

**Statement
of
Thomas B. Cochran, Ph.D.
Senior Scientist, Nuclear Program,
and
Christopher E. Paine
Director, Nuclear Program
Natural Resources Defense Council, Inc.**

on

Nuclear Energy Developments

**Before the
Committee on Energy and Natural Resources
United States Senate
Washington, D.C.**

March 18, 2009



**Natural Resources Defense Council, Inc.
1200 New York Avenue, N.W., Suite 400
Washington, D.C. 20005
Tele: 202-289-6868
tcochran@nrdc.org
cpaine@nrdc.org**

I. Introduction

Mr. Chairman and members of the Committee, thank you for providing the Natural Resources Defense Council (NRDC) the opportunity to present its views on several current issues related to nuclear energy. NRDC is a national, non-profit organization of scientists, lawyers, and environmental specialists, dedicated to protecting public health and the environment. Founded in 1970, NRDC serves more than 1.2 million members and supporters with offices in New York, Washington, D.C., Los Angeles, San Francisco, Chicago and Beijing.

Our testimony focuses on three issues: a) whether additional federal loan guarantees should be provided to construct new nuclear power plants; b) whether the United States should engage in reprocessing of spent nuclear fuel; and c) whether Congress should intervene in the Nuclear Regulatory Commission's proposed rulemakings on temporary storage of spent fuel and so-called "waste confidence," that is, whether sufficient confidence exists today in our long-term ability to isolate spent fuel from the biosphere that we can responsibly license new reactors that will add to the nuclear waste burden.¹

II. Summary of Recommendations

A. Loan Guarantees. Congress should not provide additional loan guarantees to construct new nuclear plants. Sufficient nuclear loan guarantee authority already exists to accomplish the legitimate public purpose that is involved here. Let us define here what we believe to be the legitimate purpose of loan guarantees—they are intended to shift much of the downside financial risk involved in the initial commercial deployment of new or significantly improved low-carbon energy technologies from private interests to federal taxpayers.

Since the underlying light-water reactor technology to be supported by these guarantees has been around for 45 years, has been the prior recipient of many tens of billions of dollars in government support, and already accounts for 20% of U.S. grid-

¹ NRC, *Consideration of Environmental Impacts of Temporary Storage of Spent Fuel After Cessation of Reactor Operation* (hereinafter "Proposed Temporary Storage Rule") 73 Fed. Reg. 59547 (October 9, 2008), and *Waste Confidence Decision Update*, (hereinafter "Proposed Waste Confidence Rule") NRC, 73 Fed. Reg. 59551 (October 9, 2008).

connected power generation, the technology innovation case for nuclear loan guarantee support is weak, and at best, a very narrow one. To avoid serious and lasting distortion of the U.S. energy marketplace and an economically inefficient decarbonization effort, nuclear loan guarantees should be limited to *the lead units of new nuclear plant designs*, not previously deployed in the United States or in similar markets abroad with comparable regulatory requirements. These designs must *incorporate substantial design innovations promising improved safety, increased operating efficiencies, significantly reduced capital costs, and lower environmental impacts*.

In our view, few if any of the Gen III + reactors being proposed today plausibly meet this description, but if any of them do, it could only be *the lead units of new passive safety, smaller footprint, less capital intensive designs that have not yet been deployed elsewhere*. Fitting that description currently are the AP-1000 and the Economic Simplified Boiling Water Reactor (ESBWR), and possibly later the Very High-Temperature Gas-Cooled Reactor (VHTGR), now in the early stages of development by the Department of Energy (DOE).

But even here, we find that there are currently three regulated utilities, each proposing to add two AP1000 units to their respective rate bases, which do not appear to *require* loan guarantees for financing, or at least full loan guarantee coverage at 80% of total project cost. We believe that the \$18.5 billion is already sufficient to support construction of more than just the lead units of the innovative standardized reactor designs currently available to the U.S. market, and therefore no additional loan guarantee authority is needed.

More loan guarantee support to underwrite the U.S. market penetration of additional designs, already deployed or under construction in foreign markets, would only further distort the energy marketplace and undermine the goal of design standardization, which is a widely shared objective of the DOE, Nuclear Regulatory Commission (NRC), nuclear industry and others concerned about the future effectiveness of the NRC's safety regulation.

Federal loan guarantees should not be abused to insulate an entire industry from competition with a host of new energy technologies that promise comprehensive environmental and social benefits. Unlike improvements in efficiency and renewable

technologies, nuclear power is a decarbonization solution packaged with a host of non-carbon environmental, security, and waste problems. For these reasons, nuclear power should not be considered for inclusion in any “Renewable Electricity Standard” Congress may legislate.

B. Spent Fuel Reprocessing. The federal government should not encourage or support commercial spent fuel reprocessing. Putting aside for the moment the serious proliferation and security concerns involved in any future global shift toward reprocessing, it’s clear that combating climate change is an urgent task that requires near term investments yielding huge decarbonization dividends on a 5 to 20 year timescale. For thermal reactors, the closed fuel cycle (spent fuel reprocessing and recycling plutonium) is unlikely ever to be less costly than the once-through fuel cycle, even assuming significant carbon controls. But setting aside such near-term cost barriers, commercial viability for a closed fuel cycle employing fast reactors is an even longer-term proposition. So even fervent advocates of nuclear power need to put the reprocessing agenda aside for a few decades, and focus on swiftly deploying and improving the low-carbon energy solutions.

Think about it. In pursuit of closing the fuel cycle, the U.S. government could easily spend on the order of \$150 billion over 15 years just to get to the starting line of large-scale commercialization. But all that spending will not yield one additional megawatt of low-carbon electricity beyond what could be obtained by sticking with the current once-through cycle, much less by investing that \$150 billion in renewable and efficient energy technologies. Spent-fuel reprocessing, plutonium recycle, and fast reactor waste transmutation are currently uneconomical, higher-risk, 100-year answers to an urgent climate question that now requires low-risk 5 to 20 year solutions. For now, Congress and the new Administration should terminate funding for the Global Nuclear Energy Partnership (GNEP) and its associated efforts to close the nuclear fuel cycle and introduce fast burner reactors in the United States.

At any point along the way, Mr. Chairman, we can revisit this issue to assess whether there may be truly disruptive innovations in nuclear technology that would alter this negative assessment, and induce us to view closing the fuel cycle as a more cost-

effective pathway to decarbonization than the host of cheaper alternatives we have available to us today.

C. Nuclear Waste Disposal. As the political sun sets on the proposed Yucca Mountain project, the federal government needs to begin identifying alternative geological disposal sites for the country's nuclear waste. Congress should initiate a search for a new geologic repository site for disposal of spent fuel, and insure that adequate federal funding is available to retain the technical community associated with the Yucca Mountain project, so that this expertise will be available to assess and develop new proposed geological waste disposal sites. The Congress should not interfere in the NRC's ongoing Waste Confidence and Temporary Storage rulemakings, and let this regulatory body attempt to fulfill its independent regulatory mandate.

III. Detailed Observations

A. Loan Guarantees—Congress should not further subsidize the construction of new nuclear power plants and not provide additional loan guarantees for this purpose.

In the United States existing nuclear power plants operate efficiently and are profitable either because ratepayers long ago paid the piper for their stranded capital costs, or these assets were heavily discounted when corporate ownership changed in the 1990's and now are carried on the books of the new owners at a small fraction of their original asset value. The domestic nuclear power industry, however, is confronting two big economic dilemmas with respect to new nuclear plants. New plants remain uneconomical when compared to other electricity generating technologies and improvements in end-use efficiency; and the unit costs of new nuclear plants are so high that they are difficult to finance in the private capital markets, especially today.

As a purely commercial proposition, when stripped of all the various forms of federal and state subsidies, new nuclear plants are likely to remain non-competitive with other forms of baseload generation in most areas of the country until the price of carbon emissions exceeds \$50 per ton of carbon dioxide. We note, however, that efficiency and many renewable sources are competitive with nuclear now and will only become more so. To bridge this gap, the nuclear industry, through its congressional boosters, has

already received production tax credits for the first 6,000 megawatts of new capacity, licensing cost sharing with DOE, “regulatory risk” insurance against delays in construction, and to date some \$18.6 billion in federal loan authority to support the construction of new plants. In addition, most new reactor projects are benefitting from additional subsidies and incentives, such as tax abatements and worker training programs, offered by state and county governments.

Now the industry is returning to Congress for yet more support, essentially stipulating that nuclear power “must be part of the energy mix” needed to mitigate climate change and to provide for jobs under the economic stimulus plan. We should reject this categorical imperative, command economy type approach. It reminds us of the mindset we used to encounter in Minatom, the old Soviet Ministry of Atomic Energy. The economically efficient way to mitigate climate change is to internalize the cost of carbon emissions through a declining cap-and-trade program, which NRDC strongly supports.

This Committee should reject any broader attempt to use loan guarantees to recapitalize a technically mature industry, or to shift the overall terms of trade in the electricity marketplace in favor of nuclear power. This runs a serious risk of misdirecting investment capital away from commercialization of low-carbon energy technologies that are cheaper, cleaner, and more versatile than currently available nuclear power plants.

Shifting the overall terms of energy commerce in favor of low-carbon solutions, nuclear power included, is the task of a climate bill, not the federal loan guarantee program. At best, federal loan guarantees should be construed as bridging the gap between successful prototype development and a foothold in the commercial marketplace, by spreading the risk of the initial capital investments required to bring a new technology to commercial scale.

But federal loan guarantees should not be abused to insulate an entire industry from competition with a host of new energy technologies that promise comprehensive environmental and social benefits. Unlike improvements in efficiency and renewable technologies, nuclear power is a decarbonization solution packaged with a host of non-carbon environmental, security, and waste problems. For these reasons, nuclear power

should not be considered for inclusion in any “Renewable Electricity Standard” Congress may legislate.

In sum, the economically *inefficient* way to mitigate climate change is to broadly subsidize deployment of currently available nuclear power plant technologies. This will crowd out or slow investment in improved energy efficiency, utility-scale renewable electricity supply, and decentralized smart-grid technologies that can mitigate climate change in less time, with less cost and risk. If Congress is unwilling or unable politically to let a climate bill do the work of sorting out the most cost-effective low-carbon energy technologies, one possible way to mitigate economic inefficiency would be to closely couple any additional federal loan guarantees for nuclear with utility commitments to phase out existing coal capacity, such that future electricity demand growth in the affected service area or regional grid must be met in the first instance by large improvements in less costly energy efficiency, and by the development of renewable sources having environmental impacts and a marginal cost of generation less than nuclear power.

The idea that the nuclear and coal dependent Southeastern region of the United States is without renewable resources worthy of development is a gross distortion that needs to be dispelled. The region has vast distributed potential for photo-voltaic solar development, waste-heat cogeneration, bio-gasification, small hydro, and offshore wind. Above all, with the highest rates in the nation of energy consumption per unit of economic output, the region has a huge energy efficiency resource that can be tapped at far less cost than nuclear. The fact that the dominant utilities and electricity grid in that region are not currently structured to take advantage of these resources does not mean that they do not exist.

We should not use loan guarantees, or any other federal subsidies, to promote the economically inefficient use of nuclear power ahead of low-carbon energy alternatives that will be available sooner, at lesser cost, and with fewer environmental impacts. Under a well designed cap and trade system with competitive open access to the transmission and distribution grid, if nuclear power is needed for decarbonization, the marketplace for low-carbon energy will get around to demanding more of it, but not before it has exhausted the potential of other available energy resources (including all cost-effective

avenues for extracting energy savings from improvements in efficiency) that can displace CO₂ at a lower cost per ton than nuclear power.

An appropriate role for direct federal support of low-carbon energy is to underwrite research, development, and demonstration of meritorious new technologies that are unlikely to be developed by private industry acting alone, either because the return on the investment is too distant or because the investment risks are too high. Alternatively, society may reap benefits by using production or investment tax credits to more rapidly expand the market for beneficial emerging technologies, thereby helping to driving down unit costs of production to a level that allows the technology to become self-sustaining in the marketplace.

Further subsidization of new nuclear power plants does not meet either of these criteria. The first 6,000 megawatts of nuclear new-build capacity are already covered by a production tax credit comparable to wind, and sufficient loan guarantee authority (\$18.5 billion) has already been made available to support construction of the first ‘new’ Gen III+ reactor designs proposed for the U.S. market—the Toshiba-Westinghouse AP1000 and the GE-Hitachi ESBWR. All other reactor designs proposed for construction in the United States either don’t qualify as innovative, have already been constructed elsewhere, or both.

Furthermore, loan guarantees are not essential for nuclear plants currently being developed by regulated utilities as evidenced by Progress Energy’s efforts to build two new units in Levy County, Florida, Georgia Power’s efforts to build two units (Alvin W. Vogle Units 3 and 4), and South Carolina Electric & Gas’s efforts to build two units (Virgil C. Summer Units 2 and 3). All six of these proposed units are AP1000 designs.

Finally, as NRC Chairman Dale E. Klein noted last week, the “excessive exuberance” for nuclear power has declined because of the global credit and economic crisis. The current economic recession has reduced the projected demand for electricity and there is a reduced need to build new base-load electricity generating capacity.

B. Reprocessing—The Federal Government should not encourage or support commercial spent fuel reprocessing.

Reprocessing of commercial spent fuel, as it is practiced today in France, Russia and Japan offers no advantages and numerous disadvantages over continuing to rely on the once-through nuclear fuel cycle as practiced in the United States and most countries with nuclear power plants. The trend in recent years has been for more countries to abandon reprocessing than to initiate reprocessing.

Relative to the existing open fuel cycle, the use of a closed or partially closed mixed-uranium and plutonium oxide (MOX) fuel cycle in thermal reactors has proven to be more costly and less safe. It leads to greater routine releases of radioactivity into the environment, greater worker exposures to radiation, larger inventories of nuclear waste that must be managed, and it doesn't appreciably reduce the geologic repository requirements for spent fuel or high-level nuclear waste.

Because reprocessing as it is practiced today does not appreciably reduce repository requirements it is not an alternative to Yucca Mountain. Should GNEP's advanced reprocessing technologies—essential to the success of the GNEP vision—prove technically feasible, they are unlikely to significantly impact repository requirements, because the fast reactors required for efficient waste transmutation are likely to remain more costly and less reliable than conventional thermal reactors, and hence will not be commercially deployed in sufficient numbers to effect the desired reductions.

The GNEP vision of burning the long-lived actinides, requires that some 30 to 40 percent of all reactor capacity be supplied by fast reactors. In other words, for every 100 thermal reactors of the type used throughout the United States today, some 40 to 75 new fast reactors of similar capacity would have to be built. The commercial use of large numbers of fast reactors for actinide burning is unlikely to occur because—to borrow observations made by U.S. Navy Admiral Hyman Rickover more than 50 years ago that remain true today—fast reactors have proven to be “expensive to build, complex to operate, susceptible to prolonged shutdown as a result of even minor malfunctions, and difficult and time-consuming to repair.”

The development of fast reactors to breed plutonium failed in the United States, the United Kingdom, France, Germany, Italy, and Japan. We would argue it failed in the

Soviet Union despite the fact that the Soviets operated two commercial-size fast breeder plants, BN-350 (now shut down in Kazakhstan) and BN-600 (still operational in Russia), because the Soviet Union and Russia never successfully closed the fuel cycle and thus never operated these plants using MOX fuel.

Moreover, the advanced reprocessing technologies are even more costly than the conventional PUREX method and produce even larger inventories of intermediate and low-level nuclear wastes.

The closed fuel cycle technologies required by GNEP pose greater proliferation risks than the once-through fuel cycle. Even though GNEP's ambitious vision of deploying new reprocessing plants and fast reactors in large numbers will surely fail to materialize, the partnership's research program will encourage the development in non-weapon states of research facilities well suited for plutonium recovery, i.e., small hot cells and even larger reprocessing centers, as well as the training of experts in plutonium chemistry and metallurgy, all of which pose grave proliferation risks. It is for this reason that we advocate terminating the GNEP research on advanced reprocessing technologies.

For now, Congress and the new Administration should terminate funding for the GNEP and its associated efforts to close the nuclear fuel cycle and introduce fast burner reactors in the United States. This leaves the question of what level of long-term DOE research funding is appropriate to explore advanced nuclear fuel recycling technologies.

We hold the view that even substantial research spending in this area is unlikely to lead to disruptive nuclear technology breakthroughs that actually meet the stated goals of the research—cost-effective and non-proliferative techniques for reprocessing, recycling and transmuting plutonium-based fuels. And while the proliferation risks of this cooperative international research would be ongoing and tangible, we and many others in the nonproliferation community believe that shutting down the current U.S. plutonium recycle research effort, and any support it extends to foreign efforts, is the wisest course, at least until such time as the latent nuclear proliferation risk in the world is much better controlled than it is today.

Others, including Energy Secretary Steven Chu, appear to believe that some level of ongoing advanced fuel cycle research is appropriate and has some chance of yielding the desired disruptive nuclear technology breakthrough, if pursued for perhaps a decade

or more. History has not been very kind to this view, but the plutonium fuel cycle community is a lot like the fusion energy community in this respect—hope springs eternal as long as federal research dollars are within reach.

So weighing these contrasting glass-half-full and glass half-empty perspectives, Mr. Chairman, you might conclude that some modest long-term research program, geared to narrowing the technical and cost uncertainties surrounding the toughest unresolved technical, economic, safeguards, and proliferation issues, would be an appropriate and prudent middle path to pursue with respect to closing the fuel cycle. We would emphasize that even more important than the particular choice of technology is a better understanding of the requirements for the international institutional setting in which a large-scale fast reactor roll-out would be attempted. This, more than the technology, is the long pole in the closed fuel cycle tent. If one is serious about wanting to minimize the risks of proliferation, one is more or less driven to consider some form of international ownership and control over nuclear fuel cycle facilities, and this is likely to prove just as demanding a task as the development of more “proliferation resistant” strains of reprocessing. We also note that absent such an international structure for closely regulating the closed fuel cycle, we are unlikely ever to transition to a world free of nuclear weapons.

C. Congress should not interfere in the NRC’s ongoing Waste Confidence and Temporary Storage rulemakings.

The issue of whether and how the availability of permanent geologic disposal should factor into the NRC licensing of commercial nuclear power plants has been with us for decades. A compromise on how the issue would be addressed in a scientific and publicly acceptable manner was reached nearly twenty five years ago and the basic framework of that compromise has not changed substantially over the years.

To make a long story short, in June of 1977, the NRC denied a NRDC petition that forced the question of whether there should be a rulemaking proceeding to determine whether high-level radioactive wastes generated in nuclear power reactors can be permanently disposed of without undue risk to public health and safety. NRDC then petitioned the United States Court of Appeals for the Second Circuit to review the NRC

decision. The D.C. Circuit remanded the matter to the NRC for further proceedings to determine whether there was reasonable assurance that a permanent disposal facility will be found. This and a related case gave rise to the NRC's "waste confidence" rulemaking. The NRC issued a set of findings in 1984 and subsequently revised them in 1990, and reaffirmed them in 1999. The NRC is now revisiting the issue.

The resolution of this issue properly remains with the NRC which was established to address health and safety issues associated with civil use of atomic energy. We would caution against intervention into this ongoing NRC decision-making process. It may be instructive to remind ourselves that the current failure to develop a geologic disposal facility for high level radioactive waste and spent fuel is due in large part to interventions by Congress subsequent to the passage of the Nuclear Waste Policy Act of 1982.