PLUTONIUM DECISION-MAKING IN THE U.S. GOVERNMENT

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ABSTRACT

This paper reviews the development of U.S. plutonium policy from the early 1960's to the present, highlighting the shifting positions on the linkage between plutonium as a nuclear fuel and as a weapons material. The domestic groups involved in such policymaking are described. The author concludes that over the past 30 years the vicissitudes of U.S. plutonium policy have depended most sensitively on a strong proponent of non-proliferation, either in the Presidency or in the Department of Defense. These proponents, or the lack of them, can change at least every four years. It is, consequently, impossible to predict with confidence what the U.S. policy will look like after the year 2000.

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1. Background

On December 9, 1996, the Secretary of Energy announced a dual-track strategy to dispose of surplus U.S. military plutonium.[1] The strategy allowed both for immobilizing plutonium in glass or ceramic forms and for burning it as mixed oxide fuel in existing reactors.

The announcement sparked an outcry from the environmental and nonproliferation communities. They feared that the burning of military plutonium in reactors would lead to the commercial use of plutonium, which meant the wider spread of a weapon-usable material and an environmental threat. Many in the nuclear power industry, on the other hand, welcomed the announcement; and some of them hoped that the Secretary of Energy's strategy would lead to exactly the wider use of plutonium that others feared.

Twenty years ago, when the U.S. Administration viewed plutonium as the key nuclear proliferation threat, such a dual-track strategy would have been unthinkable. Thirty years ago, when the commercial use of plutonium was viewed as an inevitable part of the development of nuclear energy, the dual-track strategy would have attracted little attention.

How did the United States come so far in thirty years? This article describes the development of U.S. plutonium policy over that period and the domestic groups involved. It draws on the personal experience of the writer with these issues and on the not-for-attribution insights of officials in U.S. agencies today.[2]

2. The 1960's: economic and environmental concerns

The 1960's witnessed an expansion of systematic analysis, often economic analysis, of major government decisions. The terms "cost-effectiveness" and "cost-benefit" came to characterize the criteria by which such analysis judged alternative courses of action. Such analysis had been developed during the previous decade at the RAND Corporation (the name is an acronym for Research and Development), a "think tank" established by the U.S. Air Force in Santa Monica, California.

The initial applications of such analysis were to military force structures and budgets. The Kennedy Administration (1961-1963) reorganized the Department of Defense's planning and budgeting to make use of this mode of analysis. The Johnson Administration (1963-1969) expanded the use of such analysis to civilian programs. The Bureau of the Budget (later the Office of Management and Budget) took charge of this expanded analysis via a new PPBS (Programming, Planning, and Budgeting System) activity. A Program Evaluation Staff in BOB/OMB managed the PPBS system.

One of the earliest applications of such analysis to civilian programs was to the activities of the Atomic Energy Commission (AEC). The AEC's uranium enrichment program and its liquid metal fast breeder reactor (LMFBR) program were the foci of most of the analytical effort. Both programs were large, and both could be judged largely by economic criteria.

The LMFBR program conducted R&D to lead to the commercialization of a new type of reactor using plutonium fuel. The intent was to recycle plutonium through this reactor in order to stretch the use of uranium resources by approximately a factor of 50. Although at first glance a factor of 50 increase in the efficiency of resource use suggested favorable economics, there were several problems:

- The program had an annual budget of $1/4 billion, a significant amount in the late 1960's. Moreover, the program required the future investment of billions of dollars in R&D, demonstration facilities, and the extra capital costs of commercial LMFBR's. In contrast to these early and large investments, the benefits of increased uranium efficiency would not appear for several decades. If these investments were judged by the requirement of earning a rate of return comparable to that of other U.S. investments, the benefits would need to be very large.[3]

- The benefits of the LMFBR program depended on the growth of nuclear power and the scarcity of uranium resources. Both of these appeared to be overstated by the AEC.[4] Electricity use in the U.S. was assumed to double every 10 years, with nuclear power taking an increasing share -- straining U.S. capital resources. And uranium supplies were assumed to be fixed at those estimated at the time -- not increasing in response to exploration or to higher prices.

- Because the electric utilities and the reactor vendors would capture many of the economic benefits (if such benefits existed), the question arose why the taxpayer should foot the bill for the LMFBR program.[5]

- As an issue mentioned at the time but not actively pursued until the next decade, the wide use of plutonium in the LMFBR program raised questions of proliferation hazards. Each annual fresh fuel reload for an LMFBR would contain enough plutonium for hundreds of nuclear warheads -- more than either the U.S. or the Soviet Union possessed in the early days of the Cold War.

In the winter of 1967-68 the Bureau of the Budget directed the AEC to conduct a formal analysis of these issues as part of the annual PPBS cycle. The Chairman of the AEC immediately responded in a surprising manner. He informed the BOB that, because the LMFBR was the AEC's highest civilian priority, the Commission was certain that no analysis was needed. Consequently, the AEC would not comply with the BOB's request.

The BOB responded that it would conduct the analysis itself -- with consulting assistance from the RAND Corporation. The AEC immediately countered that the Commission had changed its mind and that the AEC would conduct the study. But it was two late. The BOB and the AEC each conducted "cost-benefit" studies of the LMFBR over the next year, with predictably different results. By conducting their own study budget officials were able to ferret out critical and unrealistic assumptions in the AEC study.

The aftermath of this bureaucratic conflict was threefold.

First, AEC denied security clearances to two RAND analysts who were assisting BOB -- on the grounds that their work indicated that they harbored views unfavorable to the Commission.[6]

Second, BOB/OMB was ever after skeptical of the LMFBR program. For much of the next decade this skepticism resulted in little more than trimming the edges of the program and delaying politically-motivated major initiatives such as the early 1970's announcement of funding for the Clinch River Breeder Reactor (CRBR). In the late 1960's and the beginning of the 1970's, the nexus of the AEC, the Congressional Joint Committee on Atomic Energy (JCAE), and the powerful nuclear industry was too strong for any OMB Director to volunteer for a frontal attack on the largest civilian reactor program. But the rationale for the program was no longer sacrosanct.

Third, the analytical insights spread, if not the official studies themselves. The nascent community of environmental analysts added economic analysis to their growing scrutiny of the problems of nuclear power in general and the LMFBR in particular.[7] Over the subsequent decade it would become widely understood that breeder reactors posed environmental issues over and above those of nuclear power generally:

- The reprocessing of spent nuclear fuel, required to recover plutonium for recycle in breeder reactors, started with highly radioactive fission products embedded in stable ceramic spent fuel. But reprocessing entailed dissolving this stable spent fuel so that the radioactive substances emerged as liquids and gases -- much more susceptible to release into the environment.

- The LMFBR used liquid sodium as a highly efficient material for transferring heat from the reactor core to water that would run electric turbines. But sodium is highly reactive with many materials -- especially with water. And tens of tons of liquid sodium would be separated from tens of tons of water by only about a millimeter of heat exchanger material -- creating the threat of leaks and fires.

- The physics of the LMFBR made "core disruptive accidents," i.e., explosions, possible. Such "excursions" could cause major environmental damage.

By the early 1970's, plutonium was no longer the unquestioned direction for nuclear energy programs. And the stage was set for a broader confrontation.

3. The 1970's: bureaucratic and proliferation concerns

On the surface, plutonium programs enjoyed prosperity and promise in the early 1970's. The wounded Nixon Administration (1969-1974) approved funds to build a major LMFBR demonstration facility, the CRBR. And the successor Ford Administration (1974-1977) approved the largest budgets ever for the LMFBR program -- on the order of $1/2 billion per year.

But with the Vietnam War and the Watergate scandal, the U.S. public was becoming suspicious of the misuse of government power. The inherent conflict of interest in an AEC that both promoted and regulated nuclear power became an early target for reformers. The Energy

Reorganization Act of 1974 split up the AEC into the Energy Research and Development Administration (ERDA) to conduct R&D and the Nuclear Regulatory Commission (NRC) to regulate nuclear energy for the protection of the public. NRC's mandate extended beyond environmental and safety regulation. A special fuel cycle section, Nuclear Materials Safeguards and Security, reviewed the proliferation consequences of nuclear materials in the U.S. and applications for export.

The concentration of Congressional power in nuclear matters into one committee, the JCAE, outlasted the AEC by only a few years. Largely as a result of lobbying by the reform organization Common Cause, the JCAE was abolished in the 1977-78 period -- its functions dispersed among other House and Senate committees.

With the Three Mile Island nuclear accident of the late 1970's, the safety requirements for nuclear power plants escalated, the capital costs to meet these requirements soared, and all new orders for nuclear power plants in the U.S. came to an end.

Thus dissolved one of the most powerful political engines in U.S. bureaucratic history -- the "iron triangle" of a self-regulating government bureaucracy, a single congressional committee, and a prosperous industrial lobby. Nuclear power was no longer accepted uncritically as the wave of the future. And plutonium was to fare even worse.

In May 1974 India surprised the world with a "peaceful nuclear explosion," using plutonium from a research reactor. Other nations -- including Argentina, Brazil, Iran, Iraq, Pakistan, South Africa, South Korea, and Taiwan -- accelerated the elements of their own "peaceful" programs that had weapons potential. The literature on the proliferation hazards of plutonium grew, with writers such as Theodore Taylor and John McPhee reaching a wide readership in *The New Yorker*. A candidate for the 1976 presidential election, Jimmy Carter, made non-proliferation his chief foreign policy issue.

Some of the literature concentrated on the incipient spread of plutonium fuels for present-day reactors as the key proliferation hazard. "Plutonium recycle" had long been envisioned as an intermediate step between present-day reactors, which did not use plutonium fuels, and breeder reactors, which would use plutonium fuels exclusively. The idea was that plutonium recycle would stretch uranium resources slightly and prepare the nuclear power industry for the wider uses of plutonium fuels. The hazard was that each reactor on plutonium recycle would be fueled annually with tens of nuclear weapons worth of plutonium. This plutonium would be embedded in relatively non-radioactive fresh fuel from which the weapons material could be extracted quickly and simply. So every nuclear power plant on plutonium recycle would become a potential source of enough nuclear weapons for a small arsenal.

The hazard was explicated most clearly in *Moving Toward Life in a Nuclear Armed Crowd?*, a research study delivered in late 1975 to the U.S. Arms Control and Disarmament Agency (ACDA).[8] The problem, as posed by the study, was "timely warning." Non-plutonium fuels of the types used by most nuclear power plants could only be diverted to nuclear weapons after months or years -- allowing the system of international inspections time to detect and report the diversion and allowing the international system time to react. But fresh plutonium fuels -- or

worse, the pure plutonium from a reprocessing plant -- could be diverted to nuclear weapons in weeks, too short a time for warning and response.

The theme was picked up in the annual ACDA report, released in July 1976.[9] The ACDA report cited "peaceful nuclear explosions" as the most direct proliferation threat, but one with dubious commercial benefits. For the first time in U.S. government publications, it cited breeder reactors as a proliferation hazard with dubious economic value; but it pointed out that breeders lay in the future and posed no immediate widespread threat. It focused on plutonium recycle as a hazard that could become widespread in the near future.

The timing was significant. Within a few weeks of the ACDA publication, a U.S. plutonium reprocessing facility -- the Barnwell Nuclear Fuel Plant of South Carolina -- requested a federal subsidy so that it could support plutonium recycle, laying the groundwork for the greatest U.S. bureaucratic battle over plutonium.

Over the summer of 1976 reams of analytical papers on the economics, environmental problems, and proliferation hazards of plutonium flew between federal agencies. The battle seemed lopsided. Only ACDA, with some support from the President's Council on Environmental Quality (CEQ), opposed the Barnwell subsidy. The State Department and ERDA had long ago committed themselves to support plutonium recycle, and they carried far more bureaucratic weight than ACDA. Barnwell enjoyed powerful congressional and industry support, while ACDA's power base depended on ideas. Seasoned observers in the U.S. government chuckled at the prolongation of a battle whose outcome seemed a foregone conclusion.

But ACDA reached out with its ideas to one key figure who had seemed irrelevant to the battle: the Secretary of Defense. Although at the time the Defense Department played a negligible role in non-proliferation issues (which were viewed as largely commercial and diplomatic), the Secretary of Defense came to view the spread of plutonium as threat to national security. So, as the issue rose from the working levels of the bureaucracy to the senior levels of the National Security Council, the fight became more evenly matched.

The President, aware of the role of non-proliferation in the final weeks of the election campaign, announced his decision in October 1976. The U.S., he announced, would "indefinitely defer" the reprocessing of plutonium for recycle in present generations of nuclear reactors. The decision would not, however, affect the plans for the development of the LMFBR. And so, for the first time in the history of atomic energy, the plans for commercialization of plutonium received a major setback.

President Ford lost the election, and the Carter Administration (1977-81) took the next steps in setting plutonium policy. It greatly expanded the staffing and roles of ACDA and CEQ. It converted ERDA, which was disproportionately devoted to nuclear research, to the Department of Energy (DOE), which spread its efforts over the full spectrum of energy and conservation technologies. It instigated an International Nuclear Fuel Cycle Evaluation (INFCE) to work toward a global consensus on the limited economic value of plutonium fuels and on the alternatives to them. It used the power to approve or disapprove the reprocessing of U.S.-origin nuclear fuel to create uncertainties in the plutonium programs in Europe and Japan, resulting in substantial international friction. It used U.S. influence to retard transfers of enrichment and

reprocessing technology to such nations as Brazil and India. And it slowed down the LMFBR program -- particularly the high-profile CRBR demonstration project.[10]

The Carter Administration's opposition to plutonium fuels was not evenly supported throughout the bureaucracy. The plutonium program managers in DOE were covered by enough layers of political appointees to prevent them from overtly opposing the Carter policies. But the State Department was more outspoken in its concerns about the effects of the policies on diplomatic relations with Europe and Japan.

The Carter Administration's focus on the hazards of plutonium was a revolution. But like all revolutions, it was followed by a Thermidore. In January 1981 the Reagan Administration (1981-1989) took office.

4. The 1980's: Adam Smith and national security

A lobbyist for the nuclear industry described his reaction to the Reagan election victory as "mixed feelings -- a mixture of euphoria and ecstasy." Candidate Reagan had little sympathy for environmentalist or arms controllers and a great deal of sympathy for high technology. So the industry had renewed hopes for nuclear power in general and plutonium programs in particular.

President Reagan fueled these hopes by a July 16, 1981, policy announcement that ended the Carter Administration's opposition to plutonium programs among close allies. The logic of the announcement was that the U.S. needed the support of these allies to restrict nuclear supplies to countries of genuine proliferation concern. But the decision meant that U.S. opposition to plutonium fuels was no longer global in scope. The Reagan Administration appointed the late Richard T. Kennedy as the State Department's Ambassador-at-Large for Non-Proliferation[11] to administer this frankly discriminatory policy. The withdrawal of opposition to plutonium in nations "of no proliferation concern" suggested that domestic U.S. plutonium programs could also proceed, giving further cause for euphoria to the plutonium industry.

But President Reagan also believed in a limited role for government. National defense was the one area where the federal government had a clear responsibility. Programs that ought to be the responsibility of the private sector should not get subsidized by the taxpayer. And taxes should be cut.

President Reagan's new Director of OMB was a former congressman who immediately identified the Clinch River Breeder Reactor as the kind of program that should not be subsidized by the taxpayer. But the CRBR program (and the LMFBR program in general) could not generate the economic returns demanded by the private sector. So without federal support, the "invisible hand" of Adam Smith would crush the program. The stage was set for a peculiar multi-year congressional battle in which non-proliferators and environmentalists joined with conservative organizations such as the Heritage Foundation to use Reagan arguments against the CRBR. Every stop was pulled out, including conservative distaste for the Senator from Tennessee, the home-to-be of the CRBR. In 1983, under the weight of bipartisan opposition, funding for the CRBR was killed.

At the same time, the weight of bureaucratic opposition to plutonium programs shifted from a relatively weak ACDA to the most powerful agency in the Reagan Administration, the Department of Defense. The Director of ACDA during the plutonium recycle battle of the Ford Administration became Under Secretary for Policy at DOD. His Assistant Secretary for International Security Policy, Richard Perle, had few tears to shed for arms control. But Perle saw proliferation as a fundamental national security threat, and he believed strongly in export controls to prevent such threats from emerging. Perle created a non-proliferation staff, and throughout the Reagan and Bush (1989-1993) Administrations that staff limited the ability of the Department of State to relax U.S. policies against plutonium.

Two episodes are illustrative of the DOD-State rivalry.

In 1984 the Japanese, with State Department approval, planned to ship via ocean freighter a large cargo of plutonium fuel from a reprocessing plant in France to a nuclear reactor in Japan. The original plan was for the security of the fuel to be verified by signed receipts at each end of the journey. There were no measures, other than communications, to deal with the possibility that the cargo might be hijacked. But DOD, alarmed by the arsenal quantity of civilian plutonium, insisted on applying U.S. nuclear weapons transportation standards for the physical security of the shipment. A bureaucratic battle ensued, leading to an armed U.S. naval escort for the shipment and a commitment from the Japanese -- averse to sending forces outside of their home area -- to take comparable physical security measures for future plutonium shipments.

The other episode involved DOD access to information on State Department negotiations regarding plutonium and other non-proliferation issues. By the mid-1980's it was clear that the State Department was using special communication channels to keep knowledge of such negotiations in-house. Another bureaucratic battle ensued, leading to Senate hearings in which Kennedy and Perle set out their cases. The outcome was a slight improvement in DOD access and a great improvement in State Department circumspection.

5. The 1990's: flux and state of play

The Bush Administration generally continued the policies and bureaucratic balances of the Reagan Administration. These changed, however, with the Clinton Administration (1993-the present day).[12]

The Clinton Administration's main plutonium issues have involved negotiations for a fissile material production cutoff treaty and the DOE dual track decision. The fissile cutoff treaty negotiations, conducted in Geneva, seek global agreement to stop production of plutonium or highly enriched uranium not under international inspections. That is, the treaty would permit production of any quantity of plutonium that is under international inspections -- even though the inspections might not provide "timely warning" of diversion.[13]

Where was DOD in this decision, and for that matter in the dual-track decision? DOD's fate was decided by some major moves in the Clinton Administration.

The Clinton Administration is strongly oriented toward increasing U.S. exports. This has translated into an impatience with export controls, including those related to plutonium

technology. The first Clinton appointee for the role of Under Secretary for Policy in DOD made it clear that he wanted to end DOD's "negative" attitude toward exports. He had served in an Under Secretary post in the State Department at the end of the Bush Administration, where he fought DOD on a number of proliferation issues. His Assistant Secretary for International Security Policy (the Richard Perle post) effectively pulled major nuclear non-proliferation issues out of the staff that Perle had established and into a smaller personal staff. A multiple layer of skeptics about export controls was placed above the non-proliferation staff.[14] The DOD position on the dual-track issue (reportedly, not a particularly decisive position) was handled by the Office of Forces Policy, not an office usually associated with non-proliferation expertise. As a result, the DOD non-proliferation staff has basically gone out of the business of nuclear non-proliferation.

The center of the skepticism with respect to plutonium has swung back from DOD to ACDA. ACDA was the only agency to express concerns about the dual-track precedent of having the U.S. depart from 20 years of policy and engage in the use of plutonium fuels.[15]

Support for a plutonium track within the dual-track policy comes from the State Department and the National Security Council staff, which see it as necessary to keep the Russian advocates of plutonium fuels engaged in the process of disposition of weapon-usable materials.

At present the most interesting U.S. agency on plutonium issues is DOE. There are three DOE offices with stakes in the issues:

- The Office of Nuclear Energy. Of the DOE players, this office is the most oriented toward the U.S. nuclear industry. It advocates more R&D on advanced reactors, accepts the U.S. policy of allowing reprocessing in Europe and Japan, and would consider the burning of U.S. surplus military plutonium in foreign reactors.

- The Office of Fissile Materials Disposition. This office would implement the dual-track policy, following guidance that it be done in parallel with Russian disposition of excess plutonium and that no reprocessing -- only the burning of surplus military material -- be involved.

- The Office of Arms Control and Nonproliferation. This office is the most skeptical of the three about plutonium fuels and is the most emphatic on the requirement that the dual-track approach not entail the separation of additional plutonium by means of reprocessing.

The evolution of U.S. policy toward plutonium has been matched by congressional moves toward supporting plutonium fuel cycles. Two senior senators, opposed to plutonium fuels over more than two decades, are retiring at the end of 1998. The power is shifting to the Chairman of the Senate Appropriations Subcommittee on Energy and the Chairman of the Senate Energy and Natural Resources Committee. To read their statements and those of their staff, both are friendly to reprocessing for plutonium recycle, breeder reactors, and the disposition of nuclear waste.[16]

The elements of the nuclear industry advocating plutonium are predictably very happy. The Nuclear Energy Institute (NEI) has formed a working group to serve as a single voice to deal with

regulatory issues concerning plutonium fuels. NEI applauded the dual-track policy the day it was announced.[17]

That leaves ACDA, one office in DOE, and a handful of non-profit organizations[18] as the chief skeptics of plutonium fuels. Their work is cut out for them. The Barnwell Nuclear Fuel Plant, the test case for plutonium policy more than two decades ago, is now proposed as a plutonium fuel fabrication plant for the dual-track approach.[19]

6. The future

Over the past 30 years the vicissitudes of U.S. plutonium policy have depended most sensitively on a strong proponent of non-proliferation, either in the Presidency or in the Department of Defense. These proponents, or the lack of them, can change at least every four years. It is, consequently, impossible to predict with confidence what the U.S. policy will look like after the year 2000.

Moreover, there is a trend in the U.S. toward deregulation of the electric industry. This trend will penalize capital-intensive technologies -- including nuclear power, especially LMFBR's, and reprocessing facilities.

So one prediction is certain: Adam Smith and bureaucratic developments will continue to affect U.S. plutonium policy.

Endnotes

[1] Department of Energy press release, "Energy Secretary Unveils Strategies to Reduce Global Nuclear Danger," December 9, 1996, available on the World Wide Web at <http://www.doe.gov/html/doe/whatsnew/pressrel/pr96176.html>.

[2] There are many less personal and more official histories of U.S. nuclear energy policies. For the early development of the U.S. Atomic Energy Commission, see the classic *History of the U.S. Atomic Energy Commission* by Richard G. Hewlett in association with other authors: Volume 1, "The New World 1939-1946," with Oscar E. Anderson, University of California Press, 1991; Volume 2, "Atomic Shield 1947-1952," with Francis Duncan, University of California Press, 1991; and Volume 3, "Atoms for Peace and War 1953-1961," with Jack M. Holl, University of California Press, 1989. The early changes in plutonium policy are discussed in *The Atomic Energy Commission Under Nixon: Adjusting to Troubled Times* by Glenn T. Seaborg and Benjamin S. Loeb, St. Martins Press, 1993.

[3] In the Nixon Administration (1969-1974) OMB set the real rate of return for judging government investments at 10%, drawing on several studies of the constant-dollar pre-tax rate of return for investments in the U.S. private sector. This rate of return required, for example, that an investment that paid off in 30 years generate some 16 times as much economic savings as investment costs. The 10% rate of return criterion was the analytical standard for some two decades. In OMB Circular A-94, dated October 29, 1992, the required rate of return was reduced to 7% -- and in some cases to some 4%. In the case of the LMFBR, every 2% reduction in the required rate of return approximately doubled the economic benefit/cost ratio.

[4] For a discussion of the economics of plutonium fuel cycles, see Limiting the Spread of Weapon-Usable Fissile Material by Brian G. Chow and Kenneth A. Solomon, The RAND Corporation, 1993, pp. 21-60.

[5] For a discussion of the role of the Federal Government in financing commercial R&D, see "General Science, Space, and Technology," by Richard H. Speier in *Agenda For Progress: Examining Federal Spending*, edited by Eugene J. McAllister, The Heritage Foundation, Washington, D.C., 1981, pp. 63-84.

[6] This caused no permanent damage to the careers of the RAND analysts. A decade or so later, one had become a Commissioner of the Nuclear Regulatory Commission and the other had become a Principal Deputy Assistant Secretary of Defense.

[7] See *The Liquid Metal Fast Breeder Reactor: An Environmental and Economic Critique* by Thomas B. Cochran, Johns Hopkins University Press, 1974. Cochran wrote the book as a staff member of Resources for the Future. He has since become a senior scientist for the Natural Resources Defense Council, a leading environmental organization.

[8] *Moving Toward Life in a Nuclear Armed Crowd?*, ACDA/PAB-263, prepared by Pan Heuristics Division of Science Applications, Inc., Los Angeles, December 1975, revised April 1976. The

study later appeared in a further revision as *Swords from Plowshares: The Military Potential of Civilian Nuclear Energy* by Albert Wohlstetter, Thomas A. Brown, Gregory Jones, David C. McGarvey, Henry Rowen, Vince Taylor, and Roberta Wohlstetter; University of Chicago Press, 1977.

[9] *Arms Control Report*, Publication 89, U.S. Arms Control and Disarmament Agency, July 1976, pp. 17-27.

[10] For a balanced overview of nuclear issues at the time, see *A Nuclear Power Primer: Issues for Citizens*, League of Women Voters Education Fund, Washington, D.C., 1982.

[11] For a brief biography of this key individual, see "Ambassador-at-Large Richard T. Kennedy Dies," *Washington Post*, January 15, 1998, p. D6.

[12] See "Fact Sheet: Nonproliferation and Export Control Policy," Office of the Press Secretary, The White House, September 27, 1993.

[13] For a discussion of this proposed treaty, see *The Proposed Fissile-Material Production Cutoff: Next Steps*, by Brian G. Chow, Richard H. Speier, and Gregory S. Jones, MR-586-1-OSD, The RAND Corporation, Santa Monica, CA, 1995.

[14] See "The Perils of Perry & Co.", by Gary Milhollin, *Washington Post*, February 6, 1994, p. C3.

[15] "ACDA Chief Objects to MOX Option for Weapons-Grade Pu Disposition," by Dave Airozo, *Nucleonics Week*, November 21, 1996, pp. 4-5.

[16] See "A new nuclear paradigm," by Senator Pete V. Domenici, *Nuclear News*, December 1997, pp. 26-28, and "Aide Says Reprocessing Provision Will be Back in Senate Waste Bill," by Dave Airozo, *Nucleonics Week*, November 14, 1996.

[17] "Statement of the Nuclear Industry: Proposed Plutonium Policy is 'Bold, New Course," Nuclear Energy Institute, December 9, 1996.

[18] The main non-profit skeptics are the Nuclear Control Institute (website http://www.nci.org/nci/index.htm), the Natural Resources Defense Council, the Wisconsin Project for Arms Control, the Institute for Energy and Environmental Research, the Federation of American Scientists, the Institute for Science and International Security, and Greenpeace International.

[19] "Conversion of the Barnwell Nuclear Fuel Plant for MOX Fuel Fabrication to Disposition Excess Plutonium," by H. Burton, in *Third U.S.-Russian Workshop on Non-Reactor Nuclear Safety*, sponsored by the U.S. Department of Energy, hosted by the Los Alamos National Laboratory, August 14-19, 1995, pp. 94-99.