintenance of safety controls needed to prevent an accidental release of radioactive materials in or from the work place, or mitigate the consequences of an accident if one should occur.[613]

---

[610] House, Commerce Subcommittee on Energy and Power, Legislation to Improve Safety and Security in the Department of Energy, 27.
[611] Joseph J. DiNunno, "Fundamentals for Understanding Standards-Based Safety Management of DOE Defense Nuclear Facilities," DNFSB/TECH–5 (paper prepared for the Defense Nuclear Facilities Safety Board Public Meeting On Standards-Based Safety Management, Washington, DC, May 31, 1995), http://www.hss.doe.gov/deprep/archive/techrpts/bm95u13b.htm.
[612] Interview, Mansfield.
[613] DNFSB, Ninth Annual Report, 2–10.

By late 1999, as an outcome of ISM activity, more than 100 Authorization Agreements were in place in the weapons complex, serving as a substantive measure of successful ISM implementation.[614]

ISM implementation remained an ongoing focus of monitoring by the Board, which exerted additional pressure when it observed flagging efforts by DOE. In a typical intervention, the Board, for example, formally notified the DOE acting assistant secretary for environmental management in September 2004 of its concern that the "Integrated Safety Management (ISM) System for the Hanford tank farms [was] failing to control work activities adequately." The Board attributed several recent safety-related events at Hanford to a decrease in the effectiveness of the existing Hanford tank farm ISM System, observing,

> This concern has been engendered by a series of occurrences, incidents, near misses, and other operational events indicating serious weaknesses in work planning, conduct of operations, and responses to abnormal events or unexpected conditions. A prime example is the recent event where controls on worker exposure failed and a worker received an excessive and unexpected extremity exposure. . . . It would be an oversimplification to assign a single cause (e.g., accelerated cleanup) to these occurrences in light of their variety. However, the number of serious events at the tank farms is not to be expected at a project with a mature and effective ISM System . . . lasting success in implementing an effective ISM System at the tank farms has not been apparent.[615]

In response to the perception that ISM implementation was lagging in some places, the Board issued Recommendation 2004–1, *Oversight of Complex, High-Hazard Nuclear Operations*, whose thrust in part was to reinvigorate DOE's ISM implementation efforts.[616] Board member R. Bruce Matthews, DiNunno's successor, also authored a follow-on report to DiNunno's technical report on ISM, entitling the new report *Integrated Safety Management: The Foundation of a Successful Safety Culture*, DNFSB/TECH–36.[617] The Board remained convinced of ISM's

[614] DNFSB, Tenth Annual Report, 2–8.
[615] Letter to Paul M. Golan, Acting Assistant Secretary for Environmental Management, U.S. Department of Energy, September 8, 2004, from John T. Conway, Chairman, DNFSB, http://www.dnfsb.gov/pub_docs/correspondence/hanford/cor_20040908_hd.pdf.
[616] Defense Nuclear Facilities Safety Board, *Fifteenth Annual Report to Congress* (Washington, DC, February 2005), 5-2, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/ar_2005.pdf.
[617] Matthews, a Ph.D. materials scientist joined the Board in 2003. He had 30 years of experience in nuclear technologies, specializing in special nuclear materials, weapons plutonium, and nuclear reactor fuels. He also had experience managing nuclear facilities, notably, at Los Alamos National Laboratory. See U.S Department of Energy, Office of Health, Safety, and Security, "R. Bruce Matthews: Biography," http://www.hss.doe.gov/deprep/dnfsb/members/matthew.htm.

importance, as was reaffirmed in 2009 by Board Chairman Dr. A. J. Eggenberger. At a congressional hearing, Eggenberger stated,

> Shortcomings in safety and efficiency in the operation of . . . defense nuclear facilities can almost always be related to a failure to apply Integrated Safety Management.[618]

REVISITING CONGRESS'S REGULATORY COMPROMISE: 1995–2000

As the Board devoted major energies to the oversight of ISM implementation, the Board effectively demonstrated its confidence that such implementation would go a long way to alleviating the persistent complex-wide safety deficiencies that the Board identified when it took stock of its effectiveness in its fifth-year self-assessment. However, the pace of change and the emergence of additional problems in the complex, especially with the cost and continual slippages in the cleanup program frustrated many executive-branch and legislative staff, prompting renewed calls for stronger external oversight of these programs. By the mid-1990s, the Board was compelled to address a variety of proposals that envisioned a very different means to remedy DOE's safety and environmental deficiencies, namely, external regulation of the DOE defense nuclear complex.

DOE's continuing problems—including its slow responses to Board recommendations—revived discussion in both the legislative and executive branches about the best approach to regulating the DOE nuclear weapons complex. Congress had anticipated that this question would be revisited when it formulated the regulatory compromise embodied in the Board's authorizing statute. As mentioned, this statute required the Board to provide its views on, among other things, whether its statutory powers were sufficiently robust, as part of its fifth annual report to Congress. Although the Board consistently affirmed its preference for the current recommendation process over more formal regulatory mechanisms, others took DOE's difficulties and dilatory responses to the Board as evidence supporting the need for legal and/or organizational changes to the oversight regime in the weapons complex. Specifically, a number of proposals were floated and studies conducted that were predicated on the idea that DOE

[618] U.S. Congress, House of Representatives, Committee on Appropriations, Subcommittee on Energy and Water Development, 111th Cong., 1st *sess, Nuclear Weapons Complex*, March 17, 2009, 3 (statement of Dr. A.J. Eggenberger, "Weapons Complex Nuclear Safety Issues"). http://appropriations.house.gov/Witness_testimony/EW/A_J_Eggenberger_03_17_09.pdf.

needed to be subject to stronger external regulation, whether by the Board with enhanced powers or some other federal entity.

Proposed Regulatory Alternatives

The first among various initiatives to put DOE under additional or stronger external regulation and even to abolish DOE was a legislative proposal floated during the 103rd Congress (1993–94), H.R. 3920, Federal Nuclear Facilities Licensing and Regulation Act.[619] The bill was introduced in February 1994 by Representative George Miller (D–CA), chairman of the House Committee on Natural Resources, and three co-sponsors. The bill called for NRC licensing for all *new* DOE nuclear weapons and research facilities.[620] In addition, the bill proposed a federal study commission of 13 members, including the chairs of both the Board and the NRC to determine the need on a case-by-case basis for independent, external regulation and licensing of existing DOE facilities.[621] In several hearings on the bill held in March 1994 by the House Natural Resources Subcommittee on Energy and Mineral Resources, Dr. John Ahearne, a former NRC chair, then at Duke University, argued that the NRC should regulate DOE defense nuclear facilities.[622] However, neither the NRC nor the Board voiced support for H.R. 3920. In the 1994 hearings, Conway, speaking for the Board, expressed skepticism about the potential effectiveness of a federal study commission, contributing to the bill's failure.[623] The Board was more harshly dismissive of the entire bill in retrospect.

> No companion bill was introduced in the Senate and no other Committee of the Congress including those that had substantive responsibility for DOE defense activities, e.g., Committees on Armed Services and Energy and Natural Resources, considered the bill sufficiently important for consideration. Similar to

[619] Glenn Russell George, Negotiated Safety: "Intragovernmental Risk Regulation in the U.S. Nuclear Weapons Complex" (Ph.D. diss., Harvard University, May 1995), 171 (accessed via Proquest). Overlapping with the first two years of the Clinton administration, the 103rd Congress ran from January 5, 1993, to January 3, 1995.
[620] Federal Nuclear Facilities Licensing and Resolution Act, H.R. 3920, 103d Cong. (1994), http://bulk.resource.org/gpo.gov/bills/103/h3920ih.txt.
[621] U.S. General Accounting Office, *Department of Energy: Clear Strategy on Externa1 Regulation Needed for Worker and Nuclear Facility Safety*, GAO/RCED–98–163 (Washington, DC, May 21, 1998), 5, http://www.gao.gov/archive/1998/rc98163.pdf.
[622] DNFSB, *Report to Congress on the Role of the Defense Nuclear Facilities Safety Board*, 3. See also U.S. Congress, House of Representatives, Committee on Natural Resources, Subcommittee on Energy and Mineral Resources, *Federal Nuclear Facilities Licensing and Regulation Act,* 103rd Cong., 2d sess., March 1 and 8, 1994, 226–51. See also Bert Chapman, "The Defense Nuclear Facilities Safety Board's First Decade," *Journal of Government Information* 27 (2000), 363–64, http://docs.lib.purdue.edu/lib research/70.
[623] House, Natural Resources Subcommittee on Energy and Mineral Resources, *Federal Nuclear Facilities Licensing and Regulation Act*, 237–39.

> thousands of other bills introduced in the Congress that are not acted upon, this bill was never voted on or even reported out of Committee or Subcommittee.[624]

The Board was later similarly critical of another draft bill, H.R. 3907, External Regulation of the Department of Energy Act, introduced in the 106th Congress on March 14, 2000, by Representative Thomas Bliley (R–VA) and several co-sponsors.[625] The bill would establish external regulation of DOE defense nuclear facilities by the NRC, abolishing the Board and making its staff available to the NRC, effective October 1, 2001.[626]

After the 1994 failure of H.R. 3920, considerations of changes to the regulatory arrangements for defense nuclear facilities moved for a time to the executive branch of government. In January 1995, Secretary of Energy O'Leary convened a committee to examine the pros and cons of subjecting DOE nuclear facilities to further federal regulation.[627] Called the Ahearne Committee after its chairman, John Ahearne, this committee issued a final report in December 1995 that advanced three major positions:

- Essentially all aspects of safety at DOE's nuclear facilities and sites should be externally regulated.
- Existing agencies rather than a new one should have this responsibility.
- Under any regulatory regime, DOE must maintain a strong internal safety management system.[628]

In stating the rationale for these positions, the Ahearne report put great emphasis on the potential for additional external regulation "to improve the public's confidence in the safety of DOE's operations" by enhancing "opportunities for effective involvement in the regulation of safety—as . . . with similar facilities in the private sector."[629] The report restated the arguments often heard at the time the Board was created about the incompatibility of DOE's continuing self-regulation and public confidence,

> The inherent conflict of interest between mission and self-regulation of safety at DOE, aggravated by a long legacy of secrecy, is at the root of many of the safety problems in the nuclear complex. External regulation would end that conflict . . . . Only independent, external regulation can ensure the stable regulatory framework

[624] DNFSB, *Report to Congress on the Role of the Defense Nuclear Facilities Safety Board*, 3.
[625] External Regulation of the Department of Energy Act, H.R. 3907, 106th Cong. (2000).
[626] House, Commerce Subcommittee on Energy and Power, Legislation to Improve Safety and Security in the Department of Energy, 1–2.
[627] DNFSB, *Report to Congress on the Role of the Defense Nuclear Facilities Safety Board*, 3.
[628] Advisory Committee on External Regulation of Department of Energy Nuclear Safety, *Improving Regulation of Safety at DOE Nuclear Facilities. Final Report* (Washington, DC, December 1, 1995), 1–2, http://www.osti.gov/bridge/servlets/purl/181136-25nT51/webviewable/181136.PDF.
[629] Advisory Committee on External Regulation, Improving Regulation of Safety at DOE Nuclear Facilities, 2–3.

> . . . that is required to ensure credibility. The Department has been unsuccessful in its attempts to achieve credibility under self-regulation . . . and . . . the credibility of its safety efforts remains low . . . . We believe that external regulation is essential to earning the public confidence the Department seeks and needs to free itself to carry out its important national missions.[630]

In stressing the need for external regulation to enhance public confidence, the report effectively found the Board wanting in its accomplishment of one of the major goals for its creation, namely, the goal of promoting sufficient openness about safety issues in the nuclear complex to restore public confidence. The report also disparaged the Board's lack of formal enforcement authority and limited size and budget. At the same time, the report recognized that the Board's strengths in scientific and technical personnel and in operational flexibility made it a candidate agency, along with NRC, to serve as an external regulator of DOE. The report was non-committal as to which agency, the Board or NRC, should become the regulator, noting that both as currently constituted had shortcomings for the role.

> Neither NRC nor the DNFSB was designed to carry out the kinds of responsibilities required of a regulator of facility safety at the DOE nuclear complex. Both would have to undergo significant changes . . . . We present two options for facility operator—NRC with a more flexible approach and incorporating the resources of the DNFSB, or a restructured and enlarged DNFSB.[631]

In addition to an expanded mission for the NRC or the Board, the report envisaged the Occupational Safety and Health Administration (OSHA) as also regulating DOE nuclear facilities, specifically in the area of worker safety.[632] The Environmental Protection Agency (EPA) would retain its role as the regulator of "environmental protection matters for all DOE nuclear facilities and sites under the environmental statutes," operating along lines comparable to those prevailing in commercial nuclear facilities.[633]

DOE under Secretary of Energy O'Leary initially endorsed the recommendations of the Ahearne Committee report, deciding in December 1996 that NRC should become the principal external regulator of nuclear safety at DOE facilities, with a phase-in period of 10 years.[634] During that period, the Board would continue oversight activities, gradually reducing the pace and scope of its oversight as the NRC became the external regulator. In 1997, after DOE

[630] Advisory Committee on External Regulation, Improving Regulation of Safety at DOE Nuclear Facilities, 2–3.
[631] Advisory Committee on External Regulation, Improving Regulation of Safety at DOE Nuclear Facilities, 77.
[632] GAO, Department of Energy: Clear Strategy on Externa1 Regulation Needed, 6. See also Chapman, 366.
[633] Advisory Committee on External Regulation, Improving Regulation of Safety at DOE Nuclear Facilities, 3.
[634] GAO, Department of Energy: Clear Strategy on Externa1 Regulation Needed, 2.

committed to seeking the necessary legislation for this regulation plan, NRC Chair Shirley Jackson endorsed the plan.[635] O'Leary's successor, Secretary Peña, chose to evaluate the feasibility of the plan through the creation of a joint, two-year DOE–NRC pilot project for simulated regulation, with the Lawrence Berkeley National Laboratory in California as the project's initial site and selected facilities at Savannah River and Oak Ridge as follow-on sites.[636]

These moves toward external regulation by the NRC met with a mixed response. The chair of the House Commerce Subcommittee on Energy and Power, Representative Daniel Schaefer (R–CO), gave the idea full-throated support in a May 20, 1998 hearing.

> If the Department knew that a regulator with full enforcement authority was watching over its shoulders, many DOE sites would be managed more efficiently and safely. Had such a watchdog been required for DOE sites from the beginning I think we could have avoided many of the massive environmental problems that the DOE complex faces today.[637]

In the same month, the General Accounting Office (GAO) weighed in on the external regulation initiative, criticizing the choice of pilot project sites on the grounds that they were not representative of the full spectrum of safety problems to be encountered in the DOE nuclear complex. The sites contained "no nuclear reactors, weapons plants, or heavily contaminated facilities"—the very kinds of facilities that best exemplified the troubling safety issues that triggered the renewed exploration of external regulation in the first place.[638] GAO's unenthusiastic assessment contributed to already waning momentum of executive branch proposals for additional external regulation of DOE.

In addition to proposals and protracted debates about an altered regulatory regime for DOE, the late 1990s saw the revival of Reagan-era debates about the very existence of DOE, which resulted in several legislative proposals to eliminate DOE altogether.[639] Such proposals, which would also have precipitated sharp change for the Board, emerged in Congress in 1995, after the congressional majority passed into Republican hands. These proposals called for

---

[635] Interview, Kenneth M. Pusateri, Board, general manager (1989–2006), Washington, DC, January 3, 2008. Jackson's successor at the NRC was less enthusiastic.
[636] GAO, *Department of Energy: Clear Strategy on Externa1 Regulation Needed*, 8.
[637] U.S. Congress, House of Representatives, Committee on Commerce, Subcommittee on Energy and Power, *External Regulation of Department of Energy Nuclear Facilities,* 105th Cong., 2d sess., May 20, 1998, 1.
[638] GAO, Department of Energy: Clear Strategy on Externa1 Regulation Needed, 2.

transferring some programs of the dismantled DOE to other federal agencies, while privatizing other programs and putting them under the NRC.[640] One bill, the Department of Energy Abolition Act, S. 1678, was floated in 1996 by Senator Rod Grams (R–MN), and another with a similar thrust and title, H.R. 1577, was introduced in 1997 in the House of Representatives.[641] Under the unsuccessful bills, the functions of the Board were slated for transferal to the Department of Defense.

Defenses of the Regulatory Compromise that Created the Board

The various proposals for changes to the oversight and management arrangements in the DOE weapons complex were not supported by the Board, as Conway pointed out with a touch of wryness in a congressional hearing. In testimony about the latest, March 2000 legislative proposal to eliminate the Board in favor of NRC regulation (H.R. 3907), he likened the Board's situation as a small organization to that of the Marines, which was also often on the verge of being folded into a larger entity.

> My pleasure in being with you here this morning is somewhat tempered with the fact that one of the bills you propose to make into law would do away with the organization I represent. . . . .We, the members of the Board, have put together an elite group of technical experts. . . . I and our staff—I feel that we are somewhat like the Marine Corps. We have an elite group. Periodically there are discussions or recommendations to put the Marines into the Department of the Army, and for the last 4 or 5 years we have heard various suggestions of taking our staff and putting them into the NRC.[642]

At the same time that Conway critically assessed the various proposed regulatory and bureaucratic changes, he offered the view that there was no more legitimate or credible voice than the Board to speak to such changes.

> While many reports have been written about external regulation, pilots conducted at non-defense facilities, and opinions offered on this subject, I must emphasize that the Board is the only external, independent organization that has actually conducted full-time technical oversight of public and worker health and safety at

---

[639] Terrence R. Fehner and Jack M. Holl, *Department of Energy, 1977–1994: A Summary History* (Washington, DC: U.S. Department of Energy, November 1994), 31, 35–36, 51, http://www.osti.gov/bridge/servlets/purl/10106088-mgIkuD/webviewable/10106088.PDF.
[640] Interview, Pusateri.
[641] *Department of Energy Abolishment Act*, S. 1678, 104th Cong., (1996); and Department of Energy Abolishment Act, H.R. 1577, 105th Cong. (1997).
[642] House, Commerce Subcommittee on Energy and Power, Legislation to Improve Safety and Security in the Department of Energy, 25–26.

> DOE defense nuclear facilities. Consequently, the Board frequently has been called upon by both the legislative and executive branches to share its collective knowledge gained from 10 years of oversight experience in DOE's defense nuclear facilities.[643]

On one of the many occasions when the Board was asked to give its views on regulatory and oversight options, the Board provided them in the form of an extensive written report, as mandated by Congress in the National Defense Authorization Act for Fiscal Year 1998. Per the mandate, the Board provided to Congress in November 1998 its *Report to Congress on the Role of the Defense Nuclear Facilities Safety Board Regarding Regulation of DOE's Defense Nuclear Facilities*. As Conway summarized the report's findings, the Board "found no creditable arguments, either on the grounds of improved safety or cost effectiveness, to subject the defense nuclear facilities to additional external regulation." [644]

Whenever responding to queries about proposed regulatory changes, the Board always restated its fundamental support for the regulatory compromise that was struck in 1989 in the Board's enabling legislation. From the Board's point of view, much of the agitation for changes rested on fundamental misperceptions of the Board's actual powers, as well as of the actual state of regulation in DOE facilities. In the Board's view, the proposed legislative changes also misdiagnosed the sources of DOE's problems, and thus were likely to do more harm than good.

With respect to the state of regulation, Board members often pointed out that proposals for regulatory change, such as those in the Ahearne Committee report, were predicated on a dated view of the actual level or pervasiveness of regulation to which DOE facilities were subject. In the Board's view, the proponents of additional external regulation exaggerated the degree to which DOE still "self-regulated" the safety of its facilities. DiNunno, for example, who had represented the Board on the Ahearne committee but dissented from its conclusions, noted that DOE remained "self-regulating" only to a limited degree.[645] Historically, DOE had been granted autonomy to decide the trade-offs that had to be made between its paramount national security mission and its secondary mission, the mitigation of radiological risk to the public.[646]

---

[643] House, Commerce Subcommittee on Energy and Power, Legislation to Improve Safety and Security in the Department of Energy, 28.
[644] House, Commerce Subcommittee on Energy and Power, Legislation to Improve Safety and Security in the Department of Energy, 28.
[645] Interview, Pusateri. See also, "Appendix 2: Statement by Joseph J. DiNunno Relative to the Report of the Advisory Committee on External Regulation," A2/1-2, in DNFSB, *Report to Congress on the Role of the Defense Nuclear Facilities Safety Board*.
[646] GAO, Department of Energy: Clear Strategy on Externa1 Regulation Needed, 3.

However, since the 1980s, the areas in which DOE retained the freedom to regulate itself had shrunk significantly. For risks less central to the national security mission than radiological risks—e.g., occupational safety hazards and the risk of environmental contamination, particularly from non-radioactive hazardous waste—DOE had come under increasing formal external regulation.[647] As DiNunno said,

> It is important to understand that the often expressed statement that DOE regulates itself is misleading. DOE self-regulates today only in a limited area of nuclear materials. Regulation of the hazardous and toxic materials, control of some releases of radioactivity to the environment and disposal of mixed and radioactive wastes are externally regulated . . . . DOE today is not free to operate in the way that historically caused the contamination of sites now requiring major cleanup and environmental restoration.[648]

Expanding on the same idea, Conway frequently pointed out that DOE nuclear facilities were subject to an array of safety-related laws and regulatory agencies. In the 1994 hearings on H.R. 3920, for example, he mentioned that DOE nuclear facilities were subject "to federal environmental laws administered by EPA, . . . to State environmental requirements . . . to Department of Transportation regulations on the transport of nuclear materials, to the Mine Safety and Health Administration for the Waste Isolation Pilot Plant (WIPP) facility, and to NRC licensing for certain nuclear waste facilities."[649] Moreover, as Conway said, in a certain sense DOE itself already functioned as an outside regulator vis à vis its contractors.

> One must keep in mind that the actual work carried out by the Government in its nuclear weapons activities is done by contractor employees, not by federal employees of the DOE. It is DOE's responsibility to assure that the work is done safely, efficiently and with full compliance with the environmental laws . . . . [F]or all intents and purposes . . . DOE "regulates" the individual contractors doing the work. DOE has the authority and power to force a site, a facility or particular job to be curtailed or be shut down. Do we need to add additional government employees of another government agency such as the NRC to assure that DOE government employees are properly enforcing government laws, safety rules and regulations on contractor management and workers? If so, at what additional cost?[650]

---

[647] George, 56–57, 229.
[648] Joseph J. DiNunno, "External Regulation of DOE Nuclear Safety: A Different Point of View" (paper prepared for presentation to local section, American Nuclear Society, Washington, DC, February 27, 1996), http://www.dnfsb.gov/pub_docs/dnfsb/com_19960227.html.
[649] House, Natural Resources Subcommittee on Energy and Mineral Resources, *Federal Nuclear Facilities Licensing and Regulation Act*, 237–38.
[650] House, Commerce Subcommittee on Energy and Power, Legislation to Improve Safety and Security in the Department of Energy, 28.

Arguing that the pervasiveness of regulation in DOE nuclear facilities should not be underestimated, the Board also regularly argued that the Board's powers in conducting oversight likewise should not be underestimated. Advocates of external regulation typically understated the powers of the Board, repeating the notion that they were "merely advisory." However, the Board held that the authority inhering in the recommendation process and other Board powers was substantial.[651] The Board members asserted that the Board's authority, first described as "decision-forcing" by the U.S. Court of Appeals of the D.C. Circuit, was not only adequate to its oversight role, but better suited than more coercive or intrusive mechanisms would be. Eggenberger restated this position in the third year of Board operations, when he emphasized the value and appropriateness of the cooperative interaction with DOE that had developed for resolving complex technical problems.

> In many ways, I believe the recommendations that we make are stronger—stronger—than what one could do in a regulatory mode. This is because, number one, we are working directly with the Secretary of Energy [Watkins] and he is serious about safety. . . . He has cooperated with us completely in all endeavors. He has instructed his personnel to do so . . . .We have briefings with them. They brief us. They discuss issues that we ask them to discuss. We sometimes have a heated scientific discussion. But they have cooperated, and in my opinion, it is working well.[652]

Finding that the Board's manner of proceeding had demonstrated its efficacy, the Board members also retained their long-standing wariness of full formal regulation, fearing, as Conway put it, "the potentially litigious and confrontational processes that frequently characterize adjudicatory proceedings under regulatory regimes.[653] DiNunno seconded the point in arguing that the proposals of the Ahearne Committee "Taken as a whole . . . represent a regulatory model that will exacerbate DOE's problems, not solve them."[654] He added,

> The safety problems of DOE require technical solutions—stabilization of residual wastes, clean up of contaminated buildings and sites, safe dismantlement of nuclear weapons, and safe stewardship of strategic materials. The solution offered is a cumbersome, complex, legal structure with dramatically increased potential

[651] House, Natural Resources Subcommittee on Energy and Mineral Resources, *Federal Nuclear Facilities Licensing and Regulation Act*, 240.
[652] Senate, Committee on Armed Services, Department of Defense Authorization for Appropriations for Fiscal Year 1993, 244.
[653] House, Commerce Subcommittee on Energy and Power, Legislation to Improve Safety and Security in the Department of Energy, 28.
[654] U.S. Congress, Senate, Committee on Armed Services, Department of Defense Authorization for Appropriations for Fiscal Year 1997 and the Future Years Defense Program, 104th Cong., 2d sess., March 6, 13, 20, 25, 29, 1996. 33.

> for litigious proceedings that could impede DOE's mission and add unneeded cost to the taxpayer.[655]

Apart from the potential drawbacks of a legalistic framework, the Board members failed to see how additional regulation would get to the root of DOE's problems, foremost among which, in their view, remained the technical personnel problem. The Board members continued to identify this problem as the most fundamental obstacle to expeditious safety improvement in the complex. They often reiterated the point that enhanced safety in DOE nuclear facilities depended far less on the powers of the Board or specific regulatory arrangements than on the cadre of technical personnel in DOE. They repeatedly underscored the need for a level of technical competence in DOE that would allow it to be "a demanding customer" of its contractors.[656] Such competence was necessary for both enhanced safety and public confidence.

Finding no certain benefits in reformed regulatory structures and some probable drawbacks, the Board members regularly played their trump card in the external regulation debate—the issue of comparative cost.[657] The Board argued that its oversight approach was demonstrably effective—producing safety improvements—at much lower cost than various proposed regulatory alternatives. Speaking about the Board's comparative cost effectiveness in a March 1997 hearing, Conway cited estimates that the NRC would require 1,100–1,600 additional staff and $150–$200 million annually to regulate DOE's facilities.[658] By contrast, the Board operated in the late 1990s at a cost of about $17 million per year.[659] Testifying in 2000, Conway said,

> We believe that in an era of shrinking dollars to perform DOE's major missions—weapons maintenance/ stewardship and cleanup—it would not be prudent to transfer safety-related responsibilities into a more costly regulatory structure for questionable fringe benefits.[660]

In arguing in these cost/benefit terms, the Board had the support of a crucial and steady ally in Congress, the Senate Armed Services Committee. Although some of the original

---

[655] Joseph J. DiNunno, "External Regulation of DOE Nuclear Safety: A Different Point of View."
[656] Interview, Pusateri.
[657] DNFSB, Report to Congress on the Role of the Defense Nuclear Facilities Safety Board, 9–14.
[658] Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1997*, 31.
[659] The Board's initial start-up appropriation—for FY 1989—had been $7 million. Two decades later, with the growth of the Board and added oversight responsibilities, the Board's budgetary authorizations were in the range of $25 million annually.

membership on this committee responsible for creating the Board had changed since the late 1980s, the committee remained favorably disposed to the Board—the most favorably disposed among the committees with oversight responsibility for the Board.[661] Supporting the Board's cost/benefit arguments, the Senate Armed Services Committee always mentioned cost efficiency as one reason to continue current oversight arrangements. The committee also expressed wariness about the potential for external regulation to lead to undue interference with the defense mission of the nuclear weapons complex. In the committee's FY 1997 budget authorization report, for example, the committee criticized the Ahearne committee report, stating,

> [It] ignores the priorities and paramount objective of the Atomic Energy Act and . . . does not grasp the danger inherent in a weakened strategic deterrent. The committee has seen no compelling data or argument to . . . subject national security programs to a new, independent, external regulatory system. In addition, there appear to be two distinct disadvantages to external regulation . . .: (1) it could increase the potential effect of intervenors, lawyers, and the members of the judiciary, associated with the regulatory process, in imposing burdens that would have an adverse effect on the Department's defense and national security missions; and (2) it could dramatically increase operating costs. Since the creation of the Defense Nuclear Facilities Safety Board (DNFSB) in 1988, the board has gained the bipartisan support and confidence of the committee. The committee is satisfied with the current relationship between the board and the Secretary of Energy.[662]

The same committee's budget authorization report for FY 1999 was similarly negative about external regulation and positive about the Board.

> The committee is not convinced that external regulation of new or existing DOE defense nuclear facilities will increase safety, decrease cost, or improve operational efficiency at such facilities . . . . The committee is concerned that the implementation of an additional external regulation approach could draw scarce resources away from high priority, compliance driven clean-up actions and critical national security activities, with little added benefit.[663]

The report added the Board "continues to provide exceptional and effective external oversight with a budget that equals about one-tenth of one percent of total Atomic Energy Defense funding." [664]

---

[660] House, Commerce Subcommittee on Energy and Power, Legislation to Improve Safety and Security in the Department of Energy, 29.
[661] Interview, Pusateri.
[662] S. Rep. No. 104–267 [to accompany S. 1745], at n.p. (1996), http://www.congress.gov/cgi-bin/cpquery/?&sid=cp104xbGcm&refer=&r_n=sr267.104&db_id=104&item=&sel=TOC_797070&.
[663] S. Rep. No. 105–189, at 431 (1998).
[664] S. Rep. No. 105–189, at 431 (1998).

By 2000, in view of the strong votes of confidence for the Board from the Senate Armed Services Committee and steadfast support from other key players, the advocates of external regulation and privatization backed off from efforts to advance additional external regulation regimes upon DOE. In turn, assured of the indefinite extension of its statutory mandate, the Board was able to devote its full attention to its oversight of the DOE nuclear weapons complex.[665]

THE BOARD'S OPERATIONS: GROWTH, REFINEMENT, FORMALIZATION

During and after the period in which regulatory alternatives were under discussion, the Board itself saw some changes, some having to do with its methods of operation and some with its personnel.

Personnel: Stability at the Top, Expertise Throughout

In the realm of personnel, the Board was and remained a rather stable operation, characterized by low turnover in both Board membership and the three categories of staff—technical, legal, and administrative. Three of the Board's five inaugural members, Conway, Eggenberger, and Kouts, were reconfirmed and remained with the Board a decade after its establishment. The first new member of the Board, Joseph J. DiNunno, served for a decade prior to his retirement in June 2002.[666] John Mansfield, the second new member, appointed in 1997, remained on the Board in 2009. Only two of the later appointees were no longer on the Board in 2009, Jessie Hill Roberson and R. Bruce Matthews. Roberson, who was appointed on

[665] Interview, Pusateri. As Congress backed off from proposals to change arrangements for external oversight in the weapons complex, an organizational change in DOE did go forward, reflecting the perception of continuing management and security weaknesses in DOE. In 1999 Congress altered the organization of DOE by establishing the National Nuclear Security Administration (NNSA) as a separately organized, semi-autonomous agency within DOE. See U.S. Department of Energy, National Nuclear Safety Administration Web site, http://www.nnsa.energy.gov/about/index.htm. NNSA was charged with the management and operation of the nation's nuclear weapons, nonproliferation, and naval reactors programs. In relation to nuclear weapons, DOE's NNSA was charged with managing the facilities and activities that implemented the Stockpile Stewardship Program, including surveillance, maintenance, refurbishment, production, and dismantlement of nuclear weapons, as well as research and development and certification efforts. The facilities for which the NNSA was responsible included the three nuclear weapons laboratories, the Nevada Test Site, and four weapons handling plants—the Pantex Plant in Texas, the Y–12 National Security Complex in Tennessee, the Kansas City Plant in Missouri, and elements of the Savannah River Site in South Carolina.

[666] See U.S Department of Energy, Office of Health, Safety, and Security, "Biography: Mr. Joseph John DiNunno," http://www.hss.doe.gov/deprep/dnfsb/members/jjdinn.htm.

January 16, 2000, was subsequently appointed to be the DOE assistant secretary for environmental management.[667] The Board members serving in the Board's twentieth year had seen tenures ranging from two decades for Eggenberger, more than one decade for Mansfield, roughly a half-decade for Joseph F. Bader, and three years for Larry W. Brown and Peter S. Winokur, as noted in Table 1.

Table 1. Defense Nuclear Facilities Safety Board Membership, 1989–2009

John T. Conway (Former Chairman) 10/18/89–04/02/05	**A.J. Eggenberger** (Former Chairman) 10/18/89–07/31/09 Vice Chairman until July 2005.	**Herbert J.C. Kouts** 10/18/89– 01/14/00	**John W. Crawford Jr.** 10/18/89–11/22/96	**Edson G. Case** 10/18/89–09/16/91
Peter S. Winokur 10/23/06–present		**Jessie Hill Roberson** 01/16/00– 07/18/01	**John E. Mansfield** 10/31/97–present Vice Chairman since 2007.	**Joseph J. DiNunno** 08/13/92–06/01/02
		Joseph F. Bader 11/30/04–present	--	**R. Bruce Matthews** 04/22/03–12/31/05
			--	**Larry W. Brown** 09/29/06–present

The new Board members were all "respected experts in the field of nuclear safety," like the original members and as required by the Board's enabling statute. DiNunno had served for nearly two decades in the Navy Department, including under Rickover in the Naval Reactors Program, after which he spent 13 years with the Atomic Energy Commission (AEC), eventually heading the agency's first Office of Environmental Affairs. He also had extensive experience in private industry in a variety of nuclear safety and environmental roles.[668] Mansfield, a Ph.D. physicist and the Board's vice chairman since 2007, had a broad background of federal service in both the executive and legislative branches, as well private-sector experience.[669] He served on the staffs of the House and Senate Armed Services Committees and held senior positions at the Defense Intelligence Agency, the Defense Nuclear Agency, and the Defense Advanced Research Projects Agency (DARPA). He had expertise in risk assessement, operations analysis, nuclear

[667] See U.S Department of Energy, Office of Health, Safety, and Security, "Biography: Jessie Hill Roberson," http://www.hss.doe.gov/deprep/dnfsb/members/roberson.htm.
[668] See U.S Department of Energy, Office of Health, Safety, and Security, "Biography: Mr. Joseph John DiNunno," http://www.hss.doe.gov/deprep/dnfsb/members/jjdinn.htm.
[669] Defense Nuclear Facilities Safety Board, *Eighth Annual Report* (Washington, DC, February 1998), 1–11, and Appendix B, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php.

weapons technology, defense policy analysis, and the management of technology support to national defense programs. Roberson, a specialist in systems engineering, had extensive private-sector experience in reactor operations.[670] She served for a decade with DOE in technical and managerial positions at the Rocky Flats Environmental Technology Site and Savannah River, where her focus included environmental cleanup, waste management, safeguards, and security, as well as nuclear reactors and weapons. Matthews, a Ph.D. in materials science, had 30 years of scientific and engineering experience in nuclear technologies with a primary focus on nuclear materials for nuclear weapons and reactors.[671] As Division Director at Los Alamos National Laboratory, Matthews managed nuclear facilities with responsibility for DOE programs, operations, construction, safety and security. Bader, an expert in mechanical and nuclear engineering, had extensive knowledge of design, construction management, and operations of R&D facilities, materials production, and power plants. He held executive and senior management positions in the nuclear weapons complex and nuclear power sectors, and conducted numerous program/project reviews. Larry W. Brown served in the U.S. Navy for more than 30 years, including as commander of two non-nuclear navy destroyers.[672] After practicing law on leaving the navy, he served at DOE as a senior policy adviser on nuclear, spent fuel, and nonproliferation/security issues. Peter S. Winokur, a Ph.D. physicist, with 37 years of scientific and engineering experience, specialized in radiation effects science, technology, and hardiness assurance in support of military and space systems.[673] One of the most highy cited researchers in engineering, he served as a senior policy analyst for the National Nuclear Security Administration, a unit of DOE established in 2000, served as a senior staffer in Congress on energy issues, and held senior postions at Sandia National Laboratory.

The consistently exceptional technical and management qualifications that the Board members brought, combined with their low turnover, contributed to strong and continuous management at the Board. The continuity of management was reinforced by the nature of the Board members' appointments. Appointed for fixed five-year terms, the Board members were

[670] See U.S Department of Energy, Office of Health, Safety, and Security, "Jessie Hill Roberson: Biography," http://www.hss.doe.gov/deprep/dnfsb/members/roberson.htm.
[671] See U.S Department of Energy, Office of Health, Safety, and Security, "R. Bruce Matthews: Biography," http://www.hss.doe.gov/deprep/dnfsb/members/matthew.htm.
[672] See U.S Department of Energy, Office of Health, Safety, and Security, "Larry Warren Brown, Captain, United States Navy (ret.): Biography," http://www.hss.doe.gov/deprep/dnfsb/members/brown.htm.
[673] See U.S Department of Energy, Office of Health, Safety, and Security, "Peter S. Winokur, Ph.D.: Biography," http://www.hss.doe.gov/deprep/dnfsb/members/winokur.htm.

statutorily able to "serve after the expiration of that member's term until a successor has taken office."[674] The Board's continuity of management contributed to its ability to conduct oversight with a consistent but flexible plan of action.

Among the Board's management achievements was the creation of an exceptionally qualified staff through the pursuit of a focused human capital development program. The total number of employees, for budgetary reasons, fell short of the Board's full statutory authorization of 150 full-time employees, hovering instead at a strength of about 100 staff members. Thanks to the Board's excepted service hiring and compensation authorities, and "years of careful recruiting and selection," these staff members included about 60 technical experts of "the highest caliber."[675] This cadre of scientists and engineers served both in the field at various DOE sites and in the Washington, DC, office.[676] As Board reports to Congress noted, "Essentially all of the technical staff have technical masters degrees, and approximately 28 percent have doctoral degrees," and they commonly had practical experience in the U.S. Navy's Naval Nuclear Propulsion Program, the nuclear weapons field, and/or the commercial nuclear power industry.[677] The technical staffers brought, as the Board stated,

> [E]xtensive backgrounds in technical disciplines such as nuclear-chemical processing, conduct of operations, general nuclear safety analysis, conventional and nuclear explosive technology and safety, nuclear weapons safety, storage of nuclear materials and nuclear criticality safety, and waste management.[678]

They augmented their qualifications, at Board urging, through the serious pursuit of professional development activities. To attract younger staff members, the Board also had a three-year Professional Development Program designed to bring "entry-level technical and scientific talent into professional positions within the Board." The Board said of the program,

> Through a technical mentor, individuals are provided a series of individually tailored developmental assignments, formal academic schooling, and a 1-year hands-on field assignment.[679]

A.J. Eggenberger, Board chairman as of 2005, described the intern program's intent,

---

[674] *Atomic Energy Act of 1954* (42 USC 2011 et seq.), Section 311(d)(3).
[675] DNFSB, *Strategic Plan: FY 2003–2009*, 12–13.
[676] The Board has established site offices at the Hanford Site, Lawrence Livermore National Laboratory, the Pantex Plant, the Y–12 National Security Complex, the Savannah River Site, and the Los Alamos National Laboratory.
[677] DNFSB, *Strategic Plan: FY 2003–2009*, 12–13; DNFSB, *Ninth Annual Report to Congress*, February 1999, 5-1.
[678] DNFSB, *Strategic Plan: FY 2003–2009*, 12–13.
[679] DNFSB, *Strategic Plan: FY 2003–2009*, 13.

> [T]his is the investment the Board makes in developing our young engineers. It acts as an incentive for attracting young technical talent and it sustains the technical excellence of our staff.[680]

To maximize the effectiveness of its carefully selected staff members, the Board used a matrix form of organization to group them, which allowed the Board "to quickly reassign technical resources as needed to review emerging health and safety issues."[681] The Board organized its technical staff by strategic oversight areas of concentration, creating interdependent technical groups, "staffed with technical specialists having both the education and work experience commensurate with the designated oversight assignments." This organization fostered constant information sharing across areas of concentration, giving the Board the needed flexibility to respond to changes in DOE's priority concerns, plans, and schedules by redeploying staff resources within and among focus areas. The Board explained the premium it placed on flexibility, stating,

> The pace and focus of the Board's health and safety oversight work are controlled, in large part, by DOE's schedule for major actions in the defense nuclear complex. Thus, changes in DOE's schedules and priorities based on circumstances within and beyond DOE's control may require a corresponding change in the Board's oversight plans.[682]

Formalization of Board Activities

The explicit definition of the Board's primary areas of concentration and the corresponding organizational alignment of its staff were a formalization of the Board's division of work driven by the Government Performance and Results (GPRA) Act of 1993. The act required each federal agency to develop a five-year strategic plan that articulated its mission and goals, as well as proposed methods for achieving its goals. As required by the act, the Board issued its first Strategic Plan in 1997, along with its first annual performance plan, also required.[683] The Strategic Plan outlined general goals and objectives that addressed multi-year

[680] A. J. Eggenberger, "Technical Excellence," Presentation, at the DOE Nuclear Executive Leadership Training, September 22, 2005, https://www.hss.energy.gov/deprep/2005/FB05S22A.HTM.
[681] DNFSB, *Strategic Plan: FY 2003–2009*, 12.
[682] DNFSB, *Strategic Plan: FY 2003–2009*, 19. Because the work of the Board depended on the priorities of DOE and, more broadly, on U.S. policy on the nuclear deterrent, the Board, in formulating its strategic plans, stated several assumptions on which the plans were predicated, namely, that the United States would maintain its 1991 halt of new nuclear weapons production, and the 1992 halt of nuclear testing.
[683] Defense Nuclear Facilities Safety Board, *Strategic Plan: FY 1997–2002* (Washington, DC, 1997), http://www.hss.doe.gov/deprep/1997/bm97s30b.htm.

efforts and encompassed "a broad spectrum of technical areas relevant to the safety of DOE's defense nuclear mission."[684] The Board used its Strategic Plan to establish a framework for facilitating management decisions. In the plan, the Board recast and grouped the wide array of technical areas in which it was already performing safety oversight into strategic areas of concentration. For each strategic area, the Board's planning efforts yielded an associated set of annual performance objectives, action plans, and measurements that could "demonstrate progress toward achieving the Board's strategic goals."[685]

The first of the Board's Strategic Plans, issued "after consultation with the Office of Management and Budget, Congressional staff members, and the public," described the nature of the Board's work within three strategic areas of concentration.[686] These three focus areas, as stated in the Board's *Strategic Plan for FY 1997–2002*, were:

> I. Complex-Wide Health and Safety Issues
>
> II. Management and Stewardship of the Nation's Stockpile and Nuclear Weapons Components
>
> III. Hazardous Remnants of Weapons Production.[687]

In the first strategic area, the Board planned for continuing oversight on, among other things, DOE's implementation of Integrated Safety Management, the development and implementation of standards, requirements, and safety programs, the competence of technical personnel, and the review of DOE design and construction projects. In the second strategic area, the Board planned for continuing efforts to support the safe execution of DOE's work in the nuclear weapons stockpile, as well as associated research and development activities. In the third area, the Board planned to continue its intensive involvement in monitoring waste characterization, stabilization, and storage operations, and in urging DOE to accelerate the disposition of inventories of hazardous nuclear materials and the decommissioning of surplus facilities. As the Board pursued its safety activities, closely tying them to the goals and objectives embodied in its plans, it reported its accomplishments and associated problems extensively in its annual reports and other communications with Congress. At the same time, based on the lessons learned in its planning initiatives, the Board refined its planning efforts, seeking "a streamlined approach that allows the

[684] DNFSB, *Strategic Plan: FY 2003–2009*, 18.
[685] Transmittal letter to Jacob J. Lew, Director, Office of Management and Budget, from John T. Conway, October 30, 2000, for *Fiscal Year 2002 Performance Plan, October 2000.*
[686] Transmittal letter to Lew, from Conway, October 30, 2000.

Board to use its resources effectively," and to adapt and move resources to meet new oversight demands.[688]

As of 2003, in the *Strategic Plan for Fiscal Year 2003–2008*, the Board focused its technical nuclear safety oversight on four interdependent, strategic areas of concentration, adding one area, "Nuclear Facilities Design and Infrastructure," to the three originally set forth in the Board's 1997 strategic plan. As reformulated in the plan, the areas were:

- Nuclear Weapons Operations;
- Nuclear Material Processing and Stabilization;
- Nuclear Facilities Design and Infrastructure;
- Nuclear Safety Programs and Analysis.[689]

In effect, the Board elevated one of the objectives previously encompassed under the strategic area of "Complex-Wide Issues" to a new, fourth strategic area, "Nuclear Facilities Design and Infrastructure."[690] This creation of a new strategic area raised the profile of the Board's review of DOE's design and construction of new defense nuclear facilities and major modifications to existing facilities. The Board's legislative mandate had always included the review of DOE's design and construction projects. Although the Board was not empowered to stop facility construction, it was charged with determining that nuclear safety aspects of the design were adequate to protect health and safety. From the beginning of operations in 1989, the Board had worked with DOE to carry out this mandate, reviewing numerous DOE design and construction projects. However, the elevation of these oversight activities to a strategic focus reflected a major increase in work for the Board in the area of design/construction reviews, beginning in the early 2000s.[691]

---

[687] DNFSB, *Strategic Plan: FY 1997–2002*, 8.
[688] Interview, Pusateri. See also Transmittal letter to Lew, from Conway, October 30, 2000.
[689] DNFSB, *Strategic Plan: FY 2003–2009*.
[690] Beginning with the *Fourteenth Annual Report*, February 2004, the Board used the fourth category in its organization of its annual reports to Congress.
[691] DNFSB, *Strategic Plan: FY 1997–2002*, 7. Decisions about future weapons and the construction or upgrade of facilities to produce them were pertinent to the safety-related activities of the Board. For a time during the administration of George W. Bush, significant contingents in both the legislative and executive branches backed proposals to build a new generation of nuclear weapons, most notably the Reliable Replacement Warhead (RRW), and to revamp a consolidated nuclear weapons infrastructure to produce them. For proponents, this renovation was a better approach to ensuring the reliability of the smaller U.S. nuclear deterrent than investing in high-cost life extensions for aging weapons. In 2006 NNSA produced a multi-year plan to build new or upgraded facilities at each of its eight nuclear weapons-related sites—*Complex 2030: A Preferred Infrastructure Planning Scenario for the Nuclear Weapons Complex*. After 2007, Congress deleted all funds for the Reliable Replacement Warhead. See Michael Coleman, "Wilson: Pearce Was 'Stupid' To Introduce Bill," *Albuquerque Journal*, May 25, 2008 (accessed via Proquest).

BOARD OVERSIGHT IN THE AREA OF DESIGN AND CONSTRUCTION

The Board's inclusion of the category "Nuclear Facilities Design and Infrastructure "in its list of strategic areas of concentration was associated with a substantial increase in Board resources devoted to the area. Although the Board's oversight work in the other strategic areas continued undiminished, design and construction reviews in the early 2000s constituted an area of marked growth for the Board.[692] The increased workload associated with design/construction oversight reflected in part the fact that detailed design and construction reviews were extremely resource- and labor-intensive and time-consuming. At the same time, such reviews were considered vital to ensuring that safety was built into facility design, given the extreme expense of construction-stage retrofits in building projects. Another reason for the growth in this category of work for the Board was the growth in the number and scale of DOE's design and construction projects. Numerous projects to support the ongoing mission of the DOE nuclear complex and cleanup of sites were in various stages of development in 2001, reflecting the need for new capability to process legacy special nuclear materials, and the need to replace aging facilities required to maintain the nuclear weapons stockpile.

Writing in 2002, the Board said of this expanding DOE design and construction, "In recent years, there has been an increase in the number of new DOE projects, with 20 to 30 projects in the design and construction phase," requiring Board reviews.[693] Some examples of the projects involving Board oversight at the time included,

- the Tritium Extraction Facility, then under construction at the Savannah River Site, to process irradiated targets;
- the Hanford Waste Treatment Plant, four major nuclear facilities in the design and construction phase, to pre-treat and vitrify the high-level waste from the Hanford waste storage tanks;
- the Highly Enriched Uranium Materials Facility, in the design phase at the Y–12 National Security Complex, to provide long term consolidated storage for all highly enriched uranium materials at the site;

[692] A. J. Eggenberger, "Regulatory Challenges and Plans for the Year Ahead" (presentation to Energy Facility Contractors Group, Washington, DC, March 19–20, 2008), http://www.dnfsb.gov/pub_docs/testimonies/all/sp_20080320.pdf.
[693] DNFSB, *Strategic Plan: FY 2003–2009*, 8.

- the Pit Disassembly and Conversion Facility, in the design stage at the Savannah River Site, to convert surplus weapons grade plutonium metal into oxide for subsequent feed to the Mixed Oxide (MOX) Fuel Fabrication Facility.[694]

Other significant projects involving substantial Board oversight in the course of the 2000s included,

- the Salt Waste Processing Facility, in the design phase at Savannah River Site, to remove cesium, strontium, and actinides from high-level waste for vitrification in glass logs;
- the Chemistry and Metallurgy Research Replacement Project, in the design phase at the Los Alamos National Laboratory, to replace the current aging and deteriorating facility with a modern facility;
- the Uranium Processing Facility, in the design phase at Y–12 National Security Complex, to replace aging facilities and consolidate current capability to process uranium materials at the site;
- the New Solid Transuranic Waste Facility, in the design stage at Los Alamos, to store, characterize, repackage, and ship solid transuranic waste.[695]

Estimates of the total cost of the projects in which the Board became involved in the 2000s were more than $20 billion.[696] This involvement in design/construction reviews placed heavy demands on the technical oversight resources of the Board, in particular, as the Board stated in a budget request, "resources in specialty skill areas such as seismic engineering of structures, geotechnical reviews, concrete chemistry, systems engineering, and hazard analysis."[697]

As the Board stepped up its design/construction oversight, it stated a number of the operative assumptions with which it approached the activity, including the premise that "These facilities must be designed and constructed in a manner that will support safe and efficient operations for 20 to 50 years." Such a facility life span, as the Board noted,

> in turn requires a robust design process to ensure that appropriate health and safety controls are identified and properly implemented early in the process. ISM provides the framework for this process.[698]

---

[694] DNFSB, *Strategic Plan: FY 2003–2009*, 8.
[695] House, Appropriations Subcommittee on Energy and Water Development, *Nuclear Weapons Complex*, statement by Eggenberger, March 17, 2009, 4.
[696] Defense Nuclear Facilities Safety Board, *FY 2009 Budget Request to the Congress* (Washington, DC, February 2008), http://www.dnfsb.gov/about/budget.php.
[697] Defense Nuclear Facilities Safety Board, *FY 2008 Budget Request to the Congress* (Washington, DC, February 5, 2007), 1, http://www.dnfsb.gov/about/budget.php.
[698] DNFSB, *Thirteenth Annual Report to Congress*, February 2003.

> The Board's expectation is that the design and construction phases will identify the set of risks for each project and demonstrate clear and deliberate implementation of ISM principles and core functions.[699]

Major Board Efforts in the Design Review Area

In the Board's increased oversight of design/construction activities, the most prominent example involved the four-facility Waste Treatment and Immobilization Plant (WTP) at the Hanford Site, the largest ongoing environmental cleanup project in the world, projected to cost in excess of $12 billion.[700] The WTP, managed by the DOE unit, the Office of River Protection, is a huge vitrification complex that would receive and process the 53 million gallons of high-level nuclear waste from the Hanford tank farm.[701] Construction of the complex began in July 2002 and was slated to take some 15 years.[702]

The Board began to dedicate substantial technical resources to the project in late 2001, with oversight of the plant's design, including reviews of earthquake design documentation for the structure.[703] Beginning in mid-2002 and for the next two years, the Board repeatedly raised concerns to DOE regarding the seismic safety of the plant's design. The Board questioned the site data and seismic ground motion criteria used to design the WTP facility foundations,

---

[699] Defense Nuclear Facilities Safety Board, *FY 2010 Budget Request to the Congress* (Washington, DC, May 2009), http://www.dnfsb.gov/aboaut/budget.php.

[700] Interview, Dr. A. J. Eggenberger, July 9, 2008. For non-DOE, non-DNFSB background on Hanford's Waste Treatment Plant, see Michele Stenehjem Gerber, *On the Home Front: The Cold War Legacy of the Hanford Nuclear Site* (Lincoln: University of Nebraska Press, 1992), 253–58.

[701] Oregon, Department of Energy, Nuclear Safety Division, *Hanford Cleanup: The First 15 Years* (Salem, OR, October 2004), http://www.oregon.gov/ENERGY/NUCSAF/docs/15year.pdf. As this report stated on page 120, in July 2002, "Construction of Hanford's high-level waste vitrification facilities began, as structural concrete [was] poured as part of the 5-foot thick, steel-reinforced foundations and basement walls for one of two waste processing buildings. The project will require 58,000 tons of steel, 160 miles of piping and 1,260 miles of electrical cable. Two cement processing plants have been installed to produce the concrete that will be needed over the next five years."

[702] Interview, Eggenberger. Between 2003 and 2006 the project made progress in the cleanup of the Hanford tank wastes. The transfer of the radioactive wastes from the single-shelled tanks to the double-shelled storage tanks was finally completed. This waste awaited processing into glass in the Hanford Waste Treatment Plant.

[703] U.S. Congress, House of Representatives, Committee on Appropriations, Subcommittee on Energy and Water Development, *Energy and Water Development Appropriations for 2007*, 109th Cong., 2d sess., April 6, 2006 (testimony of Dr. A. J. Eggenberger), http://www.dnfsb.gov/pub_docs/hanford/ts_20060406_hd.pdf. Planning for vitrification facilities for the Hanford wastes began in the early 1990s, and went through several major shifts of direction. In 1995 DOE began a program to privatize the processing of high-level radioactive waste at Hanford, forming a unit to establish design requirements for the plant. Then called the Tank Waste Remediation System (TWRS), the plant was to be DOE contractor-owned and contractor-operated with licensing by the NRC. In 2000 the contractor declined to continue the TWRS program due to financial issues. DOE took over the project and abandoned the privatization approach for TWRS in favor of a more traditional government-owned, contractor-operated approach.

pointing out that they were insufficiently conservative and produced underestimates of seismic loads. As Eggenberger testified about the Board's review of seismic issues,

> The review was based on our technical people looking at the assumptions and calculations that had been previously made and the geology and seismology that we know now about the Pacific northwest area and . . . the faulting in that particular area. Based on that a set of questions were asked that could and can influence the seismic design basis. Those were asked, and these meetings were not sessions between our staff and DOE staff that lasted for an hour or so. They would last for days, and they would talk about these in extreme detail.[704]

In addition, the Board cautioned DOE that the aggressive, "fast-track" construction schedule, in which construction proceeded before the design was finalized, posed a serious risk that safety deficiencies in the design could require costly reengineering later. To avert this potential need for retrofits to ensure seismic safety, the Board advised DOE to adopt conservative design margins. By 2005, after considerable discussion between DOE and the Board, they continued to differ on seismic risk analyses and design criteria. With questions about seismic safety unresolved, DOE was compelled to suspend construction work on portions of the waste-processing facilities in March 2005, in order to double the seismic design standard.[705] Eventually, DOE developed revised estimates of ground motion, which the Board judged to be an adequately conservative basis to validate the existing design and construction of the plant. After further delay caused by congressional funding reductions through 2006, the construction stoppage affecting the pretreatment and the high-level waste facilities ended.

As the Board sought resolution of ground motion and seismic design issues in the structures of the WTP project, it also reviewed numerous other safety-related aspects of WTP's design and construction: electrical system design, instrumentation and control, ventilation systems, process safety, fire protection, hydrogen control, concrete quality, and standards issues. In connection with the hydrogen hazards and their possible impact on pipes, for example, the Board questioned the hydrogen generation rate estimates used to design hydrogen mitigation systems to prevent hydrogen-related accidents.[706] The Board's concerns prompted the contractor, Bechtel National, Inc. (BNI), to conduct studies and to revise its design basis generation rate

---

[704] House Appropriations Subcommittee on Energy and Water Development, *Energy and Water Development Appropriations for 2007*.
[705] Gerber, 255.
[706] Letter to Dr. Ines R. Triay, Acting Assistant Secretary for Environmental Management, U.S. Department of Energy, from A. J. Eggenberger, Chairman, January 8, 2009, http://www.hss.energy.gov/deprep/2009/FB09J08A.DOC

equation and its final estimate of the quantity of hydrogen that would be generated during WTP operations. The Board, always vigilant about the imperative to protect against fire, also challenged some of DOE's decisions regarding the application of fire-resistant coatings to structural steel, in response to which DOE also eventually modified aspects of its fireproofing project.[707] After the resolution of these and other concerns, the Board continued its monitoring of technical design/construction issues at the site, through the Board's resident site representatives, through regular discussions with DOE, and through site visits, e.g., a visit in January 2007 during which BNI and DOE's Office of River Protection briefed the three visiting Board members and Board staff.

Besides oversight activities at Hanford's WTP, another major Board effort in the review of facility design concerned the Chemistry and Metallurgy Research Replacement (CMRR) Project, Los Alamos National Laboratory (LANL).[708] This new facility, still in the design stage, was slated to replace the capability for operations then carried out in the five-decade-old Chemistry and Metallurgy Research facility to be closed in 2010. The Board viewed this replacement plan as a much-needed step—a prime case of the need to end reliance on unsound facilities. In the Board's view, the old "building's seismic fragility posed a continuing risk to the public and workers."[709] With respect to the planned replacement facility, the Board underscored the need to establish conservative design criteria for several of the project's safety-related systems, most notably, the ventilation and fire protection/suppression systems, as well as nuclear material container design. Under the Board's Recommendation 2004–2, *Active Confinement Systems*, the Board directed DOE's National Nuclear Security Administration to evaluate the ventilation system's design for the replacement facility to determine the adequacy of the project's strategy for confining hazardous materials.[710] However, the evaluation was delayed,

[707] On January 29, 2008, the Board issued Recommendation 2008–1, *Safety Classification of Fire Protection Systems* (Washington, DC, January 2008), http://www.dnfsb.gov/pub_docs/recommendatoins/all/rec_2008_01.pdf. This Recommendation called for standards for the design and operation of fire protection systems, a primary means of protection from radiological hazards at DOE's defense nuclear facilities.
[708] Defense Nuclear Facilities Safety Board, *FY 2008 Performance and Accountability Report* (Washington, DC, November 15, 2008), http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rcpr_2008.pdf.
[709] House Appropriations Subcommittee on Energy and Water Development, *Nuclear Weapons Complex,* statement by Eggenberger, March 17, 2009.
[710] Defense Nuclear Facilities Safety Board, *Recommendation 2004–2, Active Confinement Systems* (Washington, DC, December 7, 2004), http://www.dnfsb/pub_docs/recommendations/all/rec_2004_02.pdf. See also Defense Nuclear Facilities Safety Board, *Confinement of Radioactive Materials at Defense Nuclear Facilities,* DNFSB/TECH–34 (Washington, DC, October 2004), http://www.dnfsb.gov/pub_docs/technical_reports/all/tr_200410.pdf.

putting the project at risk for the late discovery of safety design deficiencies. In 2005, the Board identified weaknesses with the project's confinement strategy and deficiencies in the identification of safety-related controls. The Board expressed general concern in a February 2007 report on the project's safety basis documents. In late 2008, Congress intervened in the situation, enacting a limitation on funding for the project pending actions by the Board and NNSA. The Board and NNSA were each required to submit certifications to the congressional defense committees that the design concerns raised by the Board had been resolved. The issues whose resolution required certification included the design of the facility's safety class systems, including confinement system design, and seismic safety.[711]

The Push for Earlier Incorporation of Nuclear Safety in Design

In the course of performing its safety design reviews, the Board became a driver of improvements in DOE's processes for incorporating safety into the design of facilities. The Board's experiences with two major projects in particular—Hanford's Waste Treatment Plant and Los Alamos's Chemistry and Metallurgy Research Replacement project—brought forcefully home that the late identification of safety-related design flaws was a recurring DOE problem.[712] As the Board stated in its FY 2008 budget request,

> The Board has recognized during the past several years that DOE has not been conservatively designing safety into new defense nuclear facilities early in project life.[713]

Lessons learned from these two high-priority projects and others highlighted the negative consequences of delays in the resolution of safety concerns. Such delays produced overruns in total project costs and schedule slippages while corrections were made. Recognizing the cost and schedule risks of delayed issue resolution, the Board emphasized the need for early attention to identifying safety issues on both its part and that of DOE. As Eggenberger said in 2009,

> For the past several years, the Board has driven an initiative to ensure that DOE and NNSA design project teams focus on early recognition and rapid resolution of safety issues . . . .

---

[711] House Appropriations Subcommittee on Energy and Water Development, *Nuclear Weapons Complex,* statement by Eggenberger, March 17, 2009, 4. The limit on funding was stipulated in Section 3112 of the National Defense Authorization Act for Fiscal Year 2009, Pub. L. No. 110–417.
[712] Defense Nuclear Facilities Safety Board, *Eighteenth Annual Report to Congress* (Washington, DC, February 2008), 4-2, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php.
[713] DNFSB, *FY 2008 Budget Request to the Congress*, 53.

> Performing thorough reviews of safety issues earlier in the design process allows issues to be resolved efficiently and in a timely manner, and minimizes adverse impacts to project cost and schedule. This approach is essential to the success of major design and construction projects. . . .
>
> The importance of this initiative . . . cannot be overstated. This approach is the best way to avoid costly late resolution of major design issues or surprises late in the development of a new facility.[714]

Aiming to shift the identification of major hazards and safety-related design requirements to earlier in the design process, the Board and DOE began evaluating elements of DOE's design and construction process to identify actions that could ensure the expeditious resolution of safety concerns and the early incorporation of appropriate safety features into design.

Public Meetings and New Guidance on Integrating Safety into Design

The joint improvement efforts of the Board and DOE began in late 2005, when the Board held the first of a series of public meeting to explore DOE's policy direction on safety-in-design, and to delve into the DOE design process. At the initial public meeting, held on December 7, 2005, the deputy secretary of energy "acknowledged that safety was not being integrated consistently into the early stages of the design of new defense nuclear facilities," and committed to addressing the Board's fundamental concerns with that earlier integration.[715] Public hearings held in July 2006 and March 2007 on incorporating safety-in-design addressed early identification of issues, communication of Board issues to DOE, issue management, and early resolution and closure of design-related safety issues. Assessing the hearings' usefulness, the Board said,

> These public hearings have aided the Board in measuring the success of DOE's actions regarding their safety-in-design initiative and allowed examination of how DOE develops safety-related design requirements for its new projects. The Board plans to observe DOE's implementation of its safety-in-design initiative and revised directives.[716]

Through the public meetings, the Board provided impetus for DOE's new Integration Safety-in-Design initiative. This new guidance included the revision of the existing DOE Order

[714] House Appropriations Subcommittee on Energy and Water Development, *Nuclear Weapons Complex*, statement by Eggenberger, March 17, 2009, 4–5.
[715] Eggenberger, "Regulatory Challenges and Plans for the Year Ahead," 5. See also DNFSB, *FY 2008 Budget Request to the Congress*, 6–8.

for project management requirements for new design and construction, and commitments to revise the associated DOE Manual.[717] These revisions mandated the integration of safety into the design of new defense nuclear facilities at the earliest stages of project management.[718] The Board was also actively involved in the development of a new DOE standard, issued in March 2008, DOE–STD–1189, *Integration of Safety into the Design Process*. To demonstrate the application of the concepts in the revised Order 413.3A and the new standard, the Board and DOE selected two ongoing design and construction projects—the Uranium Processing Facility project and the Integrated Waste Treatment Unit project at the Idaho National Laboratory. The Board also collected information in a public hearing regarding the implementation of the revised order and the new standard.[719]

Congressional Action on Safety in Design

In addition to Board actions to drive DOE initiatives on the earlier integration of safety in design, Congress took action in late 2006, giving further impetus to these ongoing improvement efforts. As Eggenberger stated in 2008, the cost overruns and chronic schedule slippages in WTP led some in Congress to perceive "that slow resolution of safety-related issues was the primary cause," and that the Board's influence was not being heeded in DOE.[720] Troubled by the failure of DOE to act in a timely manner on technical issues raised by the Board, Congress proposed "that the Board and the Department would benefit from a more structured process for issue resolution that would allow issues to be raised, evaluated, and adjudicated at logical points in the design and construction process."[721] Lawmakers also required the Board to provide several kinds

---

[716] DNFSB, *Eighteenth Annual Report to Congress*, 4-2.
[717] DOE Order 413.3, *Program and Project Management for the Acquisition of Capital Assets*. That order, now DOE Order 413.3A, was the DOE directive on project management requirements for new design and construction projects. The revision of DOE Order 413.3 was augmented by the related revisions of the associated DOE Manual 413.3-1, *Project Management for the Acquisition of Capital Assets*.
[718] Defense Nuclear Facilities Safety Board, *Quarterly Report to Congress*, February 15, 2007, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc_20070215_qr.pdf.
[719] DNFSB, *Eighteenth Annual Report to Congress*, 4-2.
[720] Eggenberger, personal communication. See also Eggenberger, "Regulatory Challenges and Plans for the Year Ahead," 5.
[721] H.R. Rep. No. 109–702, at 976 (2006) (Conf.Rep.). See also Defense Nuclear Facilities Safety Board, *Seventeenth Annual Report to Congress* (Washington, DC, February 2007), 45, http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php. Issued on September 29, 2006 and approved by both houses of Congress, House Conference Report 109–702 on the National Defense Authorization Act for Fiscal Year 2007 (H.R. 5122), Section 3201, indicated the concern of lawmakers regarding the resolution of technical issues raised by the Board, and called for reports to Congress.

of reports to Congress. Congress instructed DOE and the Board to report jointly to the congressional defense committees "on their efforts to improve the timeliness of issue resolution, including recommendations, if any, for legislation that would strengthen and improve technical oversight of DOE's nuclear design and operational activities."[722] Pending the submission of this jointly prepared DOE–Board report, Congress directed the Board to submit quarterly reports on the "status of significant unresolved technical differences between the Board and the Department of Energy (DOE) on issues concerning the design and construction of defense nuclear facilities," and whether or not they were getting resolved.[723] On July 19, 2007, the Board and DOE issued their joint report detailing many of the actions undertaken to accelerate identification and resolution of safety issues. This report also described "more effective processes or protocols for the communication to DOE of issues identified by the Board and for the tracking and management of these issues," and stated "The Board and DOE are working together to accomplish these objectives."[724]

After the Board had discharged this reporting obligation to Congress with the issuance of seven reports, the Board indicated that it would continue the practice in the interest of continued improvement in design/construction oversight, as Eggenberger noted in 2009.

> While the direction no longer requires the Board to continue providing quarterly reports, we believe these reports serve as an appropriate mechanism to keep all parties informed of the Board's concerns with new designs for DOE defense nuclear facilities. The Board has also been encouraged by the feedback received from the Congressional committees and intends to continue providing these reports to Congress and DOE.[725]

The energy with which the Board sought continued improvement in the design/construction process reflected an overarching concern on the part of the Board about a basic threat to safety. Articulated in 2009 by Eggenberger, this was the threat of continuing reliance in the DOE nuclear weapons complex on aging and unsound facilities, many from the Manhattan Project era. Schedule slippages in replacement projects were a concern for the Board, not just because they increased costs, but also because they necessitated further use of "facilities

[722] H.R. Rep. No. 109–702, at 976 (2006).
[723] Transmittal letter forwarding DNFSB, *Eighteenth Annual Report to Congress*.
[724] Transmittal letter forwarding DNFSB, *Eighteenth Annual Report to Congress*.
[725] U.S. Congress, House of Representatives, Committee on Appropriations, *Nuclear Weapons Complex*, statement by Eggenberger, March 17, 2009, 5.

no longer suitable for prolonged use." As Eggenberger said, speaking of DOE's National Nuclear Security Administration facilities,

> NNSA continues to rely on aging facilities to carry out hazardous production missions in support of the nation's nuclear deterrent while planned replacement facilities suffer extended design and construction delays.

He acknowledged DOE/NNSA's "interim actions to improve the safety posture in the existing facilities," for example, "consolidating operations in the Chemistry and Metallurgy Research building into wings of the structure that do not lie directly above a seismic fault." However, he added,

> [T]hese are stop-gap measures. These facilities are structurally unsound, are unsuitable for use any longer than absolutely necessary, and will have to be shut down, perhaps before the replacement facilities are ready.
>
> Unfortunately, planned replacement facilities have been delayed beyond original projections and face continued scrutiny regarding cost, scope, and programmatic need. NNSA must continue to drive safety improvements at the existing facilities while, in parallel, building replacement facilities quickly or finding alternative, safer means of accomplishing mission related work.[726]

DOE/NNSA's "challenging task of operating aging facilities at a high tempo while designing, constructing, and making the transition to modern replacement facilities" ensured that the Board would continue to face growing challenges and expend increased efforts in the performance of its task of safety oversight of DOE/NNSA's activities.

THE BOARD GOING FORWARD

The Board's shift in recent years to greater emphasis on design/construction reviews, and its emphasis within that area of concentration on improving the processes for the early incorporation of safety in design serve as one example of the many adjustments made by the Board in its oversight operations in response to DOE's evolving mission and programs in the nuclear weapons complex. The Board always focused its oversight resources on the greatest potential sources of risk and the most pressing hazards in the complex, and it was adept at accommodating itself, as a small agency with a flexible management structure, to the shifts in DOE plans and priorities. As the mission of the complex changed in the early 1990s from the

[726] House, Appropriations Subcommittee on Energy and Water Development, *Nuclear Weapons Complex*, March 17, 2009.

production of nuclear weapons and materials to the maintenance of the nuclear deterrent and cleanup operations, the oversight demands on the Board also shifted, while simultaneously expanding. Oversight demands on the Board grew over the two decades of its existence, both because of the expansion by law of the Board's jurisdiction to include weapons responsibilities, and because of DOE's stepped-up activities requiring oversight. In its first decade of operations, the Board saw pressing and expanded responsibilities in the area of the stabilization and storage of nuclear materials, as well as in the area of maintaining the nuclear stockpile. The second decade brought further increases in oversight demands as the Board reviewed more DOE design and construction projects and new programs.

As the Board successfully met the challenges of increased oversight demands, Congress reaffirmed its view of the Board as an effective and cost-effective mechanism to accomplish vital safety oversight. Key congressional oversight committees expressed with satisfaction that the Board had more than met the expectations with which it was established in 1988, improving the state of nuclear safety at modest cost and, at the same time, promoting the appropriate balance between the national security mission of the nuclear weapons complex and safety. Acknowledging the "Board's unique capabilities," Congress placed ever-greater reliance on the Board. As the Board noted in its FY 2010 budget request, "The Board's Congressional oversight and appropriations committees . . . have called upon the Board to apply its health and safety expertise at higher and higher levels." The Board added,

> The committees have continued to demand that the Board increase both the scope and pace of its independent health and safety oversight reviews at all DOE defense nuclear facilities, with special attention on new facilities in various design and construction stages, while continuing to ensure that storage facilities are properly and competently maintained.[727]

In drawing up its FY 2010 budget request, the Board did not foresee that the augmentation of its oversight responsibilities would slacken. Indeed, the workload was projected to continue growing with expanding DOE design and construction, particularly the planned ramp-up of activities at Hanford. In addition, projections of the remediation activities involving nuclear wastes and residues called for continuing oversight of nuclear materials handling, including improved packaging to protect workers, storage, and long-term disposition for decades

[727] DNFSB, *FY 2010 Budget Request to the Congress*, 1.

to come.[728] Even under the most optimistic scenarios, the remediation of the Hanford tank wastes alone would continue until well beyond the middle of the 21st century.[729] The maintenance of the existing stockpile of nuclear weapons also would continue for the foreseeable future, calling for scrupulous safety oversight of the potentially hazardous operations of both weapons "life-extension" and weapons dismantlement. In addition, the Board's long-standing concern with standards would come to the fore again in connection with DOE's plans in the upcoming years to conduct a directive-by-directive review and revision of key nuclear safety directives. As Eggenberger stated in a June 2009 letter, the Board planned to maintain "an intense level of oversight over the revision of the directives system and the vitality of the directives being revised to ensure that the margin of safety embodied in DOE's directives is maintained or increased."[730] Finally, on themes the Board had struck from the earliest days of its operations, it planned to continue urging DOE to maintain strong, central authorities for internal safety oversight, and to develop an aggressive, proactive staffing plan.

[728] See Defense Nuclear Facilities Safety Board, *Recommendation 2005–1, Nuclear Material Packaging* (Washington, DC, March 10, 2005), http://www.dnfsb.gov/pub_docs/recommendations/all/rec_2005_01.pdf.
[729] U.S. Department of Energy, Office of Environmental Management, *1996 Baseline Environmental Management Report: Executive Summary* (Washington, DC, July 1996), http://www.em.doe.gov/bemr/pages/bemr96.aspx. According to this 1996 study,

> The expected end dates for the five highest-cost sites are as follows: Hanford Site (2070), Idaho National Engineering Laboratory (2045), Oak Ridge Reservation (2070), Rocky Flats Environmental Technology Site (2055), and Savannah River Site (2050). Surveillance and monitoring activities will continue beyond these dates. All sites will be complete by 2070.

[730] Letter from Chairman Eggenberger to the Under Secretary of Energy, the Honorable Kristina Johnson, re: "Views of the Defense Nuclear Facilities Safety Board on the State of Nuclear Safety at the Department of Energy's Defense Nuclear Facilities," June 10, 2009, http://www.dnfsb.gov/pub_docs/correspondence/all/cor_20090610.pdf.

BIBLIOGRAPHY: SELECTED SOURCES

Interviews by the Author

Azzaro, Richard. A. Interview, Washington, DC, August 20, 2008. (Board General Counsel)

Conway, John T. Interview, Arlington, VA, March 26, 2008. (Board Chairman, 1989–2005)

Crawford, John W., Jr. Interview, Rockville, MD, September 21, 2008. (Board member, 1989–1996)

DiNunno, Joseph J. Interview, Annapolis, MD, September 16, 2008. (Board member, 1992–2002)

Eggenberger, A.J. Interview, Washington, DC, July 9, 2008. (Board Chairman)

Goodman, Sherri Wasserman. Interview, Alexandria, VA, September 10, 2008. (Staff, Senate Armed Services Committee, 1987–1990)

Grosner, Brian. Interview, Washington, DC, January 3, 2008. (Board General Manager)

Mansfield, John E. Interview, Washington, DC, August 25, 2008 and September 10, 2008. (Board Vice-Chairman)

Pusateri, Kenneth M. Interview, Washington, D.C., January 3, 2008. (Board General Manager, 1989-2006)

Other Sources

Ackland, Len. *Making a Real Killing: Rocky Flats and the Nuclear West*. Albuquerque: University of New Mexico Press, 2002.

Advisory Committee on External Regulation of Department of Energy Nuclear Safety. *Improving the Regulation of Safety at DOE Nuclear Facilities. Final Report.* Washington, DC, December 1, 1995. http://www.osti.gov/bridge/servlets/purl/181136-25nT51/webviewable/181136.PDF.

Best Manufacturing Practices Center of Excellence. *Department of Energy, Oak Ridge Operations (National Nuclear Security Administration—Y-12*), *Oak Ridge, TN*. Information: Knowledge Preservation Program, January 18, 2007. http://www.bmpcoe.org/bestpractices/internal/oakri/oakri_113.html.

Buck, Alice L. *A History of the Atomic Energy Commission*. DOE/ES-0003/l. Washington, DC: U.S. Department of Energy, July 1983. http://www.atomictraveler.com/HistoryofAEC.pdf.

Buhl, Anthony R., Thomas Murley, George Edgar, and Donald Silverman. "NRC Regulation of DOE Facilities." *Nuclear News*, May 1997.

Chapman, Bert. "The Defense Nuclear Facilities Safety Board's First Decade." *Journal of Government Information* 27 (2000): 345–83. http://docs.lib.purdue.edu/lib research/70.

Crawford, John W., Jr. *An Assessment Concerning Safety at Defense Nuclear Facilities: The DOE Technical Personnel Problem*. DNFSB/TECH-10. Washington, DC: Defense Nuclear Facilities Safety Board, March 1996. http://www.dnfsb.gov/pub_docs/dnfsb/tr_199603.html.

Defense Nuclear Facilities Safety Board. [First–Nineteenth] *Annual Report to Congress*. Washington, DC, February 1991–March 2009. http://www.dnfsb.gov/pub_docs/reports_to_congress/all/rc.php.

Defense Nuclear Facilities Safety Board. *FY2008 Budget Request to the Congress*. Washington, DC, February 5, 2007. http://www.dnfsb.gov/budget/budget_fy2008.pdf.

Defense Nuclear Facilities Safety Board. *FY 2010 Budget Request to the Congress* (Washington, DC, May 2009), http://www.dnfsb.gov/about/files/budget/budget_fy2010.pdf.

Defense Nuclear Facilities Safety Board. *Plutonium Storage Safety at Major Department of Energy Facilities*. DNFSBTECH–1. Washington, DC, April 14, 1994. http://www.dnfsb.gov/pub_docs/dnfsb/tr_19940414.html.

Defense Nuclear Facilities Safety Board. *Recommendation*s. Washington, DC, 1990–2008. http://www.dnfsb.gov/pub_docs/recommendations/all/rec_all.php.

Defense Nuclear Facilities Safety Board. *Report to Congress on the Role of the Defense Nuclear Facilities Safety Board Regarding Regulation of DOE's Defense Nuclear Facilities*. Washington, DC, November 1998. http://www.dnfsb.gov/pub_docs/dnfsb/rc_199811.pdf.

Defense Nuclear Facilities Safety Board. *Review of the Hanford Spent Nuclear Fuel Project*. DNFSB/TECH–17. Washington, DC, October 1997. http://www.dnfsb.gov/pub_docs/hanford/tr_199710_hd.pdf.

Defense Nuclear Facilities Safety Board. "Rules Implementing the Freedom of Information Act." 56 *Fed. Reg*. 21259–21266 (May 8, 1991).

Defense Nuclear Facilities Safety Board. *Status of Highly Enriched Uranium Processing Capability at Building 9212 Oak Ridge Y–12 Plant*. DNFSB/TECH–9. Washington, DC, December 8, 1995. http://www.dnfsb.gov/pub_docs/dnfsb/tr_19951209_or.html.

Defense Nuclear Facilities Safety Board. *Strategic Plan: FY 1997–2002*. Washington, DC, 1997. http://www.hss.doe.gov/deprep/1997/bm97s30b.htm.

Defense Nuclear Facilities Safety Board. *Strategic Plan: FY 2003–2009*. Washington, DC, November 17, 2003. http://www.dnfsb.gov/pub_docs/dnfsb/rcsp_2003.pdf.

DiNunno, Joseph J. "External Regulation of DOE Nuclear Safety: A Different Point Of View." Paper Prepared For Presentation To Local Section, American Nuclear Society, Washington, DC, February 27, 1996. http://www.dnfsb.gov/pub_docs/dnfsb/com_19960227.html.

DiNunno, Joseph J. "Fundamentals for Understanding Standards-Based Safety Management of DOE Defense Nuclear Facilities." DNFSB/TECH–5. Paper Prepared for the Defense Nuclear Facilities Safety Board Public Meeting On Standards-Based Safety Management, Washington, DC, May 31, 1995. http://www.hss.doe.gov/deprep/archive/techrpts/bm95u13b.htm.

DiNunno, Joseph J. "Ideas for Improving Department of Energy's Safety Management of Nuclear Facilities, A Discussion Paper." October 26, 2001. http://www.dnfsb.gov/pub_docs/dnfsb/ts_200110_multi.pdf.

DiNunno, Joseph J. *Integrated Safety Management*. DNFSB/TECH–16. Washington, DC: Defense Nuclear Facilities Safety Board, June 1997. http://www.dnfsb.gov/pub_docs/dnfsb/tr_199706.pdf.

Dunlap, Riley E., et al, eds. *Public Reactions to Nuclear Waste: Citizens' Views of Repository Siting*. Durham, NC: Duke University Press, 1993.

Eggenberger, A.J. "Regulatory Challenges and Plans for the Year Ahead." Presentation to Energy Facility Contractors Group. Washington, DC, March 19–20, 2008. http://www.dnfsb.gov/pub_docs/testimonites/all/sp_10080320.pdf.

Eggenberger, A.J. "Technical Excellence." Presentation at the DOE Nuclear Executive Leadership Training, September 22, 2005. https:www.hss.energy.gov/deprep/2005/FB05S22A.HTM.

Fehner, Terrence R., and F.G. Gosling. "Coming in from the Cold: Regulating U.S. Department of Energy Nuclear Facilities, 1942–1996." *Environmental History* 12 (1996): 5–33.

Fehner, Terrence R., and Jack M. Holl. *Department of Energy, 1977–1994: A Summary History*. Washington, DC: U.S. Department of Energy, November 1994. http://www.osti.gov/bridge/servlets/purl/10106088mgIkuD/webviewable/10106088.PDF.

George, Glenn Russell. "Negotiated Safety: Intragovernmental Risk Regulation in the U.S. Nuclear Weapons Complex." Ph.D. dissertation. Harvard University, May 1995 (accessed via Proquest.)

Gerber, Michele Stenehjem. *On the Home Front: The Cold War Legacy of the Hanford Nuclear Site*. Lincoln: University of Nebraska Press, 1992.

Gosling, F.G., and Terrence R. Fehner. *Closing the Circle: The Department of Energy and Environmental Management, 1942–1994*. Washington, DC: U.S. Department of Energy, 1994.

International Atomic Energy Agency. *The Criticality Accident in Sarov*. Vienna, 2001. http://www-pub.iaea.org/MTCD/publications/PDF/Pub1106_scr.pdf.

Hacker, Barton C. *Elements of Controversy: The Atomic Energy Commission and Radiation Safety in Nuclear Weapons Testing, 1947–1974*. Berkeley: University of California Press, 1994.

Kouts, H. J. C., and J. J. DiNunno. *Safety Management and Conduct of Operations at the Department of Energy's Defense Nuclear Facilities*. DNFSB/TECH–6, Defense Nuclear Facilities Safety Board, Washington, D.C., October 6, 1995.

Kraft, Michael E., Eugene A. Rosa, and Riley E. Dunlap. "Public Opinion and Nuclear Waste Policymaking." In *Public Reactions to Nuclear Waste: Citizens' Views of Repository Siting*, edited by Riley E. Dunlap et al. Durham, NC: Duke University Press, 1993.

Langston, Merritt E. "Continuing Evolution of U.S. Nuclear Quality Assurance Principles, Practices and Requirements." Part I, August 2005. http://www.hss.energy.gov/CSA/CSP/qa/NQAStandardsEvolution1.doc.

Lanouette, William. "The Atom, Politics, and the Press." Washington, DC: Media Studies Project, Woodrow Wilson International Center for Scholars, December 1989.

Lanouette, William. *Tritium and the Times: How the Nuclear Weapons-Production Scandal Became a National Story*. Research Paper R–1. Cambridge, MA: Joan Shorenstein Barone Center for the Press, Politics and Public Policy, John F. Kennedy School of Government, Harvard University, May 1990.

Legal Environmental Assistance Foundation v. Hodel. 586 F.Supp. 1163 (E. D. Tenn. 1984).

Los Alamos Study Group. "Competition - or Collusion? Privatization and Crony Capitalism in the Nuclear Weapons Complex: Some Questions from New Mexico." May 30, 2006. http://www.lasg.org/NNSAPrivatization.pdf.

Los Alamos Study Group. "Declining Federal Oversight at Los Alamos, Increasing Production Incentives: A Dangerous Divergence." March 22, 2006. http://www.lasg.org/DNFSBMar06.htm.

Los Alamos Study Group. "Informal Pit Production Talking Points, Feb 24, 2007." http://www.lasg.org/PU_talking_points1.htm.

Makhijani, Arjun, Stephen I. Schwartz, and Robert S. Norris. "Dismantling the Bomb." In Stephen I. Schwartz, ed., *Atomic Audit: The Costs and Consequences of U.S. Nuclear Weapons Since 1940*. Washington, DC: Brookings Institution Press, 1998.

Makhijani, Arjun, Stephen I. Schwartz, and William J. Weida. "Nuclear Waste Management and Environmental Remediation." In Stephen I. Schwartz, ed., *Atomic Audit: The Costs and Consequences of U.S. Nuclear Weapons Since 1940*. Washington, DC: Brookings Institution Press, 1998.

Mazuzan, George T. "Conflict of Interest: Promoting and Regulating the Infant Nuclear Power Industry, 1954–1956." *Historian* 44, no. 1 (1981): 1–14.

Mazuzan, George T., and J. Samuel Walker. *Controlling the Atom: The Beginnings of Nuclear Regulation, 1946–1962*. Berkeley: University of California Press, 1984.

Medalia, Jonathan. "Nuclear Testing and Comprehensive Test Ban: Chronology Starting September 1992." *CRS Report for Congress*. Order Code 97–1007 F. Updated June 9, 2005. Washington, DC: Congressional Research Service, Library of Congress, 2005.

National Academy of Sciences. National Research Council. Committee to Assess Safety and Technical Issues at DOE Reactors. *Safety Issues at the Defense Production Reactors: A Report to the U.S. Department of Energy*. Washington, DC: National Academy Press, 1987. http://books.google.com/books?id=q2MrAAAAYAAJ&printsec=titlepage.

OECD Nuclear Energy Agency. *Public Participation in Nuclear Decision-Making: Proceedings of an International Workshop*. Paris: Organisation for Economic Co-operation and Development, 1993.

O'Neill, Kevin. "Building the Bomb." In Stephen I. Schwartz, ed. *Atomic Audit: The Costs and Consequences of U.S. Nuclear Weapons Since 1940*. Washington, DC: Brookings Institution Press, 1998.

Oregon. Department of Energy. Nuclear Safety Division. *Hanford Cleanup: The First 15 Years*. Salem, OR, October 2004. http://www.oregon.gov/ENERGY/NUCSAF/docs/15year.pdf.

Pacific Northwest National Laboratory. *FY2002 Annual Self-Evaluation Report for the Pacific Northwest National Laboratory*. PNNL–13980. October 2002. http://www.pnl.gov/main/publications/external/technical_reports/PNNL-13980.pdf.

Pool, Robert. *Beyond Engineering: How Society Shapes Technology*. New York: Oxford University Press, 1997.

Rees, Joseph V. *Hostages of Each Other: The Transformation of Nuclear Safety Since Three Mile Island*. Chicago: University of Chicago Press, 1996.

Rosa, Eugene A., and William Freudenburg. "The Historical Development of Public Reactions to Nuclear Power: Implications for Nuclear Waste Policy." In *Public Reactions to Nuclear Waste: Citizens' Views of Repository Siting*, edited by Riley E. Dunlap et al. Durham, NC: Duke University Press, 1993.

Schneider, Keith. "Nuclear Arms and New Jobs Clash in Idaho." *New York Times*, March 27, 1988. http://query.nytimes.com/gst/fullpage.html?res=940DEEDC1530F934A15750C0A96E948260&sec=&spon=&pagewanted=print.

Schepens, R., and B. Hewitt. "Progress and Challenges in Cleanup of Hanford's Tank Wastes." Paper presented at Waste Management '06 Conference. Tucson, AZ, February 26–March 2, 2006. http://www.wmsym.org/abstracts/2006/pdfs/6540.pdf.

Schwartz, Stephen I. "Congressional Oversight of the Bomb." In Stephen I. Schwartz, ed., *Atomic Audit: The Costs and Consequences of U.S. Nuclear Weapons Since 1940*. Washington, DC: Brookings Institution Press, 1998.

Schwartz, Stephen I., ed. *Atomic Audit: The Costs and Consequences of U.S. Nuclear Weapons Since 1940*. Washington, DC: Brookings Institution Press, 1998.

Titus, A. Costandina. *Bombs in the Backyard: Atomic Testing and American Politics*. Reno: University of Nevada Press, 1986.

U.S. Congress. Commission on Security and Cooperation in Europe. *The Legacy of Chornobyl 1986 to 1996 and Beyond*. 104th Cong., 2d sess., April 23, 1996. http://csce.gov/index.cfm?FuseAction=UserGroups.Home&ContentRecord_id=156&ContentType=H&ContentRecordType=H&UserGroup_id=117&Subaction=ByDate&CFTOKEN=53.

U.S. Congress. Congressional Budget Office. *Cleaning Up the Department of Energy's Nuclear Weapons Complex*. Washington, DC: May 1994. http://www.cbo.gov/ftpdocs/49xx/doc4914/doc26.pdf.

U.S. Congress. House of Representatives. Committee on Appropriations. Subcommittee on Energy and Water Development. *Energy and Water Development Appropriations for 1996*. 104th Cong., 1st sess., March 15, 1995 (statement of John T. Conway and DNFSB, "FY 1996 Appropriations Hearing").

U.S. Congress. House of Representatives. Committee on Appropriations. Subcommittee on Energy and Water Development. *Energy and Water Development Appropriations for 1996*. 104th Cong., 1st sess., January 31, 1995 (statement of John T. Conway, "Possible Restructuring of the U.S. Department of Energy").

U.S. Congress. House of Representatives. Committee on Appropriations. Subcommittee on Energy and Water Development. *Energy and Water Development Appropriations for 2007*. 109th Cong., 2d sess., April 6, 2006.

U.S. Congress. House of Representatives. Committee on Appropriations. Subcommittee on Energy and Water Development. *Nuclear Weapons Complex*. 111th Cong., 1st sess., March 17, 2009 (statement of Dr. A.J. Eggenberger, "Weapons Complex Nuclear Safety Issues"). http://appropriations.house.gov/Witness_testimony/EW/A_J_Eggenberger_03_17_09.pdf.

U.S. Congress. House of Representatives. Committee on Armed Services. Department of Energy Defense Nuclear Facilities Panel. *Hearings on National Defense Authorization Act For Fiscal Years 1992 and 1993—H.R. 2100 and Oversight of Previously Authorized Programs*: *Department of Energy Defense Programs*. 102d Cong., 1st sess., February 28, March 6, 13, 21, April 11, 18, June 18, 1991.

U.S. Congress. House of Representatives. Committee on Armed Services. Department of Energy Defense Nuclear Facilities Panel. *Hearings on National Defense Authorization Act For Fiscal Year 1993—H.R. 5006 and Oversight of Previously Authorized Programs: Department of Energy Defense Programs*. 102d Cong., 2d sess., March 18, 30, 31, April 1, 6, 28, 30, 1992.

U.S. Congress. House of Representatives. Committee on Armed Services. Subcommittee on Procurement and Military Nuclear Systems and Department of Energy Defense Nuclear Facilities Panel. *Hearings on National Defense Authorization Act For Fiscal Year 1990—H.R. 2461 and Oversight of Previously Authorized Programs: Department of Energy Modernization Study and Department of Energy Defense Programs*. 101st Cong., 1st sess., February 21, 24, March 13, 20, 21, April 3, 6, 13, 26, May 9, 16, 23, 24, June 6, July 18, 1989.

U.S. Congress. House of Representatives. Committee on Armed Services. Subcommittee on Strategic Forces. *Hearings on National Defense Authorization Act for Fiscal Year 2005—H.R. 4200 and Oversight of Previously Authorized Programs*. 108th Cong., 2d sess., February 25, March 18, 25, 2004.

U.S. Congress. House of Representatives. Committee on Commerce. Subcommittee on Energy and Power. *External Regulation of Department of Energy Nuclear Facilities*. 105th Cong., 2d sess., May 20, 1998.

U.S. Congress. House of Representatives. Committee on Commerce. Subcommittee on Energy and Power. *Legislation to Improve Safety and Security in the Department of Energy*. 106th Congress, 2d sess., March 22, 2000. http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=106_house_hearings&docid=f:64031.pdf.

U.S. Congress. House of Representatives. Committee on Commerce. Subcommittee on Oversight and Investigations. *Department of Energy's Hanford Spent Nuclear Fuel Project*. 105th Congress, 2d sess., May 12, 1998.

U.S. Congress. House of Representatives. Committee on Energy and Commerce. Subcommittee on Energy Conservation and Power. *Nuclear Reactor Safety*. 99th Cong., 2d sess., May 22, July 16, 1986.

U.S. Congress. House of Representatives. Committee on Energy and Commerce. Subcommittee on Energy and Power. *Safety of DOE Nuclear Facilities: Hearings on H.R. 783, H.R. 2047, and H.R. 3123*. 100th Cong., 1st sess., November 5, 19, 1987.

U.S. Congress. House of Representatives. Committee on Energy and Commerce. Subcommittee on Energy and Power. *Safety of DOE Nuclear Facilities*. 101st Cong., 1st sess., February 22, 1989.

U.S. Congress. House of Representatives. Committee on Energy and Commerce. Subcommittee on Oversight and Investigations. *Contracting Problems at DOE's Fernald Site*. 103rd Cong., 1st sess., December 1, 1993.

U.S. Congress. House of Representatives. Committee on Energy and Commerce. Subcommittee on Oversight and Investigations. *Health and Safety at the Department of Energy's Nuclear Weapons Facilities*. 101st Cong., 1st sess., Comm. Print 101–H, June 1989.

U.S. Congress. House of Representatives. Committee on Energy and Commerce. Subcommittee on Oversight and Investigations. *A Review of GAO's Findings and Recommendations Regarding the Department of Energy's Efforts to Consolidate Surplus Plutonium Inventories*. 109th Cong., 1st sess., October 7, 2005. http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=109_house_hearings&docid=f:24254.pdf.

U.S. Congress. House of Representatives. Committee on Energy and Commerce. Subcommittee on Oversight and Investigations. *A Review of Ongoing Management Concerns at Los Alamos National Laboratory*. 109th Cong., 1st sess., May 5, 2005.

U.S. Congress. House of Representatives. Committee on Interior and Insular Affairs. Subcommittee on Energy and the Environment. *Nuclear Licensing and Regulatory Reform Legislation*. 99th Cong., 2d sess., June 26, July 22, 1986.

U.S. Congress. House of Representatives. Committee on Interior and Insular Affairs. Subcommittee on Energy and the Environment. *Proposals Relating to the Operation of the Waste Isolation Pilot Plant (WIPP) in New Mexico*. 102d Cong., 1st sess., April 16, 1991.

U.S. Congress. House of Representatives. Committee on Natural Resources. Subcommittee on Energy and Mineral Resources. *Federal Nuclear Facilities Licensing and Regulation Act*. 103rd Cong., 2d sess., March 1, 8, 1994.

U.S. Congress. House of Representatives. Committee on Science and Technology. Subcommittee on Energy Research and Production and Subcommittee on Investigations

and Oversight. *The Impact of Mercury Releases at the Oak Ridge Complex*. 98th Cong., 1st sess., July 1983.

U.S. Congress. House of Representatives. Committee on Science, Space, and Technology. Subcommittee on Investigations and Oversight. *Environmental Crimes at the Rocky Flats Nuclear Weapons Facility*. 2 vols. 102d Cong., 2d sess. Washington, DC, 1992.

U.S. Congress. Office of Technology Assessment. *Complex Cleanup: The Environmental Legacy of Nuclear Weapons Production*. OTA–O–484. Washington, DC, February 1991. http://www.fas.org/ota/reports/9113.pdf.

U.S. Congress. Office of Technology Assessment. *Dismantling the Bomb and Managing the Nuclear Materials*. OTA–O–572. Washington, DC, September 1993. http://govinfo.library.unt.edu/ota/Ota_1/DATA/1993/9320.PDF.

U.S. Congress. Office of Technology Assessment. *Hazards Ahead: Managing Cleanup Worker Health and Safety at the Nuclear Weapons Complex*. OTA–BP–O–85. Washington, DC, February 1993.

U.S. Congress. Office of Technology Assessment. *Managing the Nation's Commercial High-Level Radioactive Waste*. OTA–0–171. Washington, DC, March 1985. http://www.princeton.edu/~ota/disk2/1985/8514_n.html.

U.S. Congress. Senate. Committee on Armed Services. *Department of Defense Authorization for Appropriations for Fiscal Years 1992 and 1993*. 102d Cong., 1st sess., April 23, May 9, 17, 22, 23, June 5, 12, 13, 19, 20, 1991.

U.S. Congress. Senate. Committee on Armed Services. *Department of Defense Authorization for Appropriations for Fiscal Year 1993 and the Future Years Defense Program*. 102d Cong., 2d sess., March 18, 24, 27, April 9, 28, May 20, June 3, 11, 1992.

U.S. Congress. Senate. Committee on Armed Services. *Department of Defense Authorization for Appropriations for Fiscal Year 1995 and the Future Years Defense Program*. 103rd Cong., 2d sess., February 8, March 2, 3, 8, 9, 1, 5, 23, April 20, 1994.

U.S. Congress. Senate. Committee on Armed Services. *Department of Defense Authorization for Appropriations for Fiscal Year 1996 and the Future Years Defense Program*. 104th Cong., 1st sess., March 28, April 25, May 2, 16, 18, 1995.

U.S. Congress. Senate. Committee on Armed Services. *Department of Defense Authorization for Appropriations for Fiscal Year 1997 and the Future Years Defense Program*. 104th Cong., 2d sess., March 6, 13, 20, 25, 29, 1996.

U.S. Congress. Senate. Committee on Armed Services. *Nominations Before the Senate Armed Services Committee, First Session, 101st Congress*. March 14, 16, April 5, 18–19, May 3,

4, 16, 18, June 22, July 31, August 3, September 7, 8, 20, October 6, 17, November 7, 9, 20, 1989.

U.S. Congress. Senate. Committee on Armed Services. Subcommittee on Strategic Forces. *Department of Defense Authorization for Appropriations for Fiscal Year 2000 and the Future Years Defense Program*. 106th Cong., 1st sess., Part. 7, February 24, 26, March 11, 22, April 14, 1999 (statement of John C. Browne Director Los Alamos National Laboratory, February 26, 1999). http://www.senate.gov/-armed-services/statemnt~ l999/990226jb.pdf.

U.S. Congress. Senate. Committee on Armed Services. Subcommittee on Strategic Forces and Nuclear Deterrence. *Plans, Progress, and Experience to Date of the Defense Nuclear Facilities Safety Board*. 101st Cong., 2d sess., March 28, 1990.

U.S. Congress. Senate. Committee on Armed Services. Subcommittee on Strategic Forces and Nuclear Deterrence. *Safety Oversight for Department of Energy Nuclear Facilities*. 100th Cong., 1st sess., October 22, 26, 27, 30, November 3, 1987.

U.S. Congress. Senate. Committee on Energy and Natural Resources. *Department of Energy Abolishment Act*. Hearings on S. 1678. 104th Cong., 2d sess., September 4, 1996.

U.S. Congress. Senate. Committee on Governmental Affairs. *Accident and Explosion Risks at Department of Energy High-Level Radioactive Waste Facilities*. 101st Cong., 2d sess., July 31, 1990.

U.S. Congress. Senate. Committee on Governmental Affairs. *Early Health Problems of the U.S. Nuclear Weapons Industry and Their Implications for Today*. 101st Cong., 1st sess. Comm. Print, December 1989.

U.S. Congress. Senate. Committee on Governmental Affairs. *Environmental Issues at Department of Energy Nuclear Facilities*. 100th Cong., 1st sess., March 17, 1987.

U.S. Congress. Senate. Committee on Governmental Affairs. Subcommittee on International Security, Proliferation, and Federal Services. *Safety and Reliability of the U.S. Nuclear Deterrent*. 105th Cong. 1st sess., October 27, 1997.

U.S. Department of Energy. *Annual Report to Congress, Department of Energy Activities Relating to the Defense Nuclear Facilities Safety Board: Calendar Year 1995*. DOE/S–0115. Washington, DC, March 1996.

U.S. Department of Energy. *Annual Report to Congress, Department of Energy Activities Relating to the Defense Nuclear Facilities Safety Board: Calendar Year 2003*. Washington, DC, February 2004.

U.S. Department of Energy. *A Report on a Safety Assessment of Department of Energy Nuclear Reactor: Report of the Crawford Committee*. DOE/US–0005. Washington, DC, March 1981.

U.S. Department of Energy. Assistant Secretary for Defense Programs. *Assessment of Plutonium Storage Safety Issues at Department of Energy Facilities*. Washington, DC, 1994.

U.S. Department of Energy. Energy Information Administration. *The Changing Structure of the Electric Power Industry, 2000: An Update*. DOE/EIA–0562(00). Washington, DC, October 2000. http://www.eia.doe.gov/cneaf/electricity/chg_stru_update/toc.html.

U.S. Department of Energy. Los Alamos National Laboratory. "Weapons Stewardship Presents New Challenges for National Labs." Los Alamos, NM, 1996.

U.S. Department of Energy. Office of Environmental Management. *Environmental Management: History*. Washington, DC, August 8, 2008. http://www.em.doe.gov/pages/History.aspx.

U.S. Department of Energy. Office of Environmental Management. *Linking Legacies: Connecting the Cold War Nuclear Weapons Production Processes to Their Environmental Consequences*. Washington, DC, January 1997. http://www.em.doe.gov/Publications/linklegacy.aspx.

U.S. Department of Energy. Office of Environmental Management. *1996 Baseline Environmental Management Report: Executive Summary*. Washington, DC, July 1996. http://www.em.doe.gov/bemr/pages/bemr96.aspx.

U.S. Department of Energy. Office of Inspector General. Office of Audit Services. *The U.S. Department of Energy's Efforts to Preserve the Knowledge Base Needed to Operate a Downsized Nuclear Weapons Complex*. DOE/IG–0428. Washington, DC, October 1998. http://www.ig.energy.gov/documents/CalendarYear1998/ig-0428.pdf.

U.S. Department of Labor. Occupational Safety and Health Administration. *Evaluation of the U.S. Department of Energy's Occupational Safety and Health Program for its Government-Owned Contractor-Operated Facilities*. Washington, DC, 1990.

U.S. Department of State. Bureau of Arms Control. "The Stockpile Stewardship Program." http://www.state.gov/www.global/arms/factsheets/wmd/nuclear/ctbt/fs_991008_stockpile.html.

U.S. General Accounting Office. *Department of Energy: Cleaning Up Inactive Facilities Will Be Difficult*. GAO/RCED–93–149. Washington, DC, June 1993.

U.S. General Accounting Office. *Department of Energy: Clear Strategy on Externa1 Regulation Needed for Worker and Nuclear Facility Safety*. GAO/RCED–98–163. Washington, DC, May 1998. http://www.gao.gov/archive/1998/rc98163.pdf.

U.S. General Accounting Office. *DOE's Safety and Health Oversight Program at Nuclear Faciliites Could Be Strengthened*. RCED–84–50. Washington, DC, November 1983.

U.S. General Accounting Office. *Environment, Safety, and Health: Status of Department of Energy's Implementation of 1985 Initiatives*. RCED–96–68FS. Washington, DC, March 1986.

U.S. General Accounting Office. *Nuclear Safety: The Defense Facilities Nuclear Safety Board's First Year of Operation*. GAO/RCED–91–54. Washington, DC, February 1991. http://archive.gao.gov/t2pbat7/143684.pdf.

U.S. General Accounting Office. *Nuclear Safety: Safety Analysis Reviews for DOE's Defense Facilities Can Be Improved*. GAO/RCED–86–175. Washington, DC, June 1986. http://archive.gao.gov/d4t4/130260.pdf.

U.S. General Accounting Office. *Nuclear Waste: DOE's Repository Site Investigations, a Long and Difficult Task*. GAO/RCED–92–73. Washington, DC, May 1992. http://archive.gao.gov/d32t10/146694.pdf.

U.S. General Accounting Office. *Nuclear Waste: Impact of Savannah River Plant's Radioactive Waste Management Practices*. GAO/RCED–86–143. Washington, DC, July 1986. http://archive.gao.gov/d4t4/130648.pdf.

U.S. General Accounting Office. *Nuclear Waste: Unresolved Issues Concerning Hanford's Waste Management Practices*. RCED–87–30. Washington, DC, November 1986. http://archive.gao.gov/t2pbat23/131661.pdf.

U.S. Government Accountability Office. *Nuclear Weapons: Annual Assessment of the Safety, Performance, and Reliability of the Nation's Stockpile*. GAO-07-243R. Washington, DC, February 2007. http://www.gao.gov/new.items/d07243r.pdf.

U.S. Nuclear Regulatory Commission. *NRC Comments on Defense Nuclear Facilities Safety Board November 1998 Report to Congress on the Role of the Defense Nuclear Facilities Safety Board Regarding Regulation of the Department of Energy's Defense Nuclear Facilities*. Washington, DC, January 15, 1999.

U.S. Nuclear Regulatory Commission. *NRC: Our History*. February 3, 2009. http://www.nrc.gov/about-nrc/history.html#aec.

U.S. Office of Management and Budget. *Appendix: Budget of the United States Government Fiscal Year 2000*. Washington, DC, 1999.

Walker, J. Samuel. *Containing the Atom: Nuclear Regulation in a Changing Environment, 1963–1971*. Berkeley: University of California Press, 1992.

Walker, J. Samuel. *Permissible Dose: A History of Radiation Protection in the Twentieth Century*. Berkeley: University of California Press, 2000.

Walker, J. Samuel. *A Short History of Nuclear Regulation, 1946–1999*. Washington, DC: U.S. Nuclear Regulatory Commission, January 2000.

Walker, J. Samuel. *Three Mile Island: A Nuclear Crisis in Historical Perspective*. Berkeley: University of California Press, 2004.

Wald, Matthew L. "10 Years After Three Mile Island." *New York Times*, March 23, 1989. http://query.nytimes.com/gst/fullpage.html?res=950DE0DF1738F930A15750C0A96F948260&sec=&spon=&pagewanted=print.

Wald, Matthew L. "Energy Dept. Shift in Safety Faulted." *New York Times*, May 2, 1993. http://query.nytimes.com/gst/fullpage.html?res=9F0CE0DE1E38F931A35756C0A965958260&sec=&spon=&pagewanted=all.

Wald, Matthew L. "Weapon Reactors Faulted on Safety." *New York Times*, October 29, 1987.

Weisman, Jonathan. "True Impact of GOP Congress Reaches Well Beyond Bills." *Congressional Quarterly Weekly Report* 54, no. 36 (September 7, 1996): 2515–20.

In addition to the sources noted above, the author consulted the volumes of bound transcripts of the Defense Nuclear Facilities Safety Board, *Public Meetings and Hearings*, U.S. Department of Energy (DOE) annual reports to Congress describing Department of Energy activities in response to formal recommendations and other interactions with the Defense Nuclear Facilities Safety Board, as well as congressional committee reports, *Congressional Record* debates, and other documents that constitute the legislative history of Pub.L. No. 100–456, the Board's enabling statute. Also used in the preparation of this report were the U.S. Code, and the Code of Federal Regulations. Online versions of the U.S Code and the Code of Federal Regulations are available on the Web site of the Cornell University Law School at http://www.law.cornell.edu/uscode/#TITLES.

The range of information available on the Defense Nuclear Facilities Safety Board Web site (http://www.dnfsb.gov/) is broad and includes, but is not limited to, Annual and Special Reports to Congress (1991–Present), Correspondence (2000–Present), Public Hearings (2003–Present), Strategic Plans and Performance Reports to Congress (1999–Present), Weekly Site Representative Reports (1996–Present), and all Recommendations. The Web site also provides a biweekly listing of all public documents received from the Department of Energy as part of the Board's oversight responsibility. Those documents are made available to the public through procedures detailed on the Web site. Other useful Web sites include the U.S. Department of Energy, Office of Health, Safety, and Security (HSS), Integrated Safety Management (ISM) (http://www.hss.energy.gov/healthsafety/ism/), Office of Environmental Management (http://www.em.doe.gov/), and the U.S. Nuclear Regulatory Commission (http://www.nrc.gov/).

APPENDIX 1: Board Enabling Legislation

ENABLING STATUTE OF THE DEFENSE NUCLEAR FACILITIES SAFETY BOARD 42 U.S.C. § 2286 et seq.

NATIONAL DEFENSE AUTHORIZATION ACT, FISCAL YEAR 1989 (Pub. L. No. 100-456, September 29, 1988),

AS AMENDED BY NATIONAL DEFENSE AUTHORIZATION ACT, FISCAL YEAR 1991 (Pub. L. No. 101-510, November 5, 1990), NATIONAL DEFENSE AUTHORIZATION ACT FISCAL YEARS 1992 AND 1993 (Pub. L. No. 102-190, December 5, 1991), ENERGY POLICY ACT OF 1992 (Pub. L. No. 102-486, October 24, 1992), NATIONAL DEFENSE AUTHORIZATION ACT FISCAL YEAR 1994 (Pub. L. No. 103-160, November 30, 1993), FEDERAL REPORTS ELIMINATION ACT OF 1998 (Pub. L. No. 105-362, November 10, 1998), NATIONAL DEFENSE AUTHORIZATION ACT FISCAL YEAR 2001 (Pub. L. No. 106-398, October 30, 2000), AND NATIONAL DEFENSE AUTHORIZATION ACT FISCAL YEAR 2003 (Pub. L. No. 107-314, December 2, 2002) NATIONAL DEFENSE AUTHORIZATION ACT FISCAL YEAR 2004 (Pub. L. No. 108-136, November 7, 2003) NATIONAL DEFENSE AUTHORIZATION ACT FISCAL YEAR 2009 (Pub. L. No. 110-417, October 14, 2008)

As of 10/14/2008

TITLE 42. THE PUBLIC HEALTH AND WELFARE
CHAPTER 23. DEVELOPMENT AND CONTROL OF ATOMIC ENERGY
SUBCHAPTER XVII.A.
DEFENSE NUCLEAR FACILITIES SAFETY BOARD
42 U.S.C. § 2286

§ 2286. Establishment of Defense Nuclear Facilities Safety Board [Atomic Energy Act, Sec. 311]

(a) Establishment.

There is hereby established an independent establishment in the executive branch, to be known as the Defense Nuclear Facilities Safety Board" (hereafter in this subchapter referred to as the "Board").

(b) Membership.

(1) The Board shall be composed of five members appointed from civilian life by the President, by and with the advice and consent of the Senate, from among United States citizens who are respected experts in the field of nuclear safety with a demonstrated competence and knowledge relevant to the independent investigative and oversight functions of the Board. Not more than three members of the Board shall be of the same political party.

(2) Any vacancy in the membership of the Board shall be filled in the same manner in which the original appointment was made.

(3) No member of the Board may be an employee of, or have any significant financial relationship with, the Department of Energy or any contractor of the Department of Energy.

(4) Not later than 180 days after September 29, 1988, the President shall submit to the Senate nominations for appointment to the Board. In the event that the President is unable to submit the nominations within such 180-day period, the President shall submit to the Committees on Armed Services and on Appropriations of the Senate and to the Speaker of the House of Representatives a report describing the reasons for such inability and a plan for submitting the nominations within the next 90 days. If the President is unable to submit the nominations within that 90-day period, the President shall again submit to such committees and the Speaker such a report and plan. The President shall continue to submit to such committees and the Speaker such a report and plan every 90 days until the nominations are submitted.

(c) Chairman and Vice Chairman.

(1) The President shall designate a Chairman and Vice Chairman of the Board from among members of the Board.

(2) The Chairman shall be the chief executive officer of the Board and, subject to such policies as the Board may establish, shall exercise the functions of the Board with respect to—

(A) the appointment and supervision of employees of the Board;

(B) the organization of any administrative units established by the Board; and

(C) the use and expenditure of funds.

(3) The Chairman may delegate any of the functions under this paragraph to any other member or to any appropriate officer of the Board.

(4) The Vice Chairman shall act as Chairman in the event of the absence or incapacity of the Chairman or in case of a vacancy in the office of Chairman.

(d) Terms.

(1) Except as provided under paragraph (2), the members of the Board shall serve for terms of five years. Members of the Board may be reappointed.

(2) Of the members first appointed—

(A) one shall be appointed for a term of one year;

(B) one shall be appointed for a term of two years;

(C) one shall be appointed for a term of three years;

(D) one shall be appointed for a term of four years; and

(E) one shall be appointed for a term of five years, as designated by the President at the time of appointment.

(3) Any member appointed to fill a vacancy occurring before the expiration of the term of office for which such member's predecessor was appointed shall be appointed only for the remainder of such term. A member may serve after the expiration of that member's term until a successor has taken office.

(e) Quorum.

Three members of the Board shall constitute a quorum, but a lesser number may hold hearings.

§ 2286a. Functions of the Board. [Atomic Energy Act, Sec. 312]

(a) In general.

The Board shall perform the following functions:

(1) Review and evaluation of standards.

The Board shall review and evaluate the content and implementation of the standards relating to the design, construction, operation, and decommissioning of defense nuclear facilities of the Department of Energy (including all applicable Department of Energy orders, regulations, and requirements) at each Department of Energy defense nuclear facility. The Board shall recommend to the Secretary of Energy those specific measures that should be adopted to ensure that public health and safety are adequately protected. The Board shall include in its recommendations necessary changes in the content and implementation of such standards, as well as matters on which additional data or additional research is needed.

(2) Investigations.

(A) The Board shall investigate any event or practice at a Department of Energy defense nuclear facility which the Board determines has adversely affected, or may adversely affect, public health and safety.

(B) The purpose of any Board investigation under subparagraph (A) shall be—

(i) to determine whether the Secretary of Energy is adequately implementing the standards described in paragraph (1) of the Department of Energy (including all applicable Department of Energy orders, regulations, and requirements) at the facility;

(ii) to ascertain information concerning the circumstances of such event or practice and its implications for such standards;

(iii) to determine whether such event or practice is related to other events or practices at other Department of Energy defense nuclear facilities; and

(iv) to provide to the Secretary of Energy such recommendations for changes in such standards or the implementation of such standards (including Department of Energy orders, regulations, and requirements) and such recommendations relating to data or research needs as may be prudent or necessary.

(3) Analysis of design and operational data.

The Board shall have access to and may systematically analyze design and operational data, including safety analysis reports, from any Department of Energy defense nuclear facility.

(4) Review of facility design and construction.

The Board shall review the design of a new Department of Energy defense nuclear facility before construction of such facility begins and shall recommend to the Secretary, within a reasonable time, such modifications of the design as the Board considers necessary to ensure

adequate protection of public health and safety. During the construction of any such facility, the Board shall periodically review and monitor the construction and shall submit to the Secretary, within a reasonable time, such recommendations relating to the construction of that facility as the Board considers necessary to ensure adequate protection of public health and safety. An action of the Board, or a failure to act, under this paragraph may not delay or prevent the Secretary of Energy from carrying out the construction of such a facility.

(5) Recommendations.

The Board shall make such recommendations to the Secretary of Energy with respect to Department of Energy defense nuclear facilities, including operations of such facilities, standards, and research needs, as the Board determines are necessary to ensure adequate protection of public health and safety. In making its recommendations, the Board shall consider the technical and economic feasibility of implementing the recommended measures.

(b) Excluded functions.[731]

The functions of the Board under this subchapter do not include functions relating to the safety of atomic weapons. However, the Board shall have access to any information on atomic weapons that is within the Department of Energy and is necessary to carry out the functions of the Board.

§ 2286b. Powers of Board. **[Atomic Energy Act, Sec. 313]**

(a) Hearings.

(1) The Board or a member authorized by the Board may, for the purpose of carrying out this subchapter, hold such hearings and sit and act at such times and places, and require, by subpoena or otherwise, the attendance and testimony of such witnesses and the production of such evidence as the Board or an authorized member may find advisable.

(2)(A) Subpoenas may be issued only under the signature of the Chairman or any member of the Board designated by him and shall be served by any person designated by the Chairman, any member, or any person as otherwise provided by law. The attendance of witnesses and the production of evidence may be required from any place in the United States at any designated place of hearing in the United States.

(B) Any member of the Board may administer oaths or affirmations to witnesses appearing before the Board.

(C) If a person issued a subpoena under paragraph (1) refuses to obey such subpoena or is guilty of contumacy, any court of the United States within the judicial district within which the hearing is conducted or within the judicial district within which such person is found or resides or transacts business may (upon application by the Board)

[731] Added by § 3202 (b)(2)(B) of the National Defense Authorization Act for Fiscal Years 1992 and 1993 (Pub. L. 102-190).

order such person to appear before the Board to produce evidence or to give testimony relating to the matter under investigation. Any failure to obey such order of the court may be punished by such court as a contempt of the court.

(D) The subpoenas of the Board shall be served in the manner provided for subpoenas issued by a United States district court under the Federal Rules of Civil Procedure for the United States district courts.

(E) All process of any court to which application may be made under this section may be served in the judicial district in which the person required to be served resides or may be found.

(b) Staff.

(1) The Board may, for the purpose of performing its responsibilities under this subchapter—

(A) hire such staff as it considers necessary to perform the functions of the Board, including such scientific and technical personnel as the Board may determine necessary, but not more than the equivalent of 150[732] full-time employees; and

(B) procure the temporary and intermittent services of experts and consultants to the extent authorized by section 3109(b) of title 5 [United States Code] at rates the Board determines to be reasonable.

(2) The authority and requirements provided in section 2201(d) of this title [§ 161 d. of the Atomic Energy Act] with respect to officers and employees of the Commission shall apply with respect to scientific and technical personnel hired under paragraph (1)(A).[733]

(c) Regulations.

The Board may prescribe regulations to carry out the responsibilities of the Board under this subchapter.

(d) Reporting requirements.

The Board may establish reporting requirements for the Secretary of Energy which shall be binding upon the Secretary. The information which the Board may require the Secretary of Energy to report under this subsection may include any information designated as classified information, or any information designated as safeguards information and protected from disclosure under section 2167 or 2168 of this title [§ 147 or 148 of the Atomic Energy Act].

[732] Amended by § 3202 (a)(1) of the National Defense Authorization Act of 1992 and 1993 (Pub. L. 102-190).

[733] Added by the National Defense Authorization Act of 1991 (Pub. L. 101-510).

(e) Use of Government facilities, etc.

The Board may, for the purpose of carrying out its responsibilities under this subchapter, use any facility, contractor, or employee of any other department or agency of the Federal Government with the consent of and under appropriate support arrangements with the head of such department or agency and, in the case of a contractor, with the consent of the contractor.

(f) Assistance from certain agencies of the Federal Government.

With the consent of and under appropriate support arrangements with the Nuclear Regulatory Commission, the Board may obtain the advice and recommendations of the staff of the Commission on matters relating to the Board's responsibilities and may obtain the advice and recommendations of the Advisory Committee on Reactor Safeguards on such matters.

(g) Assistance from organizations outside the Federal Government.

Notwithstanding any other provision of law relating to the use of competitive procedures, the Board may enter into an agreement with the National Research Council of the National Academy of Sciences or any other appropriate group or organization of experts outside the Federal Government chosen by the Board to assist the Board in carrying out its responsibilities under this subchapter.

(h) Resident inspectors.

The Board may assign staff to be stationed at any Department of Energy defense nuclear facility to carry out the functions of the Board.

(i) Special studies.

The Board may conduct special studies pertaining to adequate protection of public health and safety at any Department of Energy defense nuclear facility.

(j) Evaluation of information.

The Board may evaluate information received from the scientific and industrial communities, and from the interested public, with respect to—

(1) events or practices at any Department of Energy defense nuclear facility; or

(2) suggestions for specific measures to improve the content of standards described in section 2286a(1) of this title [§ 312(1) of the Atomic Energy Act], the implementation of such standards, or research relating to such standards at Department of Energy defense nuclear facilities.

§ 2286c. Responsibilities of the Secretary of Energy. [Atomic Energy Act, Sec. 314]

(a) Cooperation.

The Secretary of Energy shall fully cooperate with the Board and provide the Board with ready access to such facilities, personnel, and information as the Board considers necessary to carry out its responsibilities under this subchapter. Each contractor operating a Department of Energy defense nuclear facility under a contract awarded by the Secretary shall, to the extent provided in such contract or otherwise with the contractor's consent, fully cooperate with the Board and provide the Board with ready access to such facilities, personnel, and information of the contractor as the Board considers necessary to carry out its responsibilities under this subchapter.

(b) Access to information.

The Secretary of Energy may deny access to information provided to the Board to any person who—

(1) has not been granted an appropriate security clearance or access authorization by the Secretary of Energy; or

(2) does not need such access in connection with the duties of such person.

§ 2286d. Board Recommendations. [Atomic Energy Act, Sec. 315]

(a) Public availability and comment.

Subject to subsections (g) and (h) and after receipt by the Secretary of Energy of any recommendations from the Board under section 2286a of this title [§ 312 of the Atomic Energy Act], the Board promptly shall make such recommendations available to the public in the Department of Energy's regional public reading rooms and shall publish in the Federal Register such recommendations and a request for the submission to the Board of public comments on such recommendations. Interested persons shall have 30 days after the date of the publication of such notice in which to submit comments, data, views, or arguments to the Board concerning the recommendations.

(b) Response by Secretary.

(1) The Secretary of Energy shall transmit to the Board, in writing, a statement on whether the Secretary accepts or rejects, in whole or in part, the recommendations submitted to him by the Board under section 2286a of this title [§ 312 of the Atomic Energy Act], a description of the actions to be taken in response to the recommendations, and his views on such recommendations. The Secretary of Energy shall transmit his response to the Board within 45 days after the date of the publication, under subsection (a), of the notice with respect to such recommendations or within such additional period, not to exceed 45 days, as the Board may grant.

(2) At the same time as the Secretary of Energy transmits his response to the Board under paragraph (1), the Secretary, subject to subsection (h), shall publish such response, together with a request for public comment on his response, in the Federal Register.

(3) Interested persons shall have 30 days after the date of the publication of the Secretary of Energy's response in which to submit comments, data, views, or arguments to the Board concerning the Secretary's response.

(4) The Board may hold hearings for the purpose of obtaining public comments on its recommendations and the Secretary of Energy's response.

(c) Provision of information to Secretary.

The Board shall furnish the Secretary of Energy with copies of all comments, data, views, and arguments submitted to it under subsection (a) or (b) of this section.

(d) Final decision.

If the Secretary of Energy, in a response under subsection (b)(1), rejects (in whole or part) any recommendation made by the Board under section 2286a of this title [§ 312 of the Atomic Energy Act], the Board shall either reaffirm its original recommendation or make a revised recommendation and shall notify the Secretary of its action. Within 30 days after receiving the notice of the Board's action under this subsection, the Secretary shall consider the Board's action and make a final decision on whether to implement all or part of the Board's recommendations. Subject to subsection (h), the Secretary shall publish the final decision and the reasoning for such decision in the Federal Register and shall transmit to the Committees on Armed Services and on Appropriations of the Senate and to the Speaker of the House of Representatives a written report containing that decision and reasoning.

(e) Implementation plan.

The Secretary of Energy shall prepare a plan for the implementation of each Board recommendation, or part of a recommendation, that is accepted by the Secretary in his final decision. The Secretary shall transmit the implementation plan to the Board within 90 days after the date of the publication of the Secretary's final decision on such recommendation in the Federal Register. The Secretary may have an additional 45 days to transmit the plan if the Secretary submits to the Board and to the Committees on Armed Services and on Appropriations of the Senate and to the Speaker of the House of Representatives a notification setting forth the reasons for the delay and describing the actions the Secretary is taking to prepare an implementation plan under this subsection. The Secretary may implement any such recommendation (or part of any such recommendation) before, on, or after the date on which the Secretary transmits the implementation plan to the Board under this subsection.

(f) Implementation.

(1) Subject to paragraph (2), not later than one year after the date on which the Secretary of Energy transmits an implementation plan with respect to a recommendation (or part thereof) under subsection (e), the Secretary shall carry out and complete the implementation plan. If complete implementation of the plan takes more than 1 year, the Secretary of Energy shall submit a report to the Committees on Armed Services and on Appropriations of the Senate and to the Speaker of the House of Representatives setting forth the reasons for the delay and when implementation will be completed.

(2) If the Secretary of Energy determines that the implementation of a Board recommendation (or part thereof) is impracticable because of budgetary considerations, or that the implementation would affect the Secretary's ability to meet the annual nuclear weapons stockpile requirements established pursuant to section 2121 of this title [§ 91 of the Atomic Energy Act], the Secretary shall submit to the President, to the Committees on Armed Services and on Appropriations of the Senate, and to the Speaker of the House of Representatives a report containing the recommendation and the Secretary's determination.

(g) Imminent or severe threat.

(1) In any case in which the Board determines that a recommendation submitted to the Secretary of Energy under section 2286a of this title [§ 312 of the Atomic Energy Act] relates to an imminent or severe threat to public health and safety, the Board and the Secretary of Energy shall proceed under this subsection in lieu of subsections (a) through (d) of this section.

(2) At the same time that the Board transmits a recommendation relating to an imminent or severe threat to the Secretary of Energy, the Board shall also transmit the recommendation to the President and for information purposes to the Secretary of Defense. The Secretary of Energy shall submit his recommendation to the President. The President shall review the Secretary of Energy's recommendation and shall make the decision concerning acceptance or rejection of the Board's recommendation.

(3) After receipt by the President of the recommendation from the Board under this subsection, the Board promptly shall make such recommendation available to the public and shall transmit such recommendation to the Committees on Armed Services and on Appropriations of the Senate and to the Speaker of the House of Representatives. The President shall promptly notify such committees and the Speaker of his decision and the reasons for that decision.

(h) Limitation.

Notwithstanding any other provision of this section, the requirements to make information available to the public under this section—

(1) shall not apply in the case of information that is classified; and

(2) shall be subject to the orders and regulations issued by the Secretary of Energy under sections 2167 and 2168 of this title [§§ 147 and 148 of the Atomic Energy Act] to prohibit dissemination of certain information.

§ 2286e. Reports. [Atomic Energy Act, Sec. 316]

(a) Board report.

(1) The Board shall submit to the Committees on Armed Services and on Appropriations of the Senate and to the Speaker of the House of Representatives each year, at the same time that the President submits the budget to Congress pursuant to section 1105(a) of Title 31 [United States Code], a written report concerning its activities under this subchapter, including all recommendations made by the Board, during the year preceding the year in which the report is submitted. The Board may also issue periodic unclassified reports on matters within the Board's responsibilities.

(2) The annual report under paragraph (1) shall include an assessment of—

(A) the improvements in the safety of Department of Energy defense nuclear facilities during the period covered by the report;

(B) the improvements in the safety of Department of Energy defense nuclear facilities resulting from actions taken by the Board or taken on the basis of the activities of the Board; and

(C) the outstanding safety problems, if any, of Department of Energy defense nuclear facilities.

(b) DOE report.

The Secretary of Energy shall submit to the Committees on Armed Services and on Appropriations of the Senate and to the Speaker of the House of Representatives each year, at the same time that the President submits the budget to Congress pursuant to section 1105(a) of Title 31 [United States Code], a written report concerning the activities of the Department of Energy under this subchapter during the year preceding the year in which the report is submitted.

(c) Requirements for first annual report.

(1) Before submission of the first annual report by the Defense Nuclear Facilities Safety Board under section 316(a) of the Atomic Energy Act of 1954 (as added by subsection (a)), the Board shall conduct a study on whether nuclear facilities of the Department of Energy that are excluded from the definition of "Department of Energy defense nuclear facility" in section 318(1)(C) of such Act (hereafter in this subsection referred to as "non-defense nuclear facilities") should be subject to independent external oversight. The Board shall include in such first annual report the results of such study and the recommendation of the Board on whether non-defense nuclear facilities should be subject to independent external oversight.

(2) If the Board recommends in the report that non-defense nuclear facilities should be subject to such oversight, the report shall include a discussion of alternative mechanisms for implementing such oversight, including mechanisms such as a separate executive agency and oversight as a part of the Board's responsibilities. The discussion of alternative mechanisms of oversight also shall include considerations of budgetary costs, protection of the security of sensitive nuclear weapons information, and the similarities and differences in the design, construction, operation, and decommissioning of defense and non-defense nuclear facilities of the Department of Energy.

(d) Requirements for fifth annual report.

The fifth annual report submitted by the Defense Nuclear Facilities Safety Board under section 316(a) of the Atomic Energy Act of 1954 (as added by subsection (a)) shall include—

(1) an assessment of the degree to which the overall administration of the Board's activities are believed to meet the objectives of Congress in establishing the Board;

(2) recommendations for continuation, termination, or modification of the Board's functions and programs, including recommendations for transition to some other independent oversight arrangement if it is advisable; and

(3) recommendations for appropriate transition requirements in the event that modifications are recommended.

§ 2286f. Judicial Review. [Atomic Energy Act, Sec. 317]

Chapter 7 of Title 5 [5 U.S.C. §§ 701 et seq.] shall apply to the activities of the Board under this subchapter.

§ 2286g. "Department of Energy Defense Nuclear Facility" Defined. [Atomic Energy Act, Sec. 318]

As used in this subchapter, the term "Department of Energy defense nuclear facility" means any of the following:

(1) A production facility or utilization facility (as defined in section 2014 of this title [§ 11 of the Atomic Energy Act]) that is under the control or jurisdiction of the Secretary of Energy and that is operated for national security purposes, but the term does not include—

(A) any facility or activity covered by Executive Order No. 12344, dated February 1, 1982 [42 U.S.C. § 7158 note], pertaining to the Naval nuclear propulsion program;

(B) any facility or activity involved[734] with the transportation of nuclear explosives or nuclear material;

(C) any facility that does not conduct atomic energy defense activities; or

(D) any facility owned by the United States Enrichment Corporation.[735]

(2) A nuclear waste storage facility under the control or jurisdiction of the Secretary of Energy, but the term does not include a facility developed pursuant to the Nuclear Waste Policy Act of 1982 (42 U.S.C. 10101 et seq.) and licensed by the Nuclear Regulatory Commission.

§ 2286h. Contract Authority Subject to Appropriations. [Atomic Energy Act, Sec. 319]

The authority of the Board to enter into contracts under this subchapter is effective only to the extent that appropriations (including transfers of appropriations) are provided in advance for such purpose.

§ 2286h-1. Transmittal of Certain Information to Congress. [Atomic Energy Act, Sec. 320]

Whenever the Board submits or transmits to the President or the Director of the Office of Management and Budget any legislative recommendation, or any statement or information in preparation of a report to be submitted to the Congress pursuant to section 2286e(a) of this title [§ 316(a) of the Atomic Energy Act], the Board shall submit at the same time a copy thereof to the Congress.

§ 2286i. Annual Authorization of Appropriations. [Atomic Energy Act, Sec. 321]

Authorizations of appropriations for the Board for fiscal years beginning after fiscal year 1989 shall be provided annually in authorization Acts.

RELATED LEGISLATIVE PROVISIONS

§ 3135 of the National Defense Authorization Act of 1992 and 1993 (Public Law 102-190), as amended by § 401 of the Federal Reports Elimination Act of 1998 (Public Law 105-362):

§ 3135. RESUMPTION OF PLUTONIUM OPERATIONS IN BUILDINGS AT ROCKY FLATS.

(a) RESUMPTION OF PLUTONIUM OPERATIONS.

The Secretary of Energy may not resume plutonium operations in a plutonium operations

[734] Pantex and NTS were added to the Board's jurisdiction by the National Defense Authorization Act of 1992 and 1993 (Pub.L. 102-190) which struck the following language: "with the assembly or testing of nuclear explosives or."

[735] Added by amendment through the Energy Policy Act of 1992 (Pub.L. 102-486, § 902(a)(7)).

building at the Rocky Flats Plant, Golden, Colorado, until the Defense Nuclear Facilities Safety Board determines, to the satisfaction of the Board, that the Secretary's response to the Board's recommendations numbered 90-2, 90-5, and 91-1 adequately protects public health and safety with respect to the operation of such building.

(b) RESUMPTION OF PRODUCTION OF PLUTONIUM WARHEAD COMPONENTS.

The production of plutonium warhead components for any particular type of warhead may not be resumed at the Rocky Flats Plant until the later of—

(1) April 1, 1992; or

(2) 30 days after the date on which the Secretary of Defense and the Secretary of Energy certify to Congress that the production of that type of warhead is necessary in the interest of the national security of the United States.

(c) DEFINITION.

For purposes of this section, the term "plutonium operations building" means the building numbered 371, 559, 707, 771, 776, 777, or 779 at the Rocky Flats Nuclear Weapons Plant, Golden, Colorado, or any other building at such Plant in which plutonium operations are conducted.

§ 3137 of the National Defense Authorization Act for Fiscal Year 2001 (Public Law 106-398), as amended by § 3115 of the National Defense Authorization Act for Fiscal Year 2004 (Public Law 108-136):

§ 3137. CONTINUATION OF PROCESSING, TREATMENT, AND DISPOSITION OF LEGACY NUCLEAR MATERIALS.

(a) CONTINUATION.

The Secretary of Energy shall continue operations and maintain a high state of readiness at the H-canyon facility at the Savannah River Site, Aiken, South Carolina, and shall provide technical staff necessary to operate and so maintain such facility.

(b) LIMITATION ON USE OF FUNDS FOR DECOMMISSIONING OF F-CANYON FACILITY.

No amounts authorized to be appropriated or otherwise made available for the Department of Energy by this or any other Act may be obligated or expended for purposes of commencing the decommissioning of the F-canyon facility at the Savannah River Site until the Secretary submit to the Committee on Armed Services of the Senate and the Committee on Armed Services of the House of Representatives, and the Defense Nuclear Facilities Safety Board jointly a report setting forth—

(1) an assessment whether or not all materials present in the F-canyon facility as of the date of the report that required stabilization have been safely stabilized as of that date;

(2) an assessment whether or not the requirements applicable to the F-canyon facility to meet the future needs of the United States for fissile materials disposition can be met through full use of the H-canyon facility at the Savannah River Site; and

(3) if it appears that one or more of the requirements described in paragraph (2) cannot be met through full use of the H-canyon facility—

(A) an identification by the Secretary of each such requirement that cannot be met through full use of the H-canyon facility; and

(B) for each requirement so identified, the reasons why such requirement cannot be met through full use of the H-canyon facility and a description of the alternative capability for fissile materials disposition that is needed to meet such requirement."

(C) REPEAL OF SUPERSEDED PLAN REQUIREMENT.

Subsection (C) of such section is repealed.

§ 3183 of the National Defense Authorization Act for Fiscal Year 2003 (Public Law 107-314):

§ 3183. STUDY OF FACILITIES FOR STORAGE OF PLUTONIUM AND PLUTONIUM MATERIALS AT SAVANNAH RIVER SITE.

(a) STUDY.

The Defense Nuclear Facilities Safety Board shall conduct a study of the adequacy of the K-Area Materials Storage facility (KAMS), and related support facilities such as Building 235-F, at the Savannah River Site, Aiken, South Carolina, for the storage of defense plutonium and defense plutonium materials in connection with the disposition program provided in section 3182[736] and in connection with the amended Record of Decision of the Department of Energy for fissile materials disposition.

[736] Subtitle E (including § 3182) of the National Defense Authorization Act for Fiscal Year 2003 provides for the disposition of 34 metric tons of weapons-usable plutonium pursuant to the 2000 United States and Russian Federation agreement. § 3182 of the Act requires the Department of Energy to submit to Congress a plan for the construction of the MOX facility at the Savannah River Site to process the 34 metric tons of weapons-usable plutonium.

(b) REPORT.

Not later than one year after the date of the enactment of this Act [enacted December 2, 2002], the Defense Nuclear Facilities Safety Board shall submit to Congress and the Secretary of Energy a report on the study conducted under subsection (a).

(c) REPORT ELEMENTS.

The report under subsection (b) shall—

(1) address—

(A) the suitability of KAMS and related support facilities for monitoring and observing any defense plutonium or defense plutonium materials stored in KAMS;

(B) the adequacy of the provisions made by the Department for remote monitoring of such defense plutonium and defense plutonium materials by way of sensors and for handling of retrieval of such defense plutonium and defense plutonium materials; and

(C) the adequacy of KAMS should such defense plutonium and defense plutonium materials continue to be stored at KAMS after 2019; and

(2) include such proposals as the Defense Nuclear Facilities Safety Board considers appropriate to enhance the safety, reliability, and functionality of KAMS.

(d) REPORTS ON ACTIONS ON PROPOSALS.

Not later than 6 months after the date on which the report under subsection (b) is submitted to Congress, and every year thereafter, the Secretary and the Board shall each submit to Congress a report on the actions taken by the Secretary in response to the proposals, if any, included in the report.

§ 3112 of the National Defense Authorization Act for Fiscal Year 2009 (Public Law 110-417):

§ 3112. LIMITATION ON FUNDING FOR PROJECT 04-D-125 CHEMISTRY AND METALLURGY RESEARCH REPLACEMENT FACILITY PROJECT, LOS ALAMOS NATIONAL LABORATORY, LOS ALAMOS, NEW MEXICO.

Of the amounts appropriated pursuant to an authorization of appropriations in this Act or otherwise made available for fiscal year 2009 for Project 04-D-125 Chemistry and Metallurgy Research Replacement (in this section referred to as ‘‘CMRR’’) facility project, Los Alamos National Laboratory, Los Alamos, New Mexico, not more than $50,200,000 may be made available until—

(1) the Administrator for Nuclear Security and the Defense Nuclear Facilities Safety Board have each submitted a certification to the congressional defense committees stating that the concerns raised by the Defense Nuclear Facilities Safety Board regarding the design of CMRR safety class systems (including ventilation systems) and seismic issues have been resolved; and

(2) a period of 15 days has elapsed after both certifications under paragraph (1) have been submitted.

APPENDIX 2: Board Recommendations

90-1, Restart of K, L, and P Reactors at DOE Savannah River Site
90-2, DOE High Priority Defense Nuclear Facilities; Design, Construction, Operation and Decommissioning Standards
90-3, Future Monitoring Programs at the Department of Energy's Hanford Site, WA
90-4, Operational Readiness Review at the Department of Energy's Rocky Flats Plant, CO
90-5, Systematic Evaluation Program at Department of Energy's Rocky Flats Plant, CO
90-6, Criticality Safety at the Department of Energy's Rocky Flats Plant, CO
90-7, Ferrocyanide Tank Safety at the Hanford Site

91-1, Strengthening the Nuclear Safety Standards Program for DOE's Defense Nuclear Facilities
91-2, Closure of Safety Issues Prior to Restart of K-Reactor at the Savannah River Site
91-3, DOE's Comprehensive Readiness Review Prior to Initiation of the Test Phase at the Waste Isolation Pilot Plant (WIPP)
91-4, DOE's Operational Readiness Review Prior to Resumption of Plutonium Operations at the Rocky Flats Plant
91-5, Power Limits for K-Reactor Operation at the Savannah River Site
91-6, Radiation Protection for Workers and the General Public at DOE Defense Nuclear Facilities

92-1, Operational Readiness of the HB-Line at the Savannah River Site
92-2, DOE's Facility Representative Program at Defense Nuclear Facilities
92-3, Operational Readiness Reviews for the HB-Line at the Savannah River Site, SC
92-4, Multi-Function Waste Tank Facility at the Hanford Site
92-5, Discipline of Operation in a Changing Defense Nuclear Facilities Complex
92-6, Operational Readiness Reviews
92-7, Training and Qualification

93-1, Standards Utilization in Defense Nuclear Facilities
93-2, The Need for Critical Experiment Capability
93-3, Improving DOE Technical Capability in Defense Nuclear Facilities Programs
93-4, DOE's Management and Direction of Environmental Restoration Management Contracts
93-5, Hanford Waste Tanks Characterization Studies
93-6, Maintaining Access to Nuclear Weapons Expertise in the Defense Nuclear Facilities Complex

94-1, Improved Schedule for Remediation in the Defense Nuclear Facilities Complex
94-2, Conformance with Safety Standards at DOE Low-Level Nuclear Waste and Disposal Sites
94-3, Rocky Flats Seismic and Systems Safety
94-4, Deficiencies in Criticality Safety at Oak Ridge Y-12 Plant
94-5, Integration of DOE Safety Rules, Orders, and Other Requirements

95-1, Improved Safety of Cylinders Containing Depleted Uranium
95-2, Safety Management

96-1, In-Tank Precipitation System at the Savannah River Site

97-1, Safe Storage of Uranium-233
97-2, Continuation of Criticality Safety at Defense Nuclear Facilities in the Department of Energy

98-1, Resolution of Safety Issues Identified by DOE Internal Oversight
98-2, Safety Management at the Pantex Plant

99-1, Safe Storage of Fissionable Material Called "Pits"

2000-1, Prioritization for Stabilizing Nuclear Materials
2000-2, Configuration Management, Vital Safety Systems

2001-1, High-Level Waste Management at the Savannah River Site

2002-1, Quality Assurance for Safety-Related Software
2002-2, Weapons Laboratory Support of the Defense Nuclear Complex
2002-3, Requirements for the Design, Implementation, and Maintenance of Administrative Controls

2004-1, Oversight of Complex, High-Hazard Nuclear Operations
2004-2, Active Confinement Systems

2005-1, Nuclear Material Packaging

2007-1, Safety-Related In Situ Nondestructive Assay of Radioactive Materials

2008-1, Safety Classification of Fire Protection Systems

2009-1, Risk Assessment Methodologies at Defense Nuclear Faclities

APPENDIX 3: Board Technical Reports

Updated February 1, 2008

Report Number	Date	Report Title	Author(s)
TECH-36	12/2005	Integrated Safety Management: The Foundation for a Successful Safety Culture	Matthews
TECH-35	12/2004	Safety Management of Complex, High-Hazard Organizations	Matthews
TECH-34	10/2004	Confinement of Radioactive Materials at Defense Nuclear Facilities (Part of Recommendation 2004-2)	Bamdad and Zavadoski
TECH-33	11/2003	Control of Red Oil Explosions in Defense Nuclear Facilities	Robinson, Gutowski, and Yeniscavich
TECH-32	03/2002	Savannah River Site Canyon Utilization	Eggenberger and Ogg
TECH-31	03/2001	Engineering Quality Into Safety Systems	DiNunno
TECH-30	02/2001	Safety Review of the Hanford Spent Nuclear Fuel Project During the Design and Construction Phase	Wille
TECH-29	02/2001	Criticality Safety at DOE Defense Nuclear Facilities	Burns, Ogg, and Bamdad
TECH-28	10/2000	Safety Basis Expectations for Existing DOE Defense Nuclear Facilities and Activities	Bamdad, McConnell, and Andrews
TECH-27	06/2000	Fire Protection at Defense Nuclear Facilities	Shields, Bamdad, and Gwal
TECH-26	02/2000	Improving Operation and Performance of Confinement Ventilation systems at Hazardous Facilities of the DOE	Zavadoski, and Thompson
TECH-25	01/2000	Quality Assurance for Safety-Related Software at DOE Defense Nuclear Facilities	Burns, Forsbacka, and Martin
TECH-24	09/1999	Safety Handling of Insensitive High Explosive Weapon Subassemblies at the Pantex Plant	Von Holle and Martin
TECH-23	05/1999	HEPA Filters Used in the DOE's Hazardous Facilities	Zavadoski, and Thompson
TECH-22	04/1999	Savannah River Site Spent Nuclear Fuel	Fortenberry
TECH-21	03/1999	Status of Emergency Management at Defense Nuclear Facilities of the DOE	Thompson

Report Number	Date	Report Title	Author(s)
TECH-20	02/1999	Protection of Collocated Workers at the DOE's Defense Nuclear Facilities and Sites	Kouts
TECH-19	04/1998	Authorization Agreements for Defense Nuclear Facilities and Activities	Bamdad
TECH-18	11/1997	Review of the Safety of Storing Plutonium Pits at the Pantex Plant (OUO)	Keilers and Tontodonato
TECH-17	10/1997	Review of the Hanford Spent Nuclear Fuel Project	Arcaro, Barton, Grover, Gwal, Hadjian, Moury, Ogg, Roarty, Stokes, Thompson, Wille, Yensicavich, and Zavadoski
TECH-16	06/1997	Integrated Safety Management	DiNunno
TECH-15	03/1997	Operational Formality for DOE Nuclear Facilities and Activities	Krahn and Moury
TECH-14 Rev. 2	06/1007	Savannah River Site In-Tank Precipitation Facility Benzene Generation: Safety Implications	Rovinson, Sanders, Miyoshi, Fortenberry, and Zavadoski
TECH-14	02/1997	Savannah River Site In-Tank Precipitation Facility Benzene Generation: Safety Implications	Robinson, Sanders, Miyoshi, Fortenberry, and Savadoski
TECH-13	02/1997	Uranium-233 Storage Safety at DOE Facilities	Andrews, Hunt, Krahn, and Sautman
TECH-12	08/1996	Regulation and Oversight of Decommissioning Activities at DOE Defense Nuclear Facilities	Andersen and MacEvoy
TECH-11		**NOT ISSUED**	
TECH-10	03/1996	An Assessment Concerning Safety at Defense Nuclear Facilities – The DOE Technical Personnel Problem	Crawford
TECH-9	12/1995	Status of Highly Enriched Uranium Processing Capability at Building 9212 Oak Ridge Y-12 Plant	Ogg, Andrews, and Robinson
TECH-8		**NOT ISSUED**	
TECH-7	11/1995	Stabilization of Deteriorating Mark 16 and Mark 22 aluminum-Alloy Spent Nuclear Fuel at the Savannah River Site	Fortenberry, Yeniscavich, Keilers, Robinson, Moore, Merritt, Stiles, and Hayes

Report Number	Date	Report Title	Author(s)
TECH-6	10/1995	Safety Management and Conduct of Operations at the DOE's Defense Nuclear Facilities (Part of Recommendation 95-2)	Kouts and DiNunno
TECH-5	05/1995	Fundamentals for Understanding Standards-Based Safety Management of DOE Dense Nuclear Facilities (Part of Recommendation 95-2)	DiNunno
TECH-4	05/1995	Integrity of Uranium Hexaflouride Cylinders (Part of Recommendation 95-1)	Grover, Krahn, Martin, Miller, Tontodonato, and Yeniscavich
TECH-3	03/1995	Overview of Ventilation Systems at Selected DOE Plutonium Processing and Handling Facilities	Zavadoski
TECH-2	09/1994	Low-Level Waste Disposal Policy for DOE Defense Nuclear Facilities	Napolitano, Sautman, Helfrich, and Stokes
TECH-1	04/1994	Plutonium Storage at Major DOE Facilities	Hurt, De La Paz, Fortenberry, Tontodonato, and Von Holle

APPENDIX 4: Board Biographies

JOSEPH F. BADER

Mr. Joseph F. Bader, of the District of Columbia, has been appointed a Member of the Defense Nuclear Facilities Safety Board on November 29, 2004. Mr. Bader has held executive and senior management positions primarily in the nuclear weapons complex and nuclear power sectors for Hill International, Inc., Fluor Daniel, Inc., Exxon Nuclear and Westinghouse Electric Corporation. He has conducted numerous program/project reviews and has extensive knowledge of design, construction management and operations of R&D facilities, materials production, and power plants.

Career Highlights

Mr. Bader, serving as Vice President, Hill International, Inc., planned and managed a variety of programmatic and design reviews of complex DOE capital construction projects for the Office of Engineering and Construction Management. These independent reviews of DOE projects are mandated by Congress and were performed for the Office of Engineering and Construction Management.

Mr. Bader, as Senior Project Director, Fluor Daniel, Inc., started up and managed Fluor Daniel's Washington program office to perform design and construction management services in support of the $2.5 billion program to build a “safer, more modern, and more environmentally benign” DOE Nuclear Weapons Complex. Mr. Bader and his multi-disciplined staff provided regulatory compliance, master scheduling, systems engineering and integration, design and construction issues identification, and management for eight projects over eight years.

Subsequent to his assignment to lead the Weapons Complex Reconfiguration Washington office, Mr. Bader supported the $5.6 billion contract to manage and operate the DOE Hanford Reservation. He led a team of managers, professionals and workers in developing a seven-year strategic plan to double the percentage of the annual billion dollar budget applied to actual cleanup and closure activities at the DOE Hanford Site. A major focus was revising the philosophy and application of maintenance and operating procedures for the non-nuclear facilities and systems. He co-authored a Hanford site-wide “Critical Self-Assessment” of the contractors architectural, engineering, construction, construction management, operations, and maintenance performance. The Assessment was prepared for the Democratic Senator from Washington and the DOE in response to Congressional and State concern over the contractor’s performance. The final report included recommended actions to resolve performance problems uncovered in the review.

Following the completion of an internal review for Fluor Daniel to determine the causes of the Duratek Duramelter™ pilot plant failure at Fernald, Mr. Bader prepared a technical risk-based plan for treatment of silo wastes to avoid future failures. Mr. Bader performed a corporate risk analysis to determine which of the several technically feasible paths for silo waste treatment involved the least risk to worker and public health and safety.

As Vice President, Duratek Corporation, responsible for managing technology development and deployment, Mr. Bader addressed major issues from the processing of Department of Energy wastes to radioactive wastewater treatment technologies for reducing nuclear power plant waste volumes and thus operating costs. He introduced the use of vitrification for radioactive waste encapsulation to the company's products and services. He established joint ventures with Bechtel, Westinghouse and major overseas companies such as Siemens and JGC of Japan to deploy vitrification and other waste processing technology domestically. He oversaw design, installation, construction and startup of several systems resulting from these joint ventures.

As Senior Manager, Facilities and Licenses, for Urenco, Inc., Mr. Bader helped establish and manage a multi-national, United States based consortium to design and build a $750 million U.S. ultracentrifuge uranium enrichment plant based on European technology. Mr. Bader led the preparation of the technical, commercial, conceptual design and regulatory basis for the facility. A public acceptance and political acceptance program was developed and implemented.

As Westinghouse Program Manager, Mr. Bader had programmatic oversight responsibilities of the 100,000 kg/yr mixed oxide production facility. He participated in the final design decision, the development of safeguards and security requirements, and Nuclear Regulatory Commission and State of South Carolina compliance activities. He prepared and participated in the public and political acceptance activities in the State and in Washington, DC.

Mr. Bader was responsible as Senior Engineer, Babcock and Wilcox, for the thermal/hydraulic design of the nuclear reactor cores for the German commercial nuclear ship, the Otto Hahn, the Japanese commercial nuclear ship, the Mutsu, and for the nuclear reactor power upgrade of the United States commercial nuclear ship, the N.S. Savannah.

Education: M. S., Nuclear Engineering, University of Virginia, 1970
B. S., Mechanical Engineering, Villanova University, 1962

Professional American Society of Mechanical Engineers
Memberships: American Nuclear Society

Honors: Pi Tau Sigma

Others: Providence Hospital Citizens Board
Chairman, Audit Committee
Member, Finance Committee

LARRY W. BROWN

Larry W. Brown was confirmed by the U.S. Senate in September 2006 to be a member of the Defense Nuclear Facilities Safety Board for a term expiring October 18, 2010.

Prior to 2001, Mr. Brown served on active duty in the United States Navy, and on retirement in 1996 completed a law degree. He began his military service as a Seaman Recruit and retired as a United States Navy Captain after having served from 1963 to 1996 onboard ten ships, including nuclear submarines, destroyers, frigates, supply ships, and a nuclear aircraft carrier. Early in his career he qualified in nuclear plant operations on three naval nuclear reactors.

His last two sea tours were as Commanding Officer of the Guided Missile Destroyer USS LUCE (1989-91), and of the Guided Missile Frigate USS MAHLON S. TISDALE (1991-92), respectively. While serving as Commanding Officer, his ships earned many awards including the Chief of Naval Operations Safety Award and the Squadron nomination for the Pacific Fleet Lamps (Helicopter) Safety Award. He earned six personal awards while serving in the United States Navy, including the Legion of Merit for service on the staff of the Chief of Operations in 1996.

Upon retirement he completed law school and subsequently worked as an attorney before joining the Administration in 2001. Mr. Brown was assigned to the U.S. Department of Energy (DOE) and worked as the Senior Policy Advisor for nuclear, spent fuel and non-proliferation and nuclear security issues. In this role he provided recommendations on a broad cross-section of key issues to the Office of Nuclear Energy, the Office of Environmental Management, the Office of Non-proliferation and International Security, the Under Secretary, and the Deputy Secretary of Energy.

As a DOE Senior Policy Advisor he coordinated efforts to capture value from the government's uranium inventories, while encouraging private industry to modernize nuclear fuel cycle facilities in the United States. His efforts contributed to the resolution of private claims for prior transfers of 9,950 tons of contaminated natural uranium, decontamination of nearly 15,000 tons of technetium contaminated natural uranium, and recognition of the value of the government's large inventory of high assay depleted uranium. At the end of his term at DOE, the stagnant U.S. uranium enrichment industry, which previously had no concrete plans for deployment of new enrichment technology, had begun two privately funded technology development and deployment initiatives.

In 2005 the Deputy Secretary directed him to lead the DOE Task Force that developed the Global Nuclear Energy Partnership (GNEP), subsequently a Presidential initiative, with the objective of eliminating the major impediments to the expansion of commercial nuclear energy, including—on a global scale—closing the nuclear fuel cycle, reducing commercial nuclear waste and stemming the illicit spread of sensitive nuclear technologies. In 2006 Mr. Brown was presented the Secretary of Energy's Silver Award in special recognition of his work on the President's Global Nuclear Energy Partnership.

His last position at the Department of Energy before joining the Board was the Deputy Assistant Secretary for Corporate Business Operations in the Office of Nuclear Energy where he spearheaded the GNEP international initiative, which has since been embraced by all the world's major nuclear power nations, and many others.

Since reporting to the Board, Mr. Brown has visited all the defense nuclear sites multiple times, focusing attention on the facilities' material condition, formality of operations, and safety issues associated with wet chemistry operations. In addition he has highlighted the importance of DOE establishing the robust radiological safety Research and Development program discussed in the Board's recommendation 2004-

1, and strengthening government contractor oversight principally through thoroughly qualified and adequately staffed Facility Representative (FACREP) programs at each defense nuclear site.

Separate and apart from his duties as a Board Member, he has continued to participate in conferences discussing the future of commercial nuclear power, speaking principally on the issues of non-proliferation of sensitive technologies. In 2007 he spoke on the subject of non-proliferation at the GNR2 (Global Nuclear Fuel Reprocessing and Recycling) Conference, and at the Howard H. Baker Center for Public Policy conference on "The Role of Nuclear Power in Global and Domestic Energy Policy: Recent Developments and Future Expectations", and for the third time he participated in the bi-annual US-Japan Workshop on Nuclear Energy.

Education:

J.D., Georgetown University Law Center, 1998. He is licensed to practice law in the Commonwealth of Virginia, the State of Maryland, and the District of Columbia.

M.A., United States Naval War College, Newport, RI, 1993. (National Security and Strategic Studies)
B.A., University of Colorado, 1972. (Physics)

EDSON G. CASE

During his military and civilian careers, Edson Case has been in the forefront of the development and implementation of nuclear safety policy.

Case graduated from the United States Naval Academy in 1946 as an Ensign and spent the next 15 years as a Naval Officer. For several years during the 1950's, Case worked directly for Admiral Hyman Rickover as a Project Officer in the Naval Nuclear Propulsion program.

In his 30-year civilian career, Case was a senior staff member of the U.S. Atomic Energy Commission and the Nuclear Regulatory Commission (NRC). For over 10 years at the NRC, he was Deputy Director and Director of the Office of Nuclear Reactor Regulation, responsible for all safety aspects of commercial nuclear power plants, including their location, design, construction, and operation.

Case retired from the NRC in 1985 and until recently provided consulting services to the Commission. In August 1989, President George Bush nominated Edson Case to be a Member of the newly established Defense Nuclear Facilities Safety Board. In his appearance before the Senate Committee on Armed Services, Case stated his belief in timely decision-making, firm yet fair decisions, and his strong support of a competent technical staff. Following confirmation by the United States Senate, Case was sworn-in as a Member of the Board in October 1989.

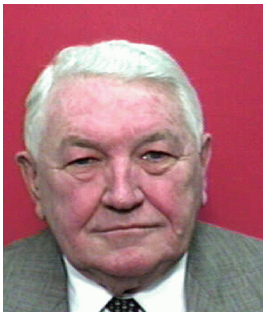
In early 1991, following renomination by President Bush, the United States Senate confirmed Mr. Case as a Member of the Defense Nuclear Facilities Safety Board for a full five-year term.

Case received degrees from the United States Naval Academy and the Massachusetts Institute of Technology. In 1982 he received the Meritorious Executive Award in the Senior Executive Service.

Case and his wife, Rita, have six grown children.

June 1991

JOHN T. CONWAY



John T. Conway, an engineer and attorney, is Chairman of the Defense Nuclear Facilities Safety Board. In October 1989, President Bush appointed him to a five-year term as Chairman of the newly established Defense Nuclear Facilities Safety Board to which he was reappointed by President Clinton to a second five-year term. His nuclear experience includes 12 years on the staff of the Joint Committee on Atomic Energy, U.S. Congress (six years as Staff Director), and 11 years as President/Chairman of the Board of the American Nuclear Energy Council. Following is a brief resume:

Oct. 1989 - 2005	Defense Nuclear Facilities Safety Board, Chairman
1982 - 1989	Consolidated Edison Company, Executive Vice President
1982 - 1989	American Nuclear Energy Council (ANEC), Chairman
1978 - 1982	American Nuclear Energy Council (ANEC), President and Chief Executive Officer
1968 - 1978	Consolidated Edison Company, Executive Assistant to Charles F. Luce, Chairman of the Board (1970-78, duties included Chairman, Nuclear Facilities Safety Committee)
1956 - 1968	United States Congress, Staff, Joint Committee on Atomic Energy (1958-62, Assistant Staff Director; 1962-68, Executive Director)
1950 - 1956	Federal Bureau of Investigation, Department of Justice, Special Agent – served in Kentucky, New York, Washington, D.C.
1949 - 1950	Meighan & Necarsulmer Law Firm, Associate
Education	Columbia University School of Law, LLB, 1949 (converted to Juris Doctor, 1969)
	Tufts University, BS Engineering, 1947
Military Service	U.S. Navy, active duty February 4, 1943 to September 1946; Saw service in North Atlantic, USPC78l, Discharged Lt. (j.g.)
Professional Memberships	Admitted to New York Bar, 1949, and Supreme Court of the United States, 1953
Awards	Grand Council of Hispanic Societies in Public Service Humanitarian Award
	The James and Jane Hoey Award for Interracial Justice

JOHN W. CRAWFORD, JR.

Jack Crawford has spent almost his entire working career in the applications of military and civilian nuclear technology. He began his naval career during World War II serving in USS YORKTOWN at Midway and then in USS SANTEE, and USS BROOKLYN. Following duty as Submarine Repair Superintendent at the Philadelphia Naval Shipyard, Crawford served in various assignments with the Atomic Energy Commission (AEC) in the Naval Reactors program. His responsibilities included providing guidance and direction to ensure that required safety, quality and reliability standards were incorporated in the planning and construction of naval nuclear power plants. In his final assignment in the program he was Deputy Manager under Admiral Rickover.

Following retirement from the United States Navy with the rank of Captain, Crawford returned to the Atomic Energy Commission (subsequently the Department of Energy) to begin a career in civilian nuclear technology. He held increasingly responsible positions culminating in being appointed Principal Deputy Assistant Secretary for Nuclear Energy. As Principal Deputy he carried out a comprehensive "post-TMI" assessment of the safety of DOE nuclear reactors, the widely publicized "Crawford Report." He retired from the Department of Energy in 1981, having been awarded its Distinguished Service Medal.

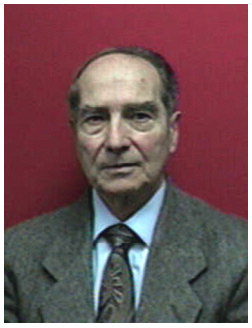
After graduation from Tilton School, Crawford attended Norwich University, was appointed to the United States Naval Academy from New Hampshire, and graduated with distinction in the class of 1942. He earned two Masters Degrees from the Massachusetts Institute of Technology (Naval Construction and Engineering, 1946, and Physics, 1950) and completed the curriculum at the Federal Executive Institute in 1968.

Renominated by President George Bush and confirmed by the United States Senate for a full five-year term to serve as a Member of the Defense Nuclear Facilities Safety Board, Crawford has brought to this position comprehensive knowledge and experience in the engineering and construction of nuclear reactors and over forty years of government service.

Married to the former Elizabeth F. Edwards, Crawford and his wife have four grown children and reside in Maryland.

July 1994

JOSEPH JOHN DiNUNNO



In May 1992, President George Bush nominated Joseph J. DiNunno to the Defense Nuclear Facilities Safety Board. Following confirmation by the United States Senate, Mr. DiNunno assumed his official duties on August 13, 1992. Mr. DiNunno was renominated by President William Clinton for an additional 5-year term. Confirmation by the Senate and reappointment were completed on April 22, 1996.

Mr. DiNunno brings to the Board more than five decades of diverse engineering and environmental experience, including 40 years in the nuclear field in senior positions within both the Federal Government and private industry.

Mr. DiNunno began his professional career in 1942 as an electrical engineer with Westinghouse Electric Corporation. Shortly thereafter, he joined the Department of the Navy, and for the next 17 years assumed increasingly responsible positions with the Bureau of Ships, the Naval Ordnance Laboratory, and the Naval Reactors Branch of the Bureau of Ships/Atomic Energy Commission (AEC). His initial assignment at Naval Reactors was oversight of the development of advanced instrumentation and controls for naval nuclear reactors. Admiral Rickover subsequently assigned Mr. DiNunno as Project Officer for the nuclear power plant of the USS Long Beach.

Upon transferring to AEC in 1959, Mr. DiNunno became a member of the regulatory staff that reviewed the safety aspects of the design, construction and operation of nuclear reactors, Space Nuclear Auxiliary Power systems and a variety of uranium and plutonium processing facilities. Among his assignments was the matrix management of subject matter experts in reactor pressure vessel design, instrumentation and control systems, emergency power systems, core designs and containment systems. Mr. DiNunno also coordinated the regulatory program of reactor safety research and directed the development of reactor siting and safety standards. In 1967 he was assigned to Paris as AEC's Scientific Representative, where he served as technical liaison with atomic energy authorities in ten European countries, the Nuclear Energy Agency and the International Atomic Energy Agency. In 1969 Mr. DiNunno returned to AEC headquarters to head the agency's first Office of Environmental Affairs. This office served as the principal AEC interface with local and national environmental groups concerned about the impact of nuclear power development on the environment and with the federal Council on Environmental Quality and other federal agencies in the development of plans for AEC implementation of the National Environmental Policy Act.

From 1972 to 1983, Mr. DiNunno was employed by the NUS Corporation. As Vice President and General Manager of the Environmental Safeguards Division, and later Technical Director of the Environmental Systems Group, he was responsible for engineering and environmental services provided to both industry and the government. He managed and technically directed an interdisciplinary staff of meteorologists, hydrologists, geologists, ecologists, socio-economists, geographers, land use planners and nuclear engineers. The Environmental Systems Group included both an Ecological Science Laboratory and a Radiation Environmental Monitoring Laboratory. It provided support services to a broad range of clients in the areas of site selection, site qualification, environmental reports, air and waste water discharge permitting, and licensing as required to satisfy federal and state environmental protection requirements (National Environmental Policy Act, Nuclear Regulatory Commission, Environmental Protection Agency, Department of Transportation). These services were performed on a wide variety of nuclear and nonnuclear projects, including environmental investigations of sites for both low- and high-level radioactive wastes.

With the exception of 2 years of full-time employment with R. F. Weston (1986-88) in support of Department of Energy's Civilian Radioactive Waste Management Program, Mr. DiNunno continued his

professional career part-time (1983-92) as an independent consultant, providing environmental and nuclear safety advisory services to both industry and the government. His career included a number of years as a member of both the Space Applications Board of the National Research Council and the Citizens' Advisory Panel on the Cleanup of Three Mile Island.

Mr. DiNunno has written extensively on such issues as the safety of nuclear reactors and environmental considerations in power plant siting. He also has lectured on these topics at universities and industry seminars.

Mr. DiNunno graduated in 1942 with a Bachelor of Science in Electrical Engineering from Pennsylvania State University. In 1954 he earned a Master of Science degree in Electrical Engineering from the University of Maryland. In 1956-57, he received training in nuclear engineering at the Oak Ridge School of Reactor Technology.

July 1996

A.J. EGGENBERGER

An expert in nuclear safety and earthquake engineering, A. J. Eggenberger was appointed in August 1989 to be Vice Chairman of the newly established Defense Nuclear Facilities Safety Board and continued to serve in this capacity until July 2005, when he was appointed Chairman. At the Defense Nuclear Facilities Safety Board he has been directly involved in all aspects of the safety oversight of the Department of Energy's nuclear facilities. This includes design, operational, decommissioning, and construction nuclear safety.

Prior to this, Eggenberger was a senior official at the National Science Foundation serving as Program Director and Leader of the Earthquake Hazard Mitigation Program. In addition to his significant contribution at the Foundation, the Department of Energy recognized Eggenberger's broad experience and knowledge by selecting him to be a member of the Committee on Seismic Isolation for the New Production Reactor Program and as a member of the Board of Governors for the Seismic Technology Program.

Eggenberger's expertise in the area of nuclear technology was acknowledged by the international community when officials of the International Atomic Energy Agency in Vienna, Austria, requested him to serve as an expert consultant with the Division of Nuclear Safety. For five years, until he assumed his Defense Nuclear Facilities Safety Board position, Eggenberger was able to share his considerable knowledge, providing expertise to the Agency and its member states on nuclear safety issues related to the siting and construction of nuclear facilities.

Until joining the National Science Foundation in 1984, Eggenberger was an Associate Partner with D'Appolonia Consulting Engineers in Pittsburgh, Pennsylvania, where he was directly in charge of the Nuclear Facilities Group. Under his direct management the Group dealt with engineering issues ranging from mining, milling, fabrication, and reprocessing to disposal facilities in the U.S. and abroad. Eggenberger also has extensive participation in Naval Reactors prototype programs.

Early in his career (1967 to 1972), Eggenberger was a Professor and Researcher at the University of South Carolina in Columbia.

Eggenberger graduated with a Bachelor of Science from Carnegie Mellon University in 1961. He earned a Master of Science from The Ohio State University in 1963, followed by a Doctor of Philosophy in 1967 from Carnegie Mellon University.

HERBERT JOHN CECIL KOUTS

Dr. Kouts is well known and highly respected in the scientific community. His renown in the nuclear area was acknowledged when he was nominated to be one of the charter Members of the Defense Nuclear Facilities Safety Board. Upon confirmation by the United States Senate, Kouts was sworn into office in October 1989.

At the close of World War II, Kouts left active service with the rank of Major to continue his education. In 1950 he joined Brookhaven National Laboratory where he headed research groups in nuclear reactor shielding and reactor physics. In 1968 he founded the Technical Support Organization, a “think tank” for the Department of Energy in nuclear materials safeguards.

In 1973 Kouts was selected as Director of Reactor Safety Research for the Atomic Energy Commission. From 1975 to 1976, he was Director of Nuclear Regulatory Research in the newly formed Nuclear Regulatory Commission.

Returning to Brookhaven, Kouts headed the International Safeguards Project Office for two years. For over a decade he was the Chairman of the Department of Nuclear Energy, relinquishing the position in 1988; however, he remained Senior Physicist at Brookhaven until officially taking up his present duties.

Over the past 30 years, Kouts has received many awards for his distinguished and significant scientific contributions including the Atomic Energy Commission's E. O. Lawrence Award. He has been chosen to serve on numerous advisory committees and panels, among them the statutory Advisory Committee on Reactor Safeguards. He has been a member and chairman of the International Nuclear Safety Advisory Group to the Director General of the International Atomic Energy Agency on nuclear safety matters. Currently he is a member of the Nuclear Power Advisory Group, advising the European Bank for Reconstruction and Development on activities of the Bank concerning nuclear plants in Eastern Europe, particularly the safety aspects.

During his illustrious career, Kouts, a well-published scientist, has authored (and coauthored) several score of articles, speeches, and research papers. He has shared his experience and expertise in seeking to resolve difficult issues in nuclear materials research and development, international safeguards, and reactor safety.

Dr. Kouts holds a Bachelor of Science in Mathematics and a Master of Science in Physics from Louisiana State University. In 1952 he earned a Doctorate in Physics from Princeton University.

July 1994

JOHN E. MANSFIELD

Dr. Mansfield is an accomplished theoretical physicist with an exceptionally broad range of experience, both within and outside government, in the management of technology support to national defense programs. From the base of his academic work in elementary particle theory, philosophy, and classical languages, Dr. Mansfield has expanded his interests and contributions to a wide variety of areas of physics, engineering, operations analysis, and political-military studies in support of the national defense and civil space programs. Following is a brief resume:

1997 – Present	Member, Defense Nuclear Facilities Safety Board Nominated by President Clinton, re-nominated by President Bush and confirmed in 2003. Nominated as Vice Chairman by President Bush and confirmed in 2007
1994 – 1997	Associate Administrator for Space Access and Technology, National Aeronautics and Space Administration, development of advanced technologies for space launch and satellite systems
1989 – 1994	Professional Staff Member, Committee on Armed Services, United States Senate, strategic submarines, missiles, aircraft, and nuclear weapons
1986 – 1989	Defense Advanced Research Projects Agency, Director of Strategic Technology Office and Chief Scientist of DARPA, research on target recognition, precision weapons, and advanced technologies
1984 – 1986	House Armed Services Committee, Professional Staff Member, nuclear weapons and testing, strategic systems, Air Force research and development
1982 – 1984	Defense Nuclear Agency, Assistant to the Deputy Director (Science and Technology) for Theoretical Research, nuclear weapons effects, radiation simulators, underground tests, support to theater commanders, security and survivability of nuclear weapons
1976 – 1982	Defense Intelligence Agency, Chief, Nuclear Energy and Applied Sciences Division, foreign nuclear weapons, reactors, and advanced technologies
1971 – 1976	Science Applications, Inc., Staff Scientist, Principle Scientist, Program Manager, nuclear weapons effects, nuclear reactor safety
1968 – 1970	University of Notre Dame, postdoctoral fellow, theoretical physics, elementary particles
Education	Ph.D., Harvard University, 1970: Theoretical Physics
	A.M., Harvard University, 1966: Physics
	Ph.L., St. Louis University, 1963: Philosophy
	M.S., St. Louis University, 1963: Mathematics
	A.B., University of Detroit, 1960: Classical Latin and Greek

R. BRUCE MATTHEWS

Dr. Matthews has more than thirty years of scientific and engineering experience in nuclear technologies with a primary focus on special nuclear materials, weapons plutonium, and nuclear reactor fuels. In addition, Dr. Matthews has managed nuclear facilities including operations, construction, regulatory compliance, integrated safety management, and safeguards and security. Dr. Matthews received a BS in Metallurgy from Penn State, an MS in Materials Science from the University of Denver, and a Ph.D. in Materials Science from the University of Wales.

Dr. Matthews was appointed by President George W. Bush on April 22, 2003, to be a Member of the Defense Nuclear Facilities Safety Board, which oversees the safe operation of the Nation's nuclear weapon plants.

Dr. Matthews spent eight years as a Research Scientist at Atomic Energy of Canada where he developed advanced nuclear fuels and structural materials. He subsequently spent two years as a Research Scientist at Pacific Northwest Labs working on proliferation resistant fuels for advanced nuclear power systems. Dr. Matthews worked as a line and program manager at Los Alamos National Laboratory since 1980, and has been involved in DOE programs in stockpile stewardship, nuclear materials disposition, environmental management, and space and terrestrial nuclear power systems. Dr. Matthews was Director of the Nuclear Materials Technology Division from 1993 to 1999 and had overall responsibility for facility operations, base technologies, and program execution involving plutonium and other actinide materials at the Los Alamos' TA–55 Plutonium Facility and the Chemistry Metallurgy Research Building. That position had two major aspects: (1) Managing the nuclear facilities infrastructure including nuclear facility construction projects, facilities operations, nuclear materials control and accountability, waste management, environmental compliance, industrial and radiation safety, training, quality assurance, and safeguards and security. (2) Managing technical and programmatic nuclear materials activities including DOE/Defense Program plutonium activities in stockpile manufacturing, surveillance and R&D; DOE/Environmental Management actinide materials projects in waste management, residue stabilization, and legacy materials cleanup; DOE/Nuclear Energy projects in Pu^{238} heat sources, advanced reactor fuels, and transmutation of nuclear wastes; and DOE/Materials Disposition projects in nuclear materials management, pit disassembly, mixed-oxide fuels, and long-term storage.

In 2000 Dr. Matthews received a Senior Scientific Manager Return to Research grant at the University of California at Santa Barbara. Dr. Matthews is the author or co-author of more than eighty journal publications, conference proceedings and technical reports. He initiated the international Plutonium Futures Conference and is a Fellow of the American Nuclear Society.

JESSIE HILL ROBERSON

In September 1999, President Bill Clinton nominated Ms. Jessie Hill Roberson, of Evergreen, Alabama, to the Defense Nuclear Facilities Safety Board. After confirmation by the United States Senate, Ms. Roberson began her duties as a Board Member on January 18, 2000.

She has more than 17 years of experience in the nuclear field, with in-depth experience in low level waste management, environmental restoration, reactor operations and project management.

Prior to her appointment to the Board, Ms. Roberson served with the Department of Energy (DOE) in a variety of responsible and challenging positions. In 1996 she became the Manager of DOE's Rocky Flats Field Office at the Rocky Flats Environmental Technology Site in Colorado, with the responsibility for integration and performance of all environmental cleanup activities on the Site. She served with distinction in this position until December 1999. In her ten years with the Department of Energy, she has held numerous technical and managerial positions at DOE's Rocky Flats Environmental Technology Site and the Savannah River Site in Aiken, South Carolina, including environmental cleanup, waste management, safeguards and security, as well as nuclear reactors and weapons.

Before joining the Department of Energy, she worked with Georgia Power Company as a system engineering specialist from 1987 to 1989. At Georgia Power, Ms. Roberson focused on maintenance, testing, upgrades and performance reliability of electrical and mechanical plant systems and equipment. She has extensive experience in nuclear reactor operations and successfully completed the testing requirements for reactor operations with E. I. DuPont in 1982. Later with DuPont she trained nuclear reactor operators and supervisors in both nuclear and field operations. Before leaving DuPont in 1987 Ms. Roberson worked as a nuclear reactor operations manager at several sites.

From 1977 to 1980, Ms. Roberson completed work assignments as a student engineer for Westinghouse at the Clinch River Breeder Reactor in Oak Ridge, Tennessee and the Nuclear Center in Monroeville, Pennsylvania. Ms. Roberson received a B.S. in Nuclear Engineering from the University of Tennessee in Knoxville, Tennessee.

March 2000

PETER S. WINOKUR

Dr. Peter S. Winokur of Maryland has been appointed a Member of the Defense Nuclear Facilities Safety Board for a term expiring October 18, 2009. Dr. Winokur has 37 years of experience as a scientist and engineer in the field of radiation effects science, technology, and hardness assurance in support of military and space systems. A Fellow of the Institute of Electrical and Electronic Engineers and the American Physical Society, he was selected as one of the most highly cited researchers in Engineering by the Institute for Scientific Information, which lists the 250 most highly cited researchers in the world in given scientific fields. Following is a brief resume:

2006 – Present	Member, Defense Nuclear Facilities Safety Board
2005 – 2006	Senior Policy Analyst, Congressional Affairs, National Nuclear Security Administration. Liaison to Congress on a broad range of policy, legislative, and budget issues dealing with nuclear weapons, nuclear nonproliferation, energy, and research and development.
2001 – 2004	IEEE Congressional Fellow, Office of Senator Harry Reid. As Energy and Transportation Advisor, crafted energy policy that included tax legislation for renewable energy, resulting in billions in economic development and the creation of tens of thousands of jobs.
1989 – 2000	Manager, Radiation Technology and Assurance Department, Sandia National Laboratories. Led programs focused on radiation-effects science and technology, hardness assurance, and development of radiation-hardened microelectronics for military and space applications.
1987 – 1989	Supervisor, Radiation Technology and Materials Division, Sandia National Laboratories. Radiation physics, materials, and modeling in support of advanced technologies with severe reliability and radiation hardness requirements. Initiated SEMATECH programs dealing with equipment and processes for improved yield and reliability.
1983 – 1987	Member Technical Staff, Advanced Microelectronics Development Division, Sandia National Laboratories, Albuquerque, NM.
1979 – 1983	Senior Staff Physicist, Radiation Effects Branch Harry Diamond Laboratories, Adelphi, MD.
1969 – 1979	Physicist, Radiation Effects Branch Harry Diamond Laboratories, Washington, DC.
1968 – 1969	Scientist, Optical Character Reader Division Control Data Corporation, Rockville, MD.

Dr. Winokur has won numerous awards including the 2000 IEEE Millennium Medal, IEEE Nuclear & Plasma Sciences Merit Award, R&D 100 Award, Industry Week's Top 25 Technologies of Year, Discover Award, and prize-winning papers. He is the author of 140 publications in the open referred literature, including more than 30 invited papers, book chapters, and short courses.

Education	Ph.D., University of Maryland, 1974: Physics
	M.S., University of Maryland, 1971: Physics
	B.S., The Cooper Union, 1968: Physics

DNFSB Board Members taking the oath of office at the White House – October 25, 1989.
From left to right, John H. Sununu – White House Chief of Staff, John W. Crawford, Edson G. Case, John T. Conway – Chairman, A.J. Eggenberger – Vice Chairman, Herbert J.C. Kouts

Senators John Glenn (2nd from left) and Strom Thurmond (2nd from right) with Board Members at the White House oath of office ceremony – October 25, 1989.

DNFSB Board Members conducting a site visit at the Waste Isolation Pilot Plant (WIPP) located in Carlsbad, New Mexico – January 1990 From left to right, Herbert J.C. Kouts, John T. Conway - Chairman, Wendell Weart – Sandia lead engineer for WIPP, Edson G. Case, John W. Crawford, A.J. Eggenberger – Vice Chairman

DNFSB Board Members – December 1997. From left to right, John E. Mansfield, Herbert J.C. Kouts, John T. Conway – Chairman, A.J. Eggenberger – Vice Chairman, Joseph J. DiNunno

DNFSB Board Members – August 2002. From left to right, Jessie Hill Roberson, John T. Conway – Chairman, John E. Mansfield, A.J. Eggenberger – Vice Chairman, Joseph J. DiNunno

DNFSB Board Members – March 2004. From left to right, John E. Mansfield, John T. Conway – Chairman, A.J. Eggenberger – Vice Chairman, R. Bruce Matthews

DNFSB Board Members – October 2007. From left to right, John E. Mansfield – Vice Chairman, Larry W. Brown, A.J. Eggenberger – Chairman, Peter S. Winokur, Joseph F. Bader

DNFSB Site Representatives – August 1994. From left to right, Harry Waugh – Pantex, Jim McConnell – Pantex, Dan Ogg – Hanford, Joe Sanders – Savannah River, Bob Warther – Rocky Flats, Kent Fortenberry – Savannah River, Paul Gubanc – Hanford, Mark Sautman – Rocky Flats

DNFSB Professional Development Program employees – November 1992.
From left to right, William (Ike) White, Derek Barboza, Joe Sanders, Jessica Booher, Paul Ret, Victor Williams, Walter Moore, Russell Green, Herb Massie – Senior Technical Mentor for the PDP Program

DNFSB Board Members conducting a public meeting and hearing in Los Alamos, New Mexico to assess the current safety posture at Los Alamos National Laboratory – December 5, 2007.

Board Staff on the steps of the Canadian Embassy taken by Mike Leggett and Andy Thibadeau - November 1996

For key to staff photo,see numbered list below.

Key to Board Staff Photograph on the steps of the Canadian Embassy, November 1996

1. Cindy Fleenor
2. Dudley Thompson
3. Rich Tontodonato
4. Jim Troan
5. Bill Von Holle
6. Ike White
7. Don Wille
8. Dermot Winters
9. Bill Yeniscavich
10. Roger Zavadoski
11. Larry Zull
12. Dave Drop
13. Donita Vines
14. Sue Megary
15. Mike Merritt
16. Cynthia Miller
17. Matt Moury
18. Dominic Napolitano
19. Jan Preston
20. Joe Roarty
21. Randy Robinson
22. Louise Sabo
23. Herb Massie
24. David Ralston
25. Tim Hunt
26. Tonya Huntley
27. Davis Hurt
36. David Hayes
37. Monique Helfrich
38. Ron Barton
39. Connie Hundemer
40. Joel Blackman
41. Colleen Snyder
42. Lora Steed
43. Dan Burnfield
44. Alice Waagner
45. Lester Clemons
46. Sheree Ward
47. Ray Daniels
48. Joyce Davis
49. Todd Davis
50. Tim Dwyer
51. Jay DeLoach
52. Jack Deplitch
53. Woody Cunningham
54. Mark Flynn
55. Vi Johnson
56. Dana Hienz
57. Nadine Loften
58. Laureen Manning
59. Brenda Atkins
60. Wayne Andrews
61. Ralph Arcaro
62. Elaine Baer

28. Loretta Borostovik
29. Lisa Jellett
30. Roy Kasdorf
31. Martina Felton-McCree
32. Bruce Graham
33. Russell Green
34. Ajit Gwal
35. Asa Hadjian

63. Farid Bamdad
64. Rich Azzaro
65. Sandy Hairston
66. John MacEvoy
67. Rick Schapira
68. Bill Shields
69. Gloria Jones
70. Ken Pusateri
71. Christine Centeno
72. Joe Neubeiser
73. Sue Dickerson
74. Dea Ruff
75. Nancy Creason

Top Row (Left to Right): Larry W. Brown, Peter S. Winokur, Joseph F. Bader, John E. Mansfield

Bottom Row (Left to Right): John W. Crawford, Jr., Jessie Hill Roberson, A.J. Eggenberger, John T. Conway, Joseph John DiNunno, R. Bruce Matthews

Photo by A. Thibadeau