THE NUCLEAR TOP TEN, 1999:

THE KEY PLAYERS DISCUSS CURRENT ISSUES IN U.S. COMMERCIAL NUCLEAR POLICY

THE NUCLEAR TOP TEN, 1999:

THE KEY PLAYERS DISCUSS CURRENT ISSUES IN U.S. COMMERCIAL NUCLEAR POLICY

APRIL 1999

Numark Associates, Inc.
1150 Connecticut Avenue, NW
Suite 715
Washington, DC 20036-4104

Please visit our website at www.numarkassoc.com to view the report online.

This report was prepared independently by Numark Associates and does not necessarily reflect the views of any client of the firm.

TABLE OF CONTENTS

FOREWORD

This inaugural edition of the *Nuclear Top Ten* report aims to illuminate and better inform the debates over key commercial nuclear policy issues by focusing on the people behind the issues. We present here a series of interviews, held in March 1999, which explore the motivations and interests of the primary players influencing U.S. nuclear policy as well as the interactions among these parties on the main issues of the day. It is our hope that this will help readers understand the priorities of the main actors on all sides, the direction in which U.S. policies related to nuclear power may be headed and the impact this may have on the commercial use of nuclear energy.

The interviews focus primarily on domestic commercial nuclear power, and the individuals we selected for the list are those we judged to be most influential in that arena from a wide range of perspectives, particularly on the year's hottest commercial nuclear policy issue, nuclear waste. Proponents of spent fuel interim storage in Nevada, adjacent to the Yucca Mountain proposed repository site, were unable to pass legislation in the last two Congresses and will try to move a bill again this year under continuing veto threat from the Clinton Administration. They view 1999 as the last chance to enact the bill, since 2000 will be a major election year in which little legislation will proceed and since the Democrats, who generally have opposed centralized interim storage, might subsequently take control of one or both houses of Congress.

The dominant industry view on waste legislation is that "a deal's a deal": the government has not met its contractual obligation to begin taking spent fuel from utilities in 1998. The Clinton Administration acknowledges this obligation but feels it does not justify building interim storage in Nevada, which might prejudge the selection of Yucca Mountain as well as divert funds from repository development -- which are already in short supply -- to the interim storage facility. Therefore, Secretary of Energy Richardson has now put forward an alternative proposal where the government would take title to spent fuel at the reactor sites and pay the storage costs. Thus far the proposal has met substantial resistance from the industry and Hill Republicans, but it could prevent the industry bill from commanding veto-proof margins. Consequently, in the interviews various members of the Nuclear Top Ten indicated an interest in working out a compromise.

From the comments on nuclear waste policy that we heard in these interviews -- see pp. 20-21 for a summary -- there is reason to believe a compromise may be achievable. It would have to address the schedule for taking title to spent fuel at the reactor sites as well as thorny funding questions for both at-reactor storage and continuing investigations of the Yucca Mountain repository site. It might also need to look more closely, on a plant-by-plant basis, at the need for off-site storage and the possibility of establishing a small interim storage facility somewhere (which, if in Nevada, might only be built once Yucca Mountain is deemed fit for a repository). An industry commitment to drop lawsuits against the government would also have to be part of any deal, and it might even be useful to lay out a contingency plan in case Yucca Mountain cannot be proven suitable for the final repository by a certain date. The key negotiators to watch as this drama unfolds: Bill Richardson, Frank Murkowski, Jeff Bingaman and Joe Barton.

Apart from the nuclear waste issue, the largest pending legislative matter now before Congress which impacts commercial nuclear power concerns the restructuring of the electric power industry. As discussed in the interviews, Secretary of Energy Richardson plans to introduce comprehensive restructuring legislation soon,

and Chairman Murkowski at the Senate Energy Committee and Chairman Barton at the House Energy and Power Subcommittee are both holding hearings and aiming to produce legislation in this Congress. We addressed the prospects for restructuring legislation with these three and the other key players.

Meanwhile, the largest pending appropriations matter related to nuclear energy concerns the Administration's proposed FY2000 budget increase for nuclear energy research. We spoke with the Top Ten about the merits of this revival in government funding of nuclear R&D, the prospects for funding and the specific research priorities.

We also asked the Top Ten to comment broadly on the future prospects for nuclear power, including its competitiveness as deregulation advances; global warming and its impact on nuclear energy; the reforms under way at the Nuclear Regulatory Commission; and the erosion of nuclear educational resources and labor market issues. Not surprisingly the responses covered the waterfront, from nuclear critics predicting no new nuclear power plants in their lifetimes to nuclear advocates citing the need for baseload power and predicting new orders as soon as 2005-2010. Some of the most notable quotes on the future of nuclear power are summarized on pp. 40-41. The interviews also touch briefly on topics of an international nature including non-proliferation issues, nuclear disarmament and post-Cold War cleanup/waste management issues.

In the coming months we will conduct further interviews to profile other individuals active in current nuclear policy debates, and will publish these on our webpage (*www.numarkassoc.com*). Beyond these individual interviews, we plan to follow this report with the *Nuclear Top Ten, 2001* in the spring of 2001.

Special thanks go to William Alberque, Jon Chase and Janet Lawrie who all worked tirelessly on the many aspects of developing and executing this project. Acknowledgements are also due to Marcus King and Rob MacDougall for their valuable contributions; to Patrice Gilbert for her skilled photographic support; and to 1050 A.D. for the cover design. Finally, our thanks go out to the members of the 1999 Nuclear Top Ten for their participation and to their staffs who helped so much to organize and prepare for the interviews.

With that introduction, we present the *Nuclear Top Ten, 1999*. We hope you will find it informative and we welcome your feedback and suggestions.

Neil J. Numark, President
Numark Associates, Inc.

BIOGRAPHIES OF THE NUCLEAR TOP TEN

Representative Joe Barton

U.S. House of Representatives

Republican Congressman Joe Barton is currently serving in his eighth term in the U.S. House of Representatives. First elected to Congress in 1984, Barton represents the State of Texas' Sixth Congressional District that includes Fort Worth and Arlington. Barton is an engineer by training.

Barton serves on the powerful House Commerce Committee, which has oversight over issues ranging from health care to energy policy. Barton was awarded this year the chairmanship of the Commerce Subcommittee on Energy & Power, placing him in the forefront of nuclear energy policy issues. His main policy objectives are to push the spent fuel interim storage bill and utility restructuring legislation. Active on energy issues since joining the Congress, Barton served as Chairman of the Commerce Subcommittee on Oversight and Investigations in the 104th and 105th Congresses.

Senator Jeff Bingaman

U.S. Senate

Democratic Senator Jeff Bingaman was first elected to represent the citizens of New Mexico in the U.S. Senate in 1982. Currently serving in his third term, Bingaman sits on key committees in the Senate related to nuclear energy issues including Energy & Natural Resources and Armed Services. Prior to becoming a Senator, Bingaman served as Attorney General of New Mexico. Bingaman has built a solid record in the Senate on strengthening education and reducing crime.

At the start of the 106th Congress, Bingaman took over as Ranking Member of the Committee on Energy & Natural Resources following the retirement of Senator Dale Bumpers of Arkansas, and is a potential future chairman should the Democrats regain control of the Senate. Seen as a moderate voice of the Democratic Party, Bingaman brings expertise on nuclear issues to his important new role as Ranking Member.

Mr. Joe Colvin

President, Nuclear Energy Institute

Joe Colvin is the President and Chief Executive Officer of the Nuclear Energy Institute, the policy and advocacy arm of the commercial nuclear industry. Colvin was elected to his position in 1996 after serving as its Executive Vice President for two years.

Colvin has a wide array of nuclear energy experience and expertise. He served 20 years in the U.S. Navy as a nuclear submarine officer, is a registered engineer and has held several senior management positions with the Institute of Nuclear Power Operations. NEI is a presence on Capitol Hill, and Colvin testifies frequently before House and Senate Committees on behalf of the nuclear industry.

Senator Pete Domenici

U.S. Senate

Republican Senator Pete Domenici was re-elected to his fifth term in the U.S. Senate in 1996. First elected by the citizens of New Mexico in 1972, Domenici is the first Senator from that state to be elected to five full terms. He is a lawyer by training.

Domenici is a high-ranking member in the Republican controlled Senate and serves as Chairman of the Senate Budget Committee. His oversight and experience on energy issues, and in particular nuclear energy, is unmatched in the body. He is a leader in both the funding and policy aspects of nuclear energy issues through his chairmanship of the Appropriations Subcommittee on Energy & Water Development as well as his senior position on the Committee on Energy & Natural Resources. Domenici has taken the lead in the Senate on nuclear disarmament and non-proliferation efforts and accompanied President Clinton to Russia in September 1998.

Ms. Wenonah Hauter

Public Citizen

Wenonah Hauter has served as Director of Public Citizen's Critical Mass Energy Project since September 1997. Prior to this position, Hauter spent two years at Citizen Action handling issues related to electric utility restructuring and six years in the Climate Change and Energy Program at the Union of Concerned Scientists. Hauter has significant experience in environmental advocacy and grassroots campaigning, having promoted sustainable energy policy issues at the state and Federal level.

As Director of Critical Mass, Hauter has increased the organization's profile on opposing nuclear power. The project is dedicated to moving the global economy away from nuclear and fossil fuel energy production towards renewables and more energy efficient technologies. Recently, Hauter has been in the forefront of Public Citizen's strong opposition to the proposed interim storage facility at Yucca Mountain, Nevada.

Professor John Holdren

Harvard University

John Holdren is a Professor of Environmental Policy and Director of the Program on Science, Technology, and Public Policy in the John F. Kennedy School of Government at Harvard University. He is a member of President Bill Clinton's Committee of Advisors on Science and Technology (PCAST) and chairman of the PCAST energy research and development panel. In this capacity he was the lead author of PCAST's 1997 report to the President recommending increased federal energy R&D funding, including in nuclear fission and fusion, as part of the response to global warming.

Holdren currently chairs the Committee on International Security and Arms Control of the National Academy of Sciences, and co-chairs the U.S.-Russian Bilateral Independent Scientific Commission on Plutonium Disposition. Holdren holds his Ph.D. in Plasma Physics and worked extensively in the fusion program. He was previously Professor of Energy at the University of California, Berkeley before moving to Harvard in 1996.

Chairman Shirley Ann Jackson

U.S. Nuclear Regulatory Commission

Dr. Shirley Ann Jackson has served as Chairman of the U.S. Nuclear Regulatory Commission since 1995. A native of Washington, D.C., Jackson received her Ph.D. in physics from the Massachusetts Institute of

Technology in 1973. Prior to taking over at NRC, Jackson was a Professor of Physics at Rutgers University, before which she spent 15 years at AT&T Bell Laboratories conducting research in theoretical physics, solid state and quantum physics, and optical physics. She has also served on the Board of Directors of the Public Service Enterprise Group and several other corporations.

Jackson has won praise from nuclear energy supporters and critics alike for taking the NRC through a number of organizational and institutional changes aimed at improving the efficiency and effectiveness of the NRC. On July 1, 1999, Jackson will leave the NRC to become the President of Renssalaer Polytechnic Institute in Troy, New York.

Representative Ed Markey

U.S. House of Representatives

Democratic Representative Edward Markey is currently serving in his 12th term in the U.S. House of Representatives. He was first elected to the 7th Congressional District of Massachusetts in 1976, after graduating from law school and serving two terms in the Massachusetts State House.

Markey is a long time member of the House Commerce Committee and serves on the Subcommittee on Energy and Power. A perennial critic of the nuclear industry, Markey has led several investigations into public health and safety issues at civilian and defense nuclear facilities. In addition, Markey has been a strong opponent of proposals to construct an interim spent fuel repository at Yucca Mountain, Nevada. Markey also serves as second-ranking Democrat on the House Resources Committee and is a member of the Commission on Security and Cooperation in Europe.

Senator Frank Murkowski

U.S. Senate

Republican Senator Frank Murkowski is currently serving the State of Alaska in his 4th term in the U.S. Senate. Murkowski formerly served as President of the Alaska National Bank, the Alaska Bankers Association and the Alaska Chamber of Commerce.

Murkowski is Chairman of the Senate Energy & Natural Resources Committee, and is a recognized expert in fossil fuel development policy. Murkowski's home state has no nuclear industry, but as Chairman of the Energy Committee the Senator has been one of the industry's strongest advocates. A supporter of interim nuclear waste storage, he has once again introduced legislation this year to accomplish that task. Murkowski is a strong advocate of increasing access to public lands and led the charge in 1996 to get the largest public land bill in history signed into law.

Secretary Bill Richardson

U.S. Department of Energy

Secretary Bill Richardson was sworn in as the ninth DOE Secretary in August 1998. A foreign policy expert, Richardson took over at DOE following his tenure as President Clinton's U.S. Ambassador to the United Nations. Prior to that, he represented the 3rd District of New Mexico for eight terms in the U.S. House of Representatives, where he sat on the Commerce Subcommittee on Energy & Power. While serving in the House, he twice successfully negotiated with high-ranking North Korean officials for the release of American captives.

DOE has been under scrutiny for its management practices from Capitol Hill for years, and Richardson has already instituted initiatives to improve the lines of communication between DOE, the Congress and the public. On the nuclear waste issue, Richardson opposes interim storage of spent fuel in Nevada but has recently put forward an alternative proposal for DOE to take title to spent fuel at the reactor sites. Richardson intends to submit proposed electric utility restructuring legislation to Congress in the near future.

THE INTERVIEWS

JOE BARTON

U.S. HOUSE OF REPRESENTATIVES

Nuclear Future

NA: Congressman Barton, as you know, a number of U.S. utilities have made decisions in recent years to shut down nuclear plants that they find uneconomical to keep operating, and the prospects for building new plants don't look so great at the moment, at least within the next 5 to 10 years. As a leading supporter of nuclear energy in Congress today, what are your priorities in the nuclear area?

Barton: I think in the short term we have to get the waste issue solved politically, whether it means storage at Yucca Mountain or someplace else. I think we need an interim storage facility for the next ten years and then you need a permanent repository by the year 2010. I think that's the short term.

I think in the long term you need to continue to invest in innovation so that you make it economically feasible to build, at some point, new nuclear power plants for baseload purposes. They're just not economical today because natural gas is so inexpensive and a combined cycle gas system is so efficient.

At some point in the next century I think nuclear power will become very viable again. Environmentally, nuclear is as clean as there is. If global warming is a reality, then we're going to need nuclear power in a big way and we're going to need it sooner rather than later.

Global Warming

NA: Do you see the global warming issue eventually leading to U.S. policies favoring energy technologies that do not emit greenhouse gases?

Barton: Well, you would assume that. Again, on the nuclear side, you've got to solve the waste issue politically and you need some new technology that's more efficient, and you probably need a regulatory fix so that you don't require the redundancy that we require now.

You can build a 500 megawatt combined cycle gas plant in about two to three years for $400 million, and just the safety systems of a nuclear plant are probably twice that. I believe the actual nuclear power generation is very competitive, but with all the safeguards and the backups and redundant systems and the reporting systems, it prices itself out of the market.

> ...If global warming is a reality, then we're going to need nuclear power in a big way sooner rather than later...

An independent power producer or a utility, their stockholders, if they're for profit, would not be very wise to build new nuclear plants because the cost is two to three times what conventional natural gas power generation is right now.

So we're going to monitor the global warming situation, and I have been an observer to the official working group meetings. Again, I think the biggest short term positive for nuclear power is the emphasis on emissions, because nuclear is clearly head-and-shoulders above conventional power sources that are available today to combat that.

And something not a lot of people think about is that if we were to shut down some of the nuclear power plants that we have, it will lead to more greenhouse gas emissions in the short term. So the worst case should be that we just keep our existing power plants in operation. In the best case, we should get the technology and change the regulatory

environment so that we can build more baseload nuclear power 10 to 15 years down the road.

Utility Restructuring

NA: Congressman, you've just opened a series of hearings on electric utility restructuring. Can you comment on your priorities for restructuring legislation and what kind of outcome you'd like to see?

Barton: Well, the outcome I want to see is a comprehensive bill that the President signs within the next 12 months, if that's possible. I'm not saying that it's probable, but it's possible.

The priority is to get all the Members of the subcommittee involved who want to be, on both sides of the aisle, to work with Representative Ralph Hall of Texas, the Ranking Democrat, and let's see where we have consensus between our Members and the Administration. Secretary Richardson has indicated that the Clinton Administration is going to introduce or publicize their bill sometime in mid-April. We'll be holding more hearings.

We'll continue those hearings through probably mid-May and if we compare the hearing record to the Administration bill, and the comments that we hear from our friends in the Senate, I think we have the possibility to put together a bipartisan consensus bill that can move relatively quickly. We'll go through subcommittee markup, full committee markup, House floor and if the Senate does something, go to conference. We could have a bill on the President's desk sometime next spring. I would like to do that.

> ...We could agree with the Administration to take title on site until a date certain, sometime in the early 2000s. And they would agree to support an interim storage facility...

NA: What should be the key elements of the bill?

Barton: From a federal perspective you need to have reliability requirements, transmission, interstate requirements, and probably some stranded cost recovery requirements. Then you deal with the issues that are totally federal, in terms of PURPA, PUHCA, Power Marketing Administrations, the Tennessee Valley Authority, and some of the municipals that are not under FERC jurisdiction. Beyond that you get into whether you have the blanket grandfathering of state action or do you have some situations where you have federal preemption. I would tend to defer as much as possible to the state, but there are a host of secondary issues, low-income energy assistance, and things like that, where there could be a federal role.

NA: To the extent that it increases competition and adds downward cost pressure on utilities, do you see restructuring causing at least near-term problems for continued operation at some of the nuclear plants?

Barton: I don't think so. I think that the reliability of the nuclear baseload plants is fairly high. And again, if we can settle the waste issue so that the Department of Energy does what it's obligated by law to do, which is not only take title, but move it off-site, most people want the nuclear power plants to keep operating. And at least until all these independent power producers come on line, we need the power. We're not in a surplus power generation situation. These gas turbines that I keep talking about, the backlog on orders is large. It takes a fair number of years to get one, if you ordered it today.

Spent Fuel/High-Level Waste Management

NA: Let's talk some more about the waste issue. Do you think the Administration and Congress will reach a compromise this year on the interim storage question? Is there room for compromise or is the "legislative train wreck" that Secretary Richardson is trying to avoid going to proceed?

Barton: Well, I think there's always room for compromise. I don't agree we're heading toward a train wreck. The worse case is when we record a bill we will get 300 votes in the House and 67 votes in the Senate.

NA: You feel that's the worst case?

Barton: Yes. Now if we can work with the Administration, and we're trying to do that, I think there is some common ground and we can meet them half way. We can agree to take title on a short-term basis until we prove the science is safe for the final disposal facility, then they agree to allow interim storage until the repository opens in 2010. At the hearing last week, the Secretary said they support 2010. They agree we need to find a realistic funding solution. So we've got a lot of common elements. We still have some posturing, that they want to veto the bill because it's in Nevada, and those who support the permanent repository going forward and an interim storage facility going forward in the short term, continue to insist that we need to move a bill this year.

I can't tell you that we've got the guaranteed vote, if we had to confront a veto. But we're in a much stronger position than the Administration is. These lawsuits that the industry has been winning are a trump on our side. The number of votes we've gotten on the floor is a trump on our side. I think common sense is a trump on our side. We've been messing with this since back in the 1950s. We ought to have the repository, a permanent one in place, on time, and we ought to

have an interim facility ready to go in the next two to three years. Technically, that can be done. There are no engineering technical showstoppers.

NA: Let me make sure I understood something you said, that maybe you could arrange to take title on an interim basis while the science is being verified?

Barton: Well, if we move the interim storage bill as it is currently written and we don't change anything, you wouldn't have an interim facility able to take waste until about 2001 or 2002. So we could agree with the Administration to take title on site until a date certain, sometime in the early 2000s. And they would agree to support an interim storage facility, subject to the approval by the NRC and the relevant scientific advisory boards. Once that check-off is done, the waste moves off-site to the interim facility while they're constructing the permanent repository. And then for doing all those good things, we will work to make sure that these lawsuits are stopped. You can develop a bill where everybody wins something.

NA: Then you're saying go ahead and continue the research and studies of Yucca Mountain to reach the site suitability determination in 2001, as scheduled, and we will not authorize interim storage in Nevada until after that site suitability determination is reached?

Barton: Right, or somewhere. I don't think the interim storage has to be done at Yucca Mountain. That's where it looks like it's headed, but it's conceivable you can do an interim facility somewhere else. I don't think you're going to move the permanent repository. I think the die has been cast on that.

NA: So you don't feel the interim facility even has to be in Nevada?

Barton: No. It needs to be in a central location somewhere, and most likely will be at Yucca Mountain. I don't want to mislead people. There are a few private companies out there that claim they could do it somewhere else. But as soon as you pick a site somewhere else, the likelihood is that once that became the prospective interim storage site you have the same issues crop up there that are already being dealt with in Nevada. And we have the benefit in Nevada of a lot of years of study and a lot of analysis and a lot of environmental impact statements and a lot of monitoring.

The Nevadans are opposed to it. There's no question about that. But I think given all the safeguards we've put in place and the work and the money that's been spent, if the decision was made to go forward that way, it would not cause additional consternation. We need to do something on this issue in this session of Congress and we need to do it sooner rather than later.

NA: You said that the final repository is definitely in Nevada. What happens if the scientific studies don't go the right way and whoever is in the White House in 2001, or maybe it's delayed even further, says, "well, we're just not sure about this thing?"

Barton: I don't think a reasonable person can look at the data and visit the site and come to the conclusion that the analysis is not going to verify that it's a suitable site. It's one of the driest places in the United States. It's one of the most monitored places in the United States. It's one of the most remote places in the United States. They were exploding nuclear bombs within 15 miles above and below ground less than 20 years ago. It's on federal land. It's one of the least densely populated places in the United States. In fact, it may be the least densely populated county in the United States.

...I don't think a reasonable person can look at the data and visit the [Yucca Mountain] site and come to the conclusion that the analysis is not going to verify that it's a suitable site...

So, I mean, I think people are running out of excuses of why it's not a suitable site. It's in a very stable rock formation. It's well above the water table and you can go on and on and on.

I am an engineer and engineers don't have preconceived political notions. We look at the problem. We come up with various solutions. You pick the optimum solution and you implement it. This may not be politically optimum but in terms of engineering, it's close to optimum.

By the way, I was a White House Fellow in the Department of Energy in 1981 and 1982. I was an observer and a fact-finder for the key players that developed what became the Nuclear Waste Policy Act in 1982. I got to sit in on the working groups that the Reagan Administration put together. I was a 33-year-old observer and researcher, but I was a part of it.

Nuclear Energy Research

NA: Congressman, the President's external advisors on science and technology have recommended federally funded research on nuclear power at a level of $100 million a year. This program is funded at $19 million this year and DOE has proposed $25 million in 2000. As you said earlier, people have to research ways to make nuclear power more efficient and economical. Do you think that that level, $25 million a year, is enough?

Barton: Well, the easy answer is no, it's not enough. But

should the federal role be larger? I don't know. Right now, given the economics of the situation, I'm not sure a larger federal contribution would make too much difference. We're going to have to let the politics of the global warming issue settle out.

When we get that issue on a stable footing, that's when you would really look at increasing, in my opinion, researching the new nuclear technology in the public sector. Now the private sector is being driven overseas and in the short term I think that's where the funding will come from.

NA: Do you see other ways of helping technologies that are not CO2 emitters, besides direct R&D funding?

Barton: In terms of government policy? Well, I'm not for mandatory set-asides. I might be persuaded to be for some incentives in the tax code, private dollars to go into that field. But I'm much more of a market person than a mandate person. And I'm not going to be in favor of a carbon tax. Put me down as a hard no on that.

NA: Getting back to the future of nuclear power: do you have a sense of how long it's going to be before there's a new order for a nuclear power plant in this country?

Barton: Well, I don't think there's a stronger supporter of nuclear power than me, in the House anyway. I'm a real optimist, and I think that there will be another power plant ordered in my lifetime. But I don't think that that order is going to come certainly in the next three to four years.

...I'm not going to be in favor of a carbon tax. Put me down as a hard no on that...

I think you've got to see global warming issues come to fruition. I think you have to see electricity restructuring happen. I think you need to see an attitudinal change in the public mind that they once again have confidence in the nuclear option. I think you have to have all that happen and that's not easy to do.

NA: And the waste bill.

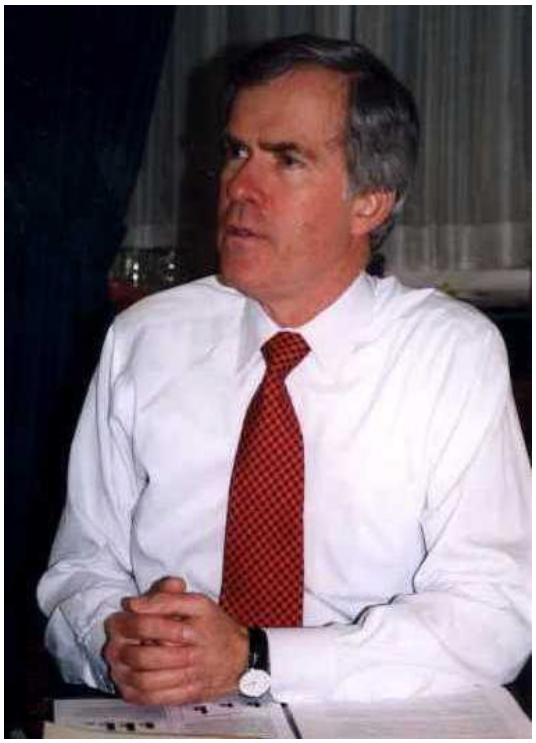
Barton: Yes. And you've got to have a solution to the waste problem. But I think it should happen and could happen and I want it to happen and I want to be a part of that. I still think the original dream of nuclear power coming out of War World II is realizable and I certainly think that in the long run you're going to see a much larger role for nuclear power.

We're not going to have natural gas prices at $1 to $2 per MCF and oil at $15 a barrel forever. And it is not impossible, but it's very expensive to clean coal up to the standards that the public is expecting in terms of the emissions of greenhouse gases.

So the option that's there that meets almost every objective is nuclear power. But it is so burdened with the legacy of the 1950s, 1960s, and 1970s, and it unfortunately has an image in the environmental community and the public mind that is not as positive as the record really indicates.

...I still think the original dream of nuclear power coming out of World War II is realizable and I certainly think that in the long run you're going to see a much larger role for nuclear power...

JEFF BINGAMAN
U.S. SENATE



National Energy Strategy/Nuclear Future

NA: Senator Bingaman, as you know, a number of U.S. utilities have made decisions in recent years to shut down nuclear power plants they find uneconomical to keep running, and more shutdowns are likely as deregulation advances. Meanwhile the near-term prospects for new reactor orders remain dim. In the long run, do you feel that nuclear energy should play a bigger role in the United States than it does today? If so, what do you think should be the government's role in helping to make that happen?

Bingaman: I support nuclear power and I believe it will continue to play an important role in our electricity supply. Nuclear power offers significant clean air and climate advantages over fossil fuels. Chernobyl and TMI aside, it has a good safety record and some of the new designs appear to be even safer.

Congress has done a lot to support the nuclear option. It has invested heavily in nuclear R&D on advanced reactor designs and safety. It has accepted responsibility for waste disposal and is making progress at Yucca Mountain. It has enacted licensing reform legislation and has indemnified utilities against accident liability through the Price-Anderson Act. But it is up to the utilities, not Congress, to decide what type of plants they are going to build. They aren't ordering nuclear plants and haven't for a quarter of a century. Nuclear plants are expensive to build and maintain. They take too long to build and require stringent safety regulation. They aren't competitive with the new gas turbines. Congress can't repeal the laws of economics.

NA: What events do you feel will be necessary before we'll see the first new reactor order in this country, such as an interim storage bill or a carbon emissions policy or higher gas prices? How long do you think it will take?

Bingaman: I don't expect to see another new reactor order in this country anytime soon. Indeed, the changes occurring in the electric utility industry will make one more unlikely. Utilities were unwilling to build new nuclear power plants when they could recover their investment through their rate base. They will be less likely to commit the billions of dollars a nuclear plant costs in a competitive market, where they have no assurance of recovering their costs.

Interim storage of spent fuel is a problem for plants that have shut down and for older plants that are running out of storage space. The fact that we have no interim storage facility is not something that should deter utilities from ordering new ones.

NA: Aside from nuclear, what other technologies in the portfolio should be on the rise to support growing energy demand and to replace greenhouse gas-emitting technologies?

...Congress can't repeal the laws of economics...

Bingaman: The Department of Energy has a wide range of R & D programs under way to develop and deploy solar and renewable energy technologies. None of them is ready to eclipse coal or nuclear as a major source of energy in the next few years, but significant progress is being made to improve these technologies and lower their cost. Research we are pursuing today on photovoltaics and hydrogen fuel cells may revolutionize the energy and transportation industries in years to come.

I am also a strong supporter of energy efficiency programs. I chair the Alliance to Save Energy, which published a report earlier this year on energy efficiency in Federal facilities. We found that improving energy efficiency in Federal buildings

could save the taxpayers about a billion dollars a year and keep millions of tons of carbon emissions out of the atmosphere.

NA: What do you see as the role of the national labs with respect to the future role for nuclear power?

Bingaman: The Department of Energy is pursuing both a "plant optimization" program that is studying plant aging and new technologies aimed at keeping current plants operating and a "research initiative" aimed at expanding the use of nuclear power in the future. The labs will play an important role in both.

Nuclear Energy Research

NA: The research initiative you just referred to has moved forward, but Congress only approved $19 million for FY99 and the Administration has only requested $25 million for FY2000. Do you believe there is support on the Hill to go to the higher levels which the President's external advisors have recommended, on the order of $100 million a year?

Bingaman: There may be support for increasing funds for the NERI program. The problem is deciding what other program you are going to have to cut to increase funding for NERI. Under the current spending caps, there is only so much money available for energy and water development programs. An increase for one program has to come out of another.

Global Warming

NA: Can you comment on the prospects for the Senate ratification of the Kyoto Protocol?

Bingaman: The Energy Committee held a hearing on the cost of implementing the Kyoto Protocol this week. I think global warming is real; it is a serious problem; and we will need to take strong measures to combat it.

> ...I think global warming is real; it is a serious problem; and we need to take strong measures to combat it...

Any climate change treaty that comes before the Senate for ratification will have to contain well-developed mechanisms to minimize the cost to the U.S. economy, including emissions trading, joint implementation, and the concepts envisioned in the Clean Development Mechanism. At this point, considerable work remains to be done within the international community on many of these issues. In the meantime, there is no question that a treaty that does not contain meaningful participation by developing countries cannot be ratified. I believe that with time such mechanisms will be negotiated that result in a global effort at emissions reductions. I cannot predict the timing, but am certain that only then will ratification of a treaty be possible.

Spent Fuel/High-Level Waste Management

NA: Secretary Richardson is preparing a proposal to take title to commercial spent fuel at the reactor sites and manage it there until a final repository is ready. Many members of Congress have expressed opposition to that and continue to push for a bill authorizing interim storage at Yucca Mountain. You expressed an interest in the development of that proposal in a recent hearing.

Are you working with the Secretary on the alternative bill? Do you feel there are good prospects that a compromise will be reached, heading off a likely Presidential veto of the Yucca Mountain interim storage bill and a possible subsequent override, or is the "legislative train wreck" the Secretary wants to avoid in fact unavoidable?

> ...People have to face the fact that the same old [waste] bill is not going to be enacted. They need to come to the table to work on a compromise solution...

Bingaman: I have spoken with the Secretary about his "alternative path" proposal. My staff is working with his staff to develop the proposal in more detail. I am optimistic that the "train wreck" can be avoided. There is wide agreement that legislation is needed. We have a Secretary who is engaged on this, who has put forward a constructive and innovative proposal, and is willing to sit down with all concerned to fill in the details and craft a solution to everyone's satisfaction.

What has to happen, and what hasn't happened yet, is that the people in the industry and Congress who have been pushing the industry bill for the past four years have to face the fact that the same old bill is not going to be enacted. They need to come to the table to work on a compromise solution, too. If they don't and continue to push the same bill that has failed twice before then, yes, we will have another "train wreck."

NA: Can you explain your opposition to the industry bill?

Bingaman: The interim storage facility that you would get under S. 608 would not provide much relief anytime soon.

Compared with the 40,000-or-so tons of spent fuel we'll have at U.S. reactors at the end of 1999, S. 608 would have us moving only 1,200 tons a year to Nevada starting in 2003, eventually reaching 3,000 tons per year in 2008. And that assumes that the deadlines in S. 608 can be achieved—not a trivial assumption. So the bill sounds good in theory, but the reality is that you're not going from 72 sites to one site, as the industry claims in support of the bill, but from 72 sites to 73 sites. If we are paying $1.5 billion to move a few thousand tons to Nevada a little sooner than you would otherwise, is that a good use of the waste fund? I don't think that case has been made, particularly since even with S. 608, interim storage wouldn't be available soon enough for some of the plants that really need the off-site storage to avoid permanent closure.

> ...You're not going from 72 sites to one site, but from 72 sites to 73 sites...

Meanwhile, the centralized storage in S. 608 would do nothing to stop the lawsuits against DOE for failing to meet the January 31, 1998 deadline. Already, about $8 billion in damages have been claimed. Most likely this would come out of the Waste Fund as well. So we could enact a law and then turn around and all the money to implement it would be gone. Building the repository has to remain the first priority, and this is how the funds should be used.

Having said that, I can't blame industry for trying to push some sort of legislation. The industry has had a legitimate complaint, in years past, that the Administration has been unwilling to address their problems and provide real resolution of the waste issue. But what's changed this year is that Secretary Richardson has come to the table with a serious proposal that involves more than just money. I think this proposal should be our focus and I think a solution can be reached that addresses the real needs out there.

NA: What about the industry's concern that the site suitability determination could be delayed past 2001, or -- worst case -- could be negative?

Bingaman: This is a scenario that any "alternative path" proposal will have to address. So far, it doesn't look like this concern will materialize. The viability assessment identified a number of key issues for attention, but did not find any "showstoppers." Nonetheless, there is still a lot of scientific work to be done before a suitability determination can be made. We need to ensure that the science is properly funded and that it is conducted in a credible manner. I hope that industry will strongly support adequate funding for the program when Congress considers the Energy and Water Development Appropriations Bill later this year.

NA: Would you support centralized interim storage at an alternative site if a volunteer could be found? E.g., private proposals to build such a facility in Utah or Wyoming, or DOE sites?

Bingaman: If the private sector could build an interim storage site or if a state were willing to host one, it would have happened by now. We passed a law 12 years ago that set up a program to find a volunteer site. The President appointed someone who spent several years and a lot of taxpayer dollars to find a volunteer. He found a couple of Indian tribes and a rural county or two that were interested, but none of them had wide support in their states.

Electric Utility Restructuring

NA: What are your priorities and concerns with respect to legislation on restructuring the electric utility industry? How do you see restructuring affecting the prospects for nuclear power in this country?

Bingaman: I believe we need federal legislation in five critical areas. First, I think we need to empower the states that choose to implement retail competition and remove any ambiguities between state and Federal jurisdiction. Second, we should have a uniform regulatory system for interstate transmission service that provides all suppliers and consumers fair and equal access. Then, to ensure fair access, FERC should have the option of requiring transmission owners to join regional transmission organizations. We also need a Federal backstop to ensure the security of the interstate transmission grid. And finally, the states must assure universal and affordable service if they elect to implement retail wheeling.

> ...The industry has had a legitimate complaint, in past years...What's changed this year is that Secretary Richardson has come to the table with a serious proposal...

My proposals could help maintain the economic viability of existing nuclear plants because the owners will have easier access to new markets for their power using the interstate transmission grid. As far as new nuclear plants being built, my proposals are market neutral-- the developing wholesale and retail markets will naturally select the lowest cost options; consumers will decide.

Plutonium Disposition; Russian Nuclear Materials Security

NA: Senator Bingaman, as you know, Presidents Clinton

and Yeltsin issued a joint statement at the Moscow summit last September committing each side to disposition about 50 tons of weapons plutonium. Unfortunately, the negotiation of a detailed agreement has been delayed and the new target date appears to be the end of 1999. Do you feel the new target date will be met even with Duma elections coming up this December?

Bingaman: The Kosovo operation may have a significant impact on various U.S.-Russian cooperative programs and agreements. It's too early to tell how significant those impacts might be and whether they will directly affect the plutonium disposition agreement.

NA: The U.S. provision of $200 million for the Russian disposition program in DOE's FY 99 funding seems to have offered some hope of jump starting a stalled process. What do you see as the main prospects at this time for paying for the Russian program?

> ...An amendment to the Emergency Supplemental bill passed by the House includes a provision to rescind $150 million of the $200 million appropriated in FY 99 to get the [Russian] program under way...

Bingaman: The future of funding for the program is far from certain. For example, an amendment to the Emergency Supplemental bill passed by the House this past week includes a provision to rescind $150 million of the $200 million appropriated in FY 99 to get the program under way.

The fate of that rescission of course will be determined in conference as the House and Senate negotiate a final version of the emergency supplemental bill. In addition, many variables in the program are not sufficiently defined that anyone knows even approximately how much the program could eventually cost. Since G-8 members are also involved in financing the program, it's far from clear what their level of participation will be.

In short, our best hopes for the moment are to keep the program moving forward during these very difficult political times. Ultimately, who will pay what and how much it will cost has yet to be decided. Given the state of the Russian economy, it's quite likely that their contribution, at least financial contribution, will be very limited. The bulk of funding will likely have to come from the U.S. and our G-8 partners.

NA: Based on your visits to Russia, what is your overall view on the nuclear materials situation and the work that remains?

Bingaman: I visited Chelyabinsk and Kurchatov Institute in Russia in May of 1997 and was very encouraged to see the progress made at those two sites to increase security in the management of nuclear materials through cooperative efforts between our laboratories and security management personnel. Work is under way at 42 nuclear materials sites in Russia and security systems are in place at 25 of them---improving security for some 30 metric tons of weapons grade nuclear material. That's the good news.

The tough news is that there is a huge amount of work that needs to be done. We've begun some very important work to secure nuclear materials and spent nuclear fuel from the Russian submarine fleet deployed in northern and eastern Russia. The original timeline to complete the Materials Protection Control and Accounting Program set a goal for 2002. Since then, our activities have expanded and will likely require many more years beyond that. The goal remains the same, however, to keep nuclear materials out of the hands of smugglers and terrorists.

To that end, it doesn't serve us to do half a job. Now that we have a better understanding of the scope of the job, in order for the program to achieve our national security goals, it behooves us to stay on track. That's going to be a serious challenge to do in today's complicated political environment.

JOE COLVIN
NUCLEAR ENERGY INSTITUTE

The Prospects for Nuclear Power

NA: Mr. Colvin, how would you say that NEI's utility members, as well as the NSSS vendors, feel about the future prospects for nuclear energy in the U.S.?

Colvin: I think they look back at 1998 and see a renewed optimism, or rediscovery, as we call it. If you take a snapshot of 1998 you see two plants going for license renewal, the sale of two nuclear units, the initial public offering at USEC and the purchase of Westinghouse's nuclear assets. When we talk to Wall Street, they are enthusiastic about the opportunities that are there in nuclear power. If I add to that the prospects for regulatory reform because of the interest in the U.S. Congress, and the support from key leaders such as Senators Domenici and Murkowski and others, we ought to be optimistic. Are there people who are a little bit pessimistic? Sure. I think some of that, quite honestly, is because many of our member companies are trying to figure out at the end of the transition to competition, "what business do I want my company to be in?" Some have figured that out, and others haven't yet. Entergy, PECO (with their creation of AmerGen), Virginia Power and others see nuclear power as the way to go for the future. Others are still at the stage of making decisions. But I think there is overall an optimism that exists today that was not there in the past year.

NA: What is your projection of nuclear power's share of the national electricity supply in the coming decades?

Colvin: Nuclear power has about 20% of the domestic electricity generation today. I see that perhaps dwindling slightly over the next five years as we transition some of these units, and perhaps take a few too early decommissioning or premature shutdown. I think we'll see a few more of these plants go through a phase where they may not be fully economic, and the decision is made to shut those down. Those companies will perhaps secure deals with the states to recover their investment, as we did with Southern California Edison's San Onofre Unit One. So the overall share of nuclear power in the mix may decline. On the upswing, though, is reactor license renewals. We're seeing that with two plants already submitted for renewal in 1998, and Entergy's announcement that they will submit a reactor for renewal by the end of the year. When you start looking at the economic benefit of renewing the license of your plant when the benefits of renewal are so high, you will do it.

I think we've got a real opportunity for nuclear. If you look at competition, the environment, and the growth in electricity demand that is going to take place over the next 15-20 years, you realize that we will build more nuclear plants, unless there's some fantastic breakthrough in technology where fusion becomes the technology of choice.

> ...We will build more nuclear plants, unless there's some fantastic break-through in technology where fusion becomes the technology of choice...

If you take the Energy Information Administration's (EIA) projections, they're talking about the need to build approximately 360,000 megawatts of new generation capacity by the year 2020 to satisfy about 1-1/2% growth in energy demand, and replace retiring nuclear and non-nuclear generating facilities. What are we going to build and what are the incentives or penalties for building certain types of generating capacity? I think nuclear has a great advantage in the choices between different types of generating capacity when you combine competition and the environment.

Competitiveness, Consolidations

NA: You have told Wall Street that competition is good for

the nuclear industry and may even be one of the best things that has happened to it in a long time. Can you say what impact you feel the consolidation will have on the existing fleet, as well as the potential for future orders?

Colvin: Absolutely. First of all, if you take a look at competition, the myth was that nuclear plants, because of their large capital investment that needs to be amortized, are at risk and that without recovery, that potentially becomes stranded investment. The reality is that the stranded investment was about $210 billion, before states started to restructure, and only one third of that was nuclear. The rest was demand side management, low-income home heating programs and long-term power purchase contracts. But the reality is that the states are dealing with the issue of stranded investment. Pennsylvania, California, Rhode Island, and some 15 other states that have acted, and the Federal government, have said that prudently incurred costs should be reasonably recoverable.

For example, if you've got an efficient 1,000 megawatt generating station running very efficiently, production costs are low. Operation, maintenance, and fuel costs are typically as good as coal, and, on average, half as cheap as natural gas at the margin. So, if you don't include capital cost, because that's being recovered through a competitive transition charge, then at the margin you're competitive. The reality is that nuclear plants can indeed operate competitively at the margin as the electric utility industry restructures. In the extreme case where companies don't get an opportunity to recover their capital investments and have to go into bankruptcy, we expect the affected units could continue to operate competitively, or a buyer would come in and purchase the affected nuclear unit at a good price, and those units would continue to be competitive at the margin. That's part of the issue you see with the sale of TMI and Pilgrim, the pending sale of Clinton, Nine Mile Point One and Two, and Vermont Yankee. You can get these plants at a low investment cost, which PECO and Entergy are doing. What a great deal. So I'm very optimistic from that standpoint.

...You can get these plants at a low investment cost, which PECO and Entergy are doing...I'm very optimistic from that standpoint...

The impact on potential future orders is also very important. Trying to figure out what business you want to be in, and then establishing your core business so you can be competitive, is important. The single unit, small nuclear power plants cannot produce enough electricity to overcome the support costs. Unless you get some economies of scale, you're not going to be competitive. In some cases, companies are required to divest generation. So the Vermont Yankees, the TMIs, and the Pilgrims need to be consolidated into a company that has the expertise to operate these facilities efficiently, cost-effectively, and obviously, safely, and can take advantage of having the larger infrastructure to support those. That's really what's happening. So, given what we now see happening in the marketplace, we may likely eventually go to about half the number of operators we have today.

NERI and NEPO

NA: I have a question about industry interest in DOE's NERI program. With standardized ALWR designs already approved by NRC, it would seem that some in the industry would feel that they're set for the future. Can you describe why the NERI program is nonetheless important to your membership?

Colvin: For several reasons. Fundamentally, nuclear R&D is a highly useful element to help reduce costs and shape a more competitive industry. Certainly we need our government to recognize the important role that nuclear energy plays in the energy mix of our country and the role R&D provides. I'm encouraged that views are changing on the Federal level, as indicated by the type of funding lawmakers appropriate to support nuclear technology. For a number of years they have really not supported nuclear power very much at all. In fact for FY 1998 they had zeroed out the nuclear R&D budget for commercial reactors.

Congress re-established the NERI program for FY 1999, however, at $19 million. Compared with the budget for other types of energy research, such as that for renewables, that is just a drop in the bucket. Still, from a philosophical and recognition point of view, a new start in FY 1999 from Congress for R&D was very telling. I think that comes back to recognition by Congress of the important role of nuclear power in this country. In the past, the nuclear industry fussed about being over-regulated without making the case of why this industry is important and shouldn't be over-regulated so that it could be competitive. Congress is now making that realization, and that is important.

NA: With the NEPO program being rejected by Congress last year, what do you believe will happen this time around?

Colvin: I think there is a realization that we need to fund R&D programs aimed at increasing the license lifetime of these plants and making them more efficient, providing some type of cost-sharing between industry and the government in some of these important areas. Renewing the licenses of our nuclear power plants will add an additional 100,000 megawatts of electricity over 20 years very economically. There ought to be some government investment in the partnership, because today the industry has been footing that bill alone. We're going to continue to work hard on a NEPO-like program, whether it's called NEPO or something else, to look at how to

optimize performance and generate electricity more efficiently while maintaining safety.

Global Warming

NA: Do you feel the Administration is doing enough to bring about emission reductions in compliance with the Kyoto Protocol?

Colvin: Absolutely not. I think it's truly unfortunate that the Administration's focus is on the changes in emissions we need to make, without recognizing how much nuclear energy reduces or avoids those emissions. We're continuing, as an industry, with voluntary programs, but we haven't seen much support from the Administration. I'm pretty pessimistic, having attended some of the Bonn meetings, the Kyoto meeting and other international conferences. From the nuclear standpoint, we've spent a lot of effort and gained a lot of credibility as part of the solution, but I see our government trying to force emissions reductions through regulation and other ways, without going through Congress or the public policy process. That troubles me.

NA: Do you expect changes in Federal policy that will promote not only renewables and efficiency improvements, but also nuclear power, down the road, perhaps?

Colvin: I think the answer is absolutely yes. I see discussions going on in Congress about such things as an emission free portfolio standard that Chairman Murkowski has talked about. We ought to set a minimum baseload of percentages of non-emitting technology, under which we as a nation will not go. The government, then, has to help people make longer-term decisions. The government should declare that the United States will have no less than 30% of the nation's power generating capacity in non-emitting technologies, and provide federal programs to make sure that happens. There are discussions about various forms of incentives, like production tax credits. Right now, the production tax credit provision of the Energy Policy Act of 1992 is up for renewal. As you probably recall, our nation gave production tax credits to wind and closed-loop biomass at one-and-a-half cents per kilowatt hour. Why don't we provide production tax credits for nuclear? The recognition of balancing the playing field so that we treat all non-emitting technologies similarly is a very important principle, and there's dialogue beginning about this.

NA: Funding for nuclear R&D has resumed, but Congress hasn't shown interest in policies such as tax credits and emissions incentives to support nuclear power. Do you think that's coming?

Colvin: I think it will happen, but what shape they will take I don't know. We've got a debate going back to the Kyoto negotiations between the Congress and this Administration on whether we ought to go forward on emissions reductions or not. That debate and uncertainty causes problems in the funding. There are a lot of people on the Hill who don't want to give DOE any money to reduce CO_2 emissions *vis-à-vis* the Kyoto Protocol. There are other people on the Hill who don't want to give DOE any money because they've taken $15 billion of ratepayer money and haven't solved the nuclear waste issue. There are a lot of those types of issues that cloud what the Congress will ultimately do. Overall we're going to move forward with those types of important policy discussions and ultimately perhaps balance out that proverbial level playing field.

Erosion/Preservation of Nuclear Workforce and Technology

NA: When do you feel that the continuing erosion of university nuclear engineering programs is likely to reach a critical point, where there are not enough new engineers coming out with degrees to replace retiring personnel?

> ...We have an initiative under way to sit down and discuss what are the barriers, impediments, and other factors that would need to be removed to build the next plant in the U.S....

Colvin: I can't speculate on the time, though I think you've raised an issue that is important and is being recognized as more important today than it has been over the past several years. The reality is, we have the same supply issue of talented, qualified people in most of the engineering disciplines that we need at our nation's nuclear plants. The industry and DOE have been doing quite a bit in that arena, but certainly not enough. Other industries are getting very aggressive in going out and marketing the students and convincing them that there is a lifetime career working in their industry. College students want to have a career that is challenging and has a long future. When these students see an industry with plants that have only 10-15 years left on their operating licenses, how do they view their career prospects? If we told them that we're going to renew the license of this plant, and it has at least 30 more years left in its operating life, then that's more than a career. We're talking about this at the CEO level. We're urging CEOs to get their companies to stand up and talk about their plants and their industry in a different way.

Another thing that the nuclear industry is doing is trying to engage women in the nuclear industry. There's an international program to do just that and, in fact, we are sponsoring the Women in Nuclear symposium and trying to get women in the working levels of our plants involved. There's also a program in Europe called the Young Generation, which are people under 35 that want to have careers in nuclear power, with whom we've had a lot of dialogue. We're trying to

work with the American Nuclear Society and get the utilities to support Young Generation. I think getting that excitement and energy back in the industry is really the key to turning things around. We need to do more from the utility side to present these students with an exciting career.

As for the reactor vendors, the real market is in Asia right now and we've put a lot of effort into opening up trade with China and being able to transfer peaceful nuclear technology. That's still a path that's got a few mine fields to cross, but I think we will ultimately begin transferring technology and building some plants in China. Westinghouse, ABB, and GE

> ...I don't want to see legislation that gets vetoed...I'm very encouraged that the Secretary is engaging in the dialogue...

are very active in that market. But I think the vendors need to find a viable market in the United States. We have an initiative under way to sit down and discuss what are the barriers, impediments, and other factors that would need to be removed to build the next nuclear plant in the U.S. Within the next month, we will begin the dialogue and get some of the more aggressive utility people to engage with the vendors and us and talk about it. As recently as five years ago, no CEO would admit that they would ever order a new nuclear plant in the U.S., but in the past year I've had four or five CEOs talk to me about that concept - nothing firm, nothing definitive, and lots of questions. But at least open to the idea that there might be an opportunity.

It's important to note that we've designed these advanced reactors, such as the GE ABWR, the ABB System 80+ and the Westinghouse AP600, to compete in a cost-of-service non-competitive market. That's not the business we're going to be in, so we're going back and talking to the companies about what changes we need to make in these reactor designs. Part of the changes are based upon changes in the regulatory design criteria. We've had discussions with NRC to change some of the basic criteria so that the design and the cost are not driven by unrealistic scenarios. We're pushing pretty hard on that.

Still, in order to place new orders by the middle of the next decade, we have to come up with criteria - how long would it take to build it, how much capital is needed, what's the cost for installing one kilowatt of capacity, what kind of securization is needed, what type of support is needed from the federal government? Does it have to be money, can it be insurance to safeguard against some inordinate delay that's caused by the public policy process? What are the kinds of constraints you place on the NRC, what types of hearings do you have, legislative-type or adjudicatory? We're going to try and flesh out these issues over the next three months, starting in about a month.

Waste Bill

NA: Secretary Richardson has now said he's preparing a proposal to take title to fuel at the reactor sites and manage it there until a final repository is ready, but many members of Congress, as well as the industry, have expressed opposition to that and continue to push for a bill authorizing interim storage at Yucca Mountain. Do you think there's any room for compromise where Congress will pass a bill and the Administration won't veto it this year, or is the Administration's proposal going to be dead on arrival?

Colvin: I think there's always room in this town for compromise. I don't want to see legislation that gets vetoed. I'd really like to get the Administration to come to the table and talk about how to solve our collective problem. What we have said is that as a stand-alone provision, taking title, compensating utilities and managing the fuel at the site, it is not acceptable unless DOE fulfills its obligation to move fuel off the sites. The real issue that we're talking about is of DOE fulfilling its legal obligation of removing the fuel. The concept of taking title, DOE owning it and compensating utilities, is probably reasonable. There's an issue of where the money comes from. To take the money from the Waste Fund to compensate all the utilities and then not get the repository ever built, or worse, to try and come back and have ratepayers pay twice or three times for this to get it done, is unacceptable.

> ...The DOE repository program plan is scheduled for operation starting in 2010. But the reality is...2024 without changes to the budget caps in Congress. It's unrealistic to think about storing this waste on site for the next 25 years...

I'm very encouraged that the Secretary is engaging in the dialogue. The Secretary recognizes the legal obligation of DOE. I think, unfortunately, we haven't been able to engage in answering some of the very difficult questions and having the Administration give the industry, the states, the governors, the attorneys general and others the confidence that there is a date by which DOE is going to perform. The DOE repository program plan is scheduled for operation starting in 2010. But the reality is that that program cannot be completed before 2024 without changes to the budget caps in

Congress. It's unrealistic to think about storing this waste on site for the next 25 years. It just doesn't pass my straight-face test. We've got to come together in some way, either with the Administration coming to the table and negotiating with

Congress to help solve this problem or Congress passing legislation and mandating that the Administration perform. I think it's certainly going to be hard to get that legislation passed if the Administration keeps resisting it.

NA: What do you think is fundamentally driving that resistance?

Colvin: It's purely personal politics in my view. Initially the President had an agreement with Nevada Governor Bob Miller and Senators Reid and Bryan that they would never allow waste in Nevada. It became a personal commitment. I think if I were Vice President Gore and I was faced with continued pressure from legislation and litigation which says this is going to cost potentially $56 billion and with the political context of telling voters that yes, it's okay to leave this waste in 72 locations in 36 states, I'd want this solved before I was running for President.

NA: Do you think the Administration could accept a compromise where there's interim storage at Yucca Mountain, but it's contingent on the site suitability determination?

Colvin: I don't know. That's a concept that we should have discussions on that might be acceptable. If you did that, you could, in theory, be accepting fuel at an interim facility in 2003 or 2004 as long as you didn't have unsuitability. That would be an acceptable solution. But if the Administration continues to say no storage until the repository actually opens for operation, then I don't think there's much room for discussion because that's not acceptable to the industry and the states. To tell the Governor of Idaho and Senator Craig that you're going to leave all the Navy's spent fuel there for the next 25 years, that's a non-starter and I think it's true in most states. I think they've got to figure out how to do this. I'm the eternal optimist; we'll continue working on it.

NA: What do you see happening if legislation authorizing interim storage fails this year?

Colvin: Well, the industry strategy in solving this issue is really based upon three factors. Legislation is only one of those. Litigation is another important piece, and the settlement agreements between the individual contract holders and the Department are a third piece. So one failure, if the legislation doesn't pass, isn't the end of the world. You still have opportunities for the Department to take other action. The Department has the legal authority, in our view, to move the fuel now off reactor sites to their locations, as they do for research reactor fuel from foreign reactors. They just don't want to do that.

With the litigation, the three Yankee decisions that came about two to three months ago are very damaging to the Department and the Administration's case. Now it doesn't matter where you are in the queue because the date that you start calculating damages from is January 31, 1998. That really escalates the damage. DOE has to live up to its obligation at some point. We can't give up, nor would our ratepayers, our shareholders and our state governments allow us to give up and not pursue some remedy.

Nuclear Regulatory Commission

NA: Turning to NRC matters, what prospects do you see for NRC reform, re-licensing, and risk-informed regulation?

Colvin: We now have a recognition in Congress and by the NRC that we have to change the way we regulate these plants, to regulate safety in an efficient way as we transition to competition and a deregulated environment. What allows some of those new approaches is the high safety and operational performance of the industry today. However, we've been regulating this industry as if we were back in the post-TMI days. That way of thinking has now changed within the NRC commission and senior management. That's what's leading to these new approaches in inspections, assessments, enforcement, and oversight of these facilities - focusing on what's really important to public health and safety and measuring it objectively.

What we've got to do is move the agency and our own industry to agreeing on where we need to be and how we're going to measure it, and what we do if, in fact, our performance starts to slide. If I let performance slide in certain indicators, then NRC should worry about it. If it keeps degrading then NRC should take more and more stringent actions to correct any slides in safety.

We've seen some changes already in the NRC's approach to enforcement. For instance, the existing level "four" category of enforcement actions has no bearing on safety. Yet every time you have a level four violation it would cost between $30,000 and $40,000 for a utility to process the violation. The NRC has eliminated level fours, and instead said that those issues need to be taken in and put in a corrective action program in each utility. They shouldn't be just ignored, and if they're not fixed, then the NRC ought to take a look at them and say that's unacceptable. That's appropriate, and a good example of a kind of change in thinking.

Finally, we've really got to think about a number of different questions when moving to risk-informed regulation: how do we really decide on what's important, how important is it, how many resources do we put there, and then how do we make sure we do it? That's what this whole process is about.

NA: Getting the most bang for the buck?

Colvin: Exactly. So, I'm really encouraged, and at the recent NRC Regulatory Information Conference, there was a night-and-day different tone and character of this meeting. This was the 11th meeting – in the first 10 the attitude was "here's what you're going to do." This meeting was an open dialogue, it was light, it was constructive, it was thoughtful.

NA: What accounts for the change?

Colvin: I think the change has come about through the initiative of the current Commission and the senior NRC management, with a little encouragement from the Congress. When Senator Domenici said that he was going to take $150 million from their program budget and cut 700 of their people, he got their attention. They went up and had the first oversight hearing in four years before Senator Inhofe and the Environment and Public Works Subcommittee, and the first meaningful hearing in 14 years. I testified at those hearings, and others basically said that there's a chronic set of problems that need to be fixed. The NRC agreed at the hearing that they need to fix it. The staff at NRC has engaged on this issue. They're not just trying to do what makes Congress happy. There really is a mindset that they can use their resources effectively by looking at real safety and things that matter. There's a whole change in attitude and there's been a lot of change in people, and in the whole environment. I'm very positive.

The Next New Order

NA: Prediction: What developments do you think are necessary before we'll see the first new reactor order in the USA and how long do you think it's going to take?

Colvin: First of all, in order to build any new large generation, nuclear or fossil or some new technology, there's got to be a need for electricity which has to be recognized by the local population. Without that there's no basis for moving forward.

The second issue is that we have to earn the public confidence that we can solve the high-level waste issue. People have to understand that it's safely stored today, it can be safely stored for hundreds of years, and we've got to rethink how to help people understand that. The irony in this is that we manage our waste byproducts better than any other industry in the world. We know where it all is, we have it under control, and the government regulates it. We haven't told that to the public. And the reality, even if Yucca Mountain moves forward, is that you're not going to cover this waste up for well over 100 years. Things are going to change in the next 100 years, so it's not like we've made this irreversible decision. I think the public is probably a lot more sophisticated than our congressmen and our political leaders think. If we talk to them and provide them with information, they really can make reasonable decisions.

The third issue is that you've got to get the economics resolved. What types of credits or penalties, what's it really going to cost, and can I, in a competitive marketplace, design, construct, and operate a facility that can get some return on my investment? If the answer is no, it doesn't matter what sort of generating capacity you're trying to build, nuclear or anything else, it's not going to be built.

NA: Before the first order comes in, do you think you'll need an increase in gas prices? A national policy on greenhouse gas reduction?

Colvin: I'm not sure I would go that far. In my view we're not playing one fuel source off of another. I think the reality is that we really need coal to supply a portion of our electricity, as well as natural gas, nuclear power, renewables and so on. We've got to have it all. I think that the coal producers and the gas producers and even the automobile manufacturers see nuclear as the way to continue their own operations, to prevent more and more severe restrictions for their industries. When you're looking at the future I think there does, however, have to be some reallocation of incentives towards generating sources that provide environmental benefits.

...The value of a nuclear plant is hidden today from an environmental standpoint until you shut it down. Then it's no longer hidden because you've got to replace it with a power source that is non-emitting.....

Right now our policy is such that in order to get any credits for not polluting you have to pollute in the first place. From a public policy standpoint, that doesn't make much sense. If I've got a fossil station, and I can keep my SOX emissions under my credits, I can bank those credits and sell them for about $110 a ton for SOX. They're getting the credit for not emitting, but there is no credit to nuclear plants for not emitting. If you disaggregate that generating source, where do those credits go? The value of a nuclear plant is hidden today from an environmental standpoint until you shut it down. Then it's no longer hidden because you've got to replace it with a power source that is non-emitting. That's the issue.

NA: So when do you predict the next order is going to come?

Colvin: I don't think that we'll be able to see the next order for a nuclear plant until at least 2005. That will be past the transition to a lot of the states going into competition in 2000-2003. We will also have sorted out waste and energy demand growth.

PETE DOMENICI
U.S. SENATE

Nuclear Future

NA: Senator Domenici, as you know a number of U.S. utilities have made decisions in recent years to shut down nuclear power plants they find uneconomical to keep running, and more shutdowns are likely as deregulation advances. And at the moment there are dim prospects for any new reactor orders in this country. As a leading supporter of nuclear energy in Congress today, what are your main priorities in the nuclear area? What do you think should be the government's role?

Domenici: I've spoken strongly on the need to ensure that nuclear energy remains a viable option for our nation's future energy supply. Perhaps other future energy sources can replace the clean energy that nuclear provides now, but we cannot identify such sources today. Future generations must be able to call with confidence on the nuclear option.

In the near term, nuclear energy must survive in an increasingly de-regulated and competitive environment, while maintaining the highest standards for safety that have characterized the industry over the past decade. In addition to providing energy economically and safely, the nuclear waste issue must be effectively addressed. I have argued repeatedly that we must move to interim storage quickly, and I've further argued that the Administration's position of tying progress on interim storage in Nevada to final acceptance of Yucca Mountain as a permanent repository is sadly flawed.

NA: What are your views on relicensing existing reactors?

Domenici: A large fraction of the nuclear plants in the U.S. are providing power at economical rates now, and those that aren't either will improve or be shut down. These realities are fueling renewed interest in the power production capabilities of existing plants. Of course, relicensing of these plants, as long as safe operations are carefully verified, enables still greater efficiencies by extending the productive life of facilities. The NRC should expedite such relicensing.

Nuclear Energy Research

NA: The Clinton Administration has acted on the November 1997 PCAST recommendation to establish a Nuclear Energy Research Initiative to address problems associated with nuclear waste management, proliferation, reactor safety and economics. However, funding for NERI has been much less than the PCAST-recommended initial funding of $50 million per year increasing over three years to a steady-state level of $100 million. You have been a strong proponent of NERI as well as other nuclear R&D programs. Do you feel the DOE request is adequate?

> ...The President's request remains well short of the PCAST recommendation, and I will be interested in raising the NERI budget as much as possible...

Domenici: Last year the Senate approved $24 million for NERI, and the final Conference granted $19 million. The slightly increased request for FY 2000 in the President's budget, to $25 million, is a positive indication that even this Administration is realizing the potential value of nuclear energy in meeting many of their advertised goals. The President's request remains well short of the PCAST recommendation, and I will be interested in raising the NERI budget as much as possible. However, given the difficulty of providing sufficient funding for a variety of important programs within the budget caps, I cannot predict with certainty what the NERI budget will finally be.

NA: Do you believe there will be sufficient support both on the Hill and in this Administration to go to substantially

higher levels in coming years?

Domenici: Support and understanding of the role of nuclear energy is increasing on the Hill, and that will help us move towards higher numbers. But there are still many who question the viability of nuclear energy, especially given the dismal record of progress on nuclear waste strategies for the nation. But too often debate focuses only on risks, rather than on the benefits derived and approaches to address any risks.

NA: As a general observation, do you feel the U.S. government is doing enough to ensure that safe and proliferation-resistant technologies will be in place when the industry is ready for a "second wave," and even to help bring that about?

Domenici: NERI should be the cornerstone of our efforts to develop new reactor concepts that can dramatically lower capital costs while ensuring even higher levels of safety in proliferation-resistant configurations. Increases in NERI underpin these new concepts. The Administration has not proposed sufficiently large budgets for NERI, but it is still gratifying to see their grudging recognition of the importance of nuclear energy.

> …It is gratifying to see [the Administration's] grudging recognition of the importance of nuclear energy...

Global Warming

NA: Senator, you have spoken out on the importance of nuclear energy in lowering our emissions of greenhouse gases. You have also called for a change in how EPA allocates emission allowances, based on plant output rather than fossil-fuel consumption, which would clearly favor non-greenhouse gas technologies economically. Do you see good prospects for this kind of change to move forward?

Domenici: The details surrounding possible climate changes induced by increased greenhouse gases remain uncertain, but I have spoken to the importance of minimizing our emission of all pollutants quite independent of final scientific understanding of possible global climate change. Nuclear energy obviously plays an essential role in these reductions.

I remain extremely interested in shifts in EPA to allocation of emission credits based only on the output of a facility, rather than their current practice of tying the credit to the amount of **fossil** fuel consumed in the facility.

NA: Congressional Republicans have been very critical of the 1997 Kyoto Treaty, which the Administration signed last November in Buenos Aires. Do you favor ratification, and can you comment on the prospects in the Senate?

> …Without serious controls over emissions of developing countries, the Kyoto Protocol will not move in the Senate...

Domenici: The Senate has indicated as strongly as it can that the Kyoto Protocol will not be ratified in its present, badly flawed, form. Without serious controls over emissions of developing countries, the Kyoto Protocol will not move in the Senate.

NA: Besides having a policy favoring non-greenhouse gas technologies, are there other ways you can envision nuclear power getting back on track within the next decade or so?

Domenici: While policies favoring non-greenhouse gas technologies could be a significant boost in the U.S. to nuclear energy, other rationale around the world will provide motivation for advances in nuclear energy. Some nations, like Japan, have limited energy resources and have made large commitments to nuclear energy - their interest will spur continued development. In the U.S., increased interest in nuclear energy requires solution to the spent fuel issues, and future new construction requires development of new generations of plants that can compete on capital as well as operating costs. This will become especially critical as deregulation progresses.

Erosion of Nuclear Workforce/Educational Programs

NA: The educational base of the U.S. nuclear industry has eroded substantially in the past decade or so, as fewer universities maintain nuclear engineering programs and research reactors. What do you feel is the appropriate government role in stopping this erosion?

Domenici: The erosion of the educational base in the U.S. in nuclear technologies is of significant concern to me. Programs like NERI can help reverse this trend, but the greatest motivator for reversal must await a rebirth of commercial interest in the field that can, in turn, fuel greater student interest. It is alarming to see the enthusiasm among the predominantly young workers in countries like France in contrast to the situation in the United States. Our current situation is far from healthy.

There are many ways that government policies impact the

commercial future of nuclear energy. National spent fuel strategies and a predictable regulatory environment are but two of these key areas.

Spent Fuel/High-Level Waste Management

NA: Secretary Richardson has indicated that the Administration is preparing a proposal to take title to spent fuel at the reactor sites and manage it there until a final repository is ready. Many senators immediately expressed opposition to the idea and have continued to push for a bill authorizing an interim storage facility at Yucca Mountain. What do you feel are the prospects that a compromise can be reached, heading off a likely Presidential veto of the Yucca Mountain interim storage bill and a possible subsequent override?

Domenici: The very recent proposal from the Administration for the Federal government to take title to spent fuel at the existing reactor sites does not strike me as a credible step forward on this issue.

Interim storage remains a vital step forward for the nation. With interim storage, we buy time to explore long-term spent fuel strategies that can serve our nation's future generations. I supported the interim storage bills in the last Session of Congress, where they faced a certain veto. That threat of veto is no less certain for bills in the 106th Congress. I remain hopeful that interim storage bills can be crafted that will command a veto-proof margin.

...As long as spent fuel is stored at many sites around the country, anti-nuclear groups will continue to use it as a focal point for their pronouncements of impending disasters...

NA: Would you support centralized interim storage at an alternative site if a volunteer could be found (e.g., private proposals to build such a facility in Utah or Wyoming, or DOE sites)?

Domenici: Interim storage is not a technically demanding challenge - we know how to do it, and we are doing it at many sites around the nation. Centralized interim storage can offer better monitoring and security for the spent fuel, plus it removes the spent fuel from the reactor sites where it is currently stored. As long as spent fuel is stored at many sites around the country, anti-nuclear groups will continue to use it as a focal point for their pronouncements of impending disasters. While a private interim storage site might work, the regulatory framework for it, coupling both state and Federal interests, will make its licensing and operation extremely difficult. The federal government agreed years ago to solve this issue for the nation, and they should be doing it.

NA: You recently announced a plan to develop legislation to require re-evaluation of our national spent fuel strategy. Can you comment on your intentions?

Domenici: I am not persuaded that we can determine today whether future generations will view spent fuel as a resource for energy or as a waste appropriate only for disposal. As part of this review, I will propose that an accelerator be constructed as a functional backup for the nation's tritium requirements, as a source of medical radioisotopes, and as a pilot test bed for waste transmutation research. This legislation would also specify that an interim site be located at the accelerator site, leading to two interim storage sites with one of them at the Nevada Test Site.

International Spent Fuel Management

NA: As you know, Russia's Ministry of Atomic Energy has recently proposed to receive foreign spent fuel, including from the United States, for long-term storage and subsequent reprocessing. Meanwhile, other proposals have emerged in recent months for international spent fuel storage or disposal. What is your view on the merits and feasibility of such international management of spent fuel?

Domenici: Various proposals have surfaced for international management of spent fuel. I think international options should not be excluded, although in general, nations with large spent fuel inventories should be expected to address their own needs. For nations with small investments in nuclear power, international spent fuel management is even more compelling.

Plutonium Disposition

NA: Senator Domenici, you were instrumental in getting Presidents Clinton and Yeltsin to move forward with a joint statement at their Moscow summit last September committing each side to disposition about 50 tons of weapons plutonium. Unfortunately the negotiation of a detailed agreement has been delayed and the new target date appears to be the end of 1999. Your inclusion of $200 million for the Russian disposition program in DOE's FY 1999 funding seems to have offered some hope of jump-starting a stalled process. What do you see as the main prospects at this time for paying for the Russian program?

Domenici: I remain committed to the importance of rapid movement on plutonium disposition in Russia, and such movement requires reciprocal actions by the United States. The pace of negotiations has been much slower than both nations need. That was why Congress endorsed $200 million to support these activities in Russia. It was my strong hope that the existence of these funds, in accounts ready for

transfer, would provide the strongest possible motivation for Russia to move ahead with agreements.

However, funds appropriated by Congress that are not expended present a target for legislators looking for offsets for other spending priorities. There are already proposals to use large parts of that $200 million as such offsets. I will argue strongly that those funds should be preserved to continue to provide incentives for faster Russian action.

NA: Do you still favor the President's appointment of a special envoy?

Domenici: I have repeatedly called for designation of a Presidential Envoy for Plutonium Disposition. While the Administration has not concurred in my call, they have dramatically elevated the importance of the negotiations by assigning John Holum, Acting Under Secretary of State, as our lead negotiator. This role for Mr. Holum is a significant step by the Administration toward recognizing the importance of this issue and placing appropriate priority on it. I am waiting to see whether this step leads to more rapid progress.

Mr. Holum and I have met frequently, and he assures me that he shares my concern over rapid progress. He is involved in regular negotiations that hopefully can show success soon. One of his goals is discussions with the G-8 countries to encourage their recognition of the global nature of the problem at hand and their contributions to the overall program.

> ...It was my strong hope that the existence of these funds [for Russian plutonium disposition], in accounts ready for transfer, would provide the strongest possible motivation for Russia to move ahead with agreements...

NA: What achievements do you feel are necessary in these negotiations for you to be willing to support DOE's proposed budget of $200 million for the domestic plutonium disposition program for FY 2000?

Domenici: Significant progress on these negotiations is essential to proceeding with our own plutonium disposition program. Programs in the two countries must proceed within a negotiated framework that maintains a strong degree of transparency and reciprocity. Failure to move ahead with a negotiated agreement could jeopardize our own progress on facilities at Savannah River.

NRC Reform

NA: Are you satisfied with the regulatory reform initiatives taken to date by the NRC?

Domenici: The NRC has made significant strides to improve their operations since I introduced pointed questions into the last Appropriations actions. I've met with Chairman Jackson and I appreciate the actions she has taken to advance the NRC's pace of change toward a risk-informed regulatory framework.

As an indication of my continued commitment to ensuring improvements at the NRC, I serve as co-chairman of an ongoing CSIS study that is exploring NRC policies and recommending areas for improvement.

NA: Are you concerned whether the reforms can continue smoothly after Chairman Jackson leaves the Commission this June?

Domenici: It will be very important to me that the pace of change and improvement continues under the leadership of their new Chairman, who should be identified by the Administration in the next few months.

Fuel Cycle Future

NA: You have advocated establishing an R&D program to evaluate future alternatives for spent fuel management, with an emphasis on reducing the toxicity of high level wastes. You have also just established a new research program on accelerator transmutation of wastes. What prospects do you see for international cooperation in these areas?

Domenici: I've indicated strong interest in improving our national strategy for nuclear spent fuel management. I've questioned whether our current path, to simply place spent fuel in a permanent repository, is a wise or credible approach. Future generations may need the energy potential that remains in that spent fuel, and I believe that our current generation could be doing quite a disservice if we proceed simply with permanent disposal.

Waste transmutation is one approach that should be explored now, using either accelerators or reactors. With transmutation, the character of the waste entering a repository can be dramatically altered, and licensing issues and public concerns surrounding a repository could be directly addressed. While transmutation is technically possible, a careful R&D program must be completed to identify its economic impacts.

Waste transmutation is not the only aspect of spent fuel strategy that should be studied. Reprocessing technologies should also be under study, not from the perspective of deploying them today, but from the perspective of providing options that can be considered in the future when higher fuel prices may provide motivation for spent fuel recycle that is

lacking today. Alternatives to the PUREX-based process used in France, patterned after the initial work in the United States, should be studied to understand how waste volumes and environmental impacts can be minimized.

I've received strong expressions of international interest in development of advanced spent fuel management strategies. Japan, Russia, and France are all very interested in such a program, and all have significant technical capabilities to add to an international effort. Handling of spent nuclear fuel is very much a global problem from proliferation, safety, and economic perspectives. This issue deserves careful international study and attention. Other nations are far ahead of the United States in evaluating a range of spent fuel strategies, and most conclude that our current policy is sadly lacking.

New Mexico's Leadership on Energy Issues

NA: Senator, with your New Mexico colleagues Jeff Bingaman taking over as Ranking Member on the Senate Energy and Natural Resources Committee this year and Bill Richardson taking over at DOE last September, the state now seems to have a firm grip on U. S. nuclear energy policy. Do you see bright prospects for cooperation in this field as a result of good working relationships among this powerful triumvirate?

...Reprocessing technologies should also be under study...from the perspective of providing options that can be considered in the future when higher fuel prices may provide motivation for spent fuel recycle that is lacking today...

Domenici: I discuss energy issues frequently with my colleagues Senator Jeff Bingaman and Secretary Bill Richardson. Certainly the laboratories and facilities in New Mexico are critical players in all nuclear technologies and many experts in New Mexico share their ideas with me.

But the issues surrounding the nation's energy strategy far transcend New Mexico and its resources. It will require all of our nation's capabilities in these areas to craft and implement policies that effectively address the range of national security, environmental, energy, and economic attributes underlying nuclear issues. Many of these issues, like plutonium disposition, have ramifications for future global stability.

The importance of the broad set of nuclear issues drove me to issue my call at Harvard in October 1997 for a new national dialogue on nuclear technologies. The response to that call has been dramatic, and our progress has been dramatic as well. But this is only the start of a long journey towards effectively realizing the benefits that can flow from nuclear technologies. I look forward to continuing the journey.

WENONAH HAUTER
PUBLIC CITIZEN

Background; Role of Public Citizen

NA: Before going to the question list, can you comment on your personal background, on Public Citizen overall, and how you see your role vis-à-vis nuclear power and nuclear waste issues in the United States?

Hauter: The achievements of the anti-nuclear movement cannot be attributed to one person or organization, or even several people or organizations. It has always been a democratic and decentralized movement, with thousands of people and hundreds of organizations involved. The movement never received much support from the foundation community or from most of the mainstream environmental groups. Yet, it has been an enormously successful grassroots movement, which is largely responsible for changing the course of energy policy in this country. No new reactor has been ordered and built since 1973, and there is almost no possibility that a new reactor could be sited in the U.S.

...There is almost no possibility that a new reactor could be sited in the U.S....

Ralph Nader was one of the early critics of the nuclear industry and in 1974 he convened the Critical Mass Energy Conference, bringing together 1,200 leaders of the growing anti-nuclear movement. It was during this event that the Critical Mass Energy Project was formed and it shortly became part of Nader's umbrella organization, Public Citizen. From 1974-86, Critical Mass chronicled the efforts of activists and disseminated new information on energy issues through the Critical Mass Journal, which was later replaced by the Critical Mass Bulletin. The organization has been involved in many battles over the years, including, stopping the Clinch River Breeder Reactor from 1976 to 1983, playing an important role in closing Rancho Seco, working to release secret documents revealing nuclear power plant problems, inducing Congress to terminate wasteful programs like the Advanced Liquid Metal Reactor, and fighting the irresponsible nuclear waste legislation.

I grew up as an activist, engaged in anti-war, civil rights, and environmental issues. In 1989 I decided I wanted to refocus my work on environmental issues and started working for the Union of Concerned Scientists. I had the pleasure of doing some research for Bob Pollard, one of the most effective nuclear whistleblowers of all time. I also had the privilege of working with activists fighting against bad nuclear policies, like those activists in Minnesota who waged a powerful battle to stop Northern States Power from storing 48 casks of high-level nuclear waste at their Prairie Island nuclear plant, located on an island in the Mississippi River. The fight resulted in the State of Minnesota mandating hundreds of megawatts of renewable energy in exchange for NSP being able to build 17 casks for storage if certain conditions are met. I also worked on a renewable energy project in the Midwest that convinced me that we have the technology today to begin replacing the polluting conventional fuels with renewable energy and energy efficiency technologies.

At the end of 1995 I left UCS to work as the environmental program director for Citizen Action. I worked primarily on energy issues related to the deregulation of the electric utility industry. We opposed the bailout of the electric utility industry, including bills like AB 1890, California's deregulation bill, which gave a $29.5 billion bailout of the nuclear utilities and provides on-going operating subsidies for California's nuclear plants, failing to protect consumers or the environment adequately.

In 1997, I began directing Public Citizen's Critical Mass Energy Project. Our goal is to move our global economy away from nuclear and fossil fuels and toward environmentally safe renewable energy and energy efficient technologies. Critical Mass has programs on nuclear waste, nuclear power safety, and on the deregulation of the electric industry. We want to ensure that energy is affordable and not under the control of unregulated monopolies. One of our major concerns is about

the trend towards consolidation in the electric industry, and the way that the incumbent utilities are gaming the state deregulation legislation to become unregulated monopolies.

Yucca Mountain Repository

NA: Ms. Hauter, we would like to begin with some questions concerning Public Citizen's February 10 testimony to the House Energy and Power Subcommittee concerning proposed legislation on high-level waste management. You expressed the view that DOE's Viability Assessment on the Yucca Mountain site provides conclusive evidence that it should never be built. This contrasts with the Secretary of Energy's statement that the VA identified "no showstoppers." Do you feel that DOE should already be looking elsewhere? What strategy should the U.S. take?

Hauter: The goal of a national waste policy must be to permanently isolate radioactive waste and to prevent exposure of current and future generations. The VA and other scientific documentation provide dramatic proof that scientists cannot predict how long radionuclides can be isolated. First, by using chlorine-36 as a tracer, scientists found that residues from rainwater less than 50 years old have been detected at the level of the proposed repository. This significant discovery contradicts earlier models of rainwater flow. Coupled with the groundwater flow model, this indicates that the site meets the conditions for disqualification under the Hydrology Guidelines. They state that a groundwater travel time to the accessible environment of less than 1000 years shall be grounds for disqualification.

...We need a completely independent commission, with heavy citizen participation, to reshape every aspect of our nation's waste policy...

We have additional concerns about the suitability of the Yucca Mountain site related to seismic activity, volcanic activity and human intrusion. Enough scientific evidence has been amassed to prove that Yucca Mountain will never be an appropriate site for nuclear waste disposal. Unfortunately, DOE and the nuclear industry will not admit that the Yucca Mountain site is inappropriate. And, the nuclear industry continues to use their enormous resources to lobby lawmakers that the protective standards for radiation exposure should be reduced. If they are successful in legislating a weaker level of protection than recommended by the National Academy of Sciences, a standard that fails to protect children, pregnant women and other vulnerable populations will be established. Instead of bending to industry pressure, the DOE should disqualify the site, and the United States should rethink its nuclear waste policies.

Our nation's policy towards nuclear power and nuclear waste is not driven by what is in the public interest. Unfortunately, many of our nation's policymakers have turned a deaf ear to their constituencies' concerns about nuclear power and nuclear waste. In the 1970s, when new nuclear plants were still being planned, we cautioned policy makers about the inadvisability of relying on an energy source with an intractable waste problem.

Prior to the passage of the Nuclear Waste Policy Act of 1982, policy makers were warned by Public Citizen and other environmental organizations that the scientific knowledge necessary for locating and evaluating permanent site locations based on a geological evaluation did not yet exist. Then when the 1982 law was amended in 1987 to make Yucca Mountain the only candidate site for a permanent repository, we told policymakers repeatedly that the decision was wrong because it was based on politics, not science. In retrospect, had policy makers listened to the warnings concerning nuclear waste and the laws pertaining to it, we would not have had the string of public policy failures related to nuclear waste. But, so much state and private capital has been poured into nuclear power that we are faced with a massive wall of interlocking economic interests and misleading industry propaganda. The current legislation in the House of Representatives is an excellent example. Members of Congress received approximately $15.5 million in PAC contributions from corporations and other groups that are members of the Nuclear Energy Institute, the lobbying arm of the nuclear industry. The leading recipients of contributions from the nuclear industry are those House members who supported H.R. 1270, the industry's nuclear waste bill, in the 105th Congress. Meanwhile, the political parties have accepted $3.7 million in soft money from NEI and its membership since 1997.

The time has come to completely review and reevaluate public policy regarding nuclear waste. We need a completely independent commission, with heavy citizen participation, to reshape every aspect of our nation's waste policy—from the disposal of high level waste to the "recycling" of radioactive scrap metal and other materials. It is absolutely clear that a sound scientific basis, greater technical justification and greater public acceptance are prerequisites for developing a meaningful radioactive waste storage policy.

The challenge in appointing a commission is to surmount the political pressure for appointing nuclear industry scientists and promoters. A balanced commission should be comprised of recognized scientists, members of affected and potentially affected communities, representatives from Native American tribes, representatives from state government agencies that must address the waste problem, and ordinary citizens. In short, the commission should resemble our nation itself. We must develop a sensible and safer means of handling nuclear waste and the process should not be dominated by the

nuclear industry.

NA: You also stated in your House testimony that the VA estimates that the radiation dose to the population living near the site would peak at 300 millirem, a near doubling of natural background radiation exposure, and that "any increase, no matter how small, in background levels of radiation is intolerable, and doubling the local exposure is absolutely immoral." Do you mean that you have a policy of zero tolerance of public health risk from any industrial activities, regardless of the degree of offsetting benefits?

Hauter: We should ask the inverse. Do you mean that in making public policy, the public's health and safety should not be put before maximizing profit? Unfortunately, because of the enormous amount of influence that large economic interests have over our political decision-making process, many of our policymakers have "zero-tolerance" for protecting the public if it reduces corporate profits. Public Citizen believes that insuring the public's health and safety always comes before corporate profits.

Just because people are exposed to naturally-occurring radiation does not mean we should tolerate increasing their exposure to man-made radiation. Naturally-occurring radiation can be unsafe, and we try to minimize our exposure to it. An example is radon.

NA: Public Citizen has said that centralizing spent fuel storage in Nevada "will increase political pressure to make the science fit the site" because politicians would then be "reluctant to admit Yucca Mountain isn't a safe repository." If the Yucca Mountain site investigation proceeds now without centralizing storage and the results turn out to be favorable, and if there is strong independent corroboration of such a finding from the broad scientific community, would you support getting the waste out of the at-reactor storage facilities at that time?

Hauter: The proposals for long-term storage of high-level waste are still at the R&D stage. There is not yet a final disposal solution. Yucca Mountain is not a suitable site for a permanent repository and we should not make the site a *de facto* permanent dump by building a temporary storage facility. All of the scientific data shows that the goal of isolating nuclear waste and preventing current and future generations from exposure cannot be achieved at Yucca Mountain.

Until there has been a scientific breakthrough that makes it possible to isolate nuclear waste and which will prevent future generations from being exposed to radiation, or until all commercial nuclear power plants are closed, we will not support a centralized storage plan. In reality, as long as the 103 nuclear plants continue to operate, there will be waste on site. Spent fuel must "rest" for several years before it can be moved, so long as the reactors operate, they will be radioactive waste dumps. While we do not believe that nuclear waste should remain on site indefinitely, we believe it is safer to leave it there for the time being, than to move it on the rails and roads of our nation, exposing Americans.

We should remember the words of the Nobel Prize-winning physicist Hannes Alfven who said, "If a problem is too difficult to solve one can not claim that it's solved by pointing to all the efforts made to solve it…"

NA: Some of your critics charge that you are not just watch-dogging the Yucca Mountain investigations to ensure safe waste disposal but that you don't want the nuclear waste issue solved because it could help the future prospects for nuclear power. How do you respond to that criticism?

Hauter: That's a mischaracterization. We don't see a future for nuclear power and would like the plants to close sooner rather than later. I don't think the process for finding a safe disposal facility has gotten us where we wanted to be in this country. Policymakers were warned that the dates they put into the 1982 law were not realistic. But even if the waste problem is solved soon, which is very unlikely, we don't think nuclear power has a future in the United States.

...Yucca Mountain is not a suitable site for a permanent repository and we should not make the site a *de facto* permanent dump by building a temporary storage facility...

NA: With Republicans in control of Congress, the House voted overwhelmingly last year in favor of the waste legislation and the Senate had a nearly-veto-proof margin. Do you feel you will be able to block passage of this bill?

Hauter: Because the public does not support the policies in H.R. 45, we believe that we can stop it from passing. A national survey conducted found that 70% of the population wants Congress to immediately form an independent commission to find new solutions for storing radioactive waste instead of transporting it to Nevada. The poll was conducted by Research/ Strategy/ Management, Inc of Lanham, Maryland, headed by Dr. Vincent Breglio, a noted Republican pollster whose clients have included Presidents Reagan and Bush and the NBC/Wall Street Journal poll. Personally, I have spoken all over the country on this issue, and when people hear about the scheme for moving waste to a temporary facility in Nevada, they believe that members of Congress who support the bill have lost their collective sense. Those of us who work in the public interest will never have anywhere near the amount of money that the nuclear industry has. Public Citizen will soon be releasing a report, *The Nuclear Industry: A Cash Cow for Congress II*, which lists

campaign contributions for all members of the House. It shows that the industry ensured a substantial flow of contributions to Commerce Committee members and particularly Committee leaders. The nuclear industry gave the average Committee member almost $34,000 in the 1997-98 election cycle and the average member of the Energy and Power Subcommittee almost $40,000. Commerce Committee Chairman Tom Bliley (R-VA), who is trying to shepherd H.R. 45 through the Committee, received over $80,000 and Ranking Democrat John Dingell (D-MI) received over $110,000. Energy and Power Subcommittee Chairman Joe Barton (R-TX) received nearly $120,000 and Ranking Democrat Ralph Hall (D-TX) received nearly $70,000.

Money talks on Capitol Hill, and if we had that much money we would win tomorrow. But, we do have a resource: concerned citizens. In our democracy, an organized voting bloc that holds its elected representatives accountable is the best way we have of defeating bad legislation. In cooperation with our allies, we have a district-by-district organizing strategy on the waste bill. Each year we become more organized. The fact that we have prevented this bill from passing, even with all the money on the other side, shows that we have an excellent chance of defeating this outrageous legislation. This year, we hope to gain votes against H.R. 45 in the House, and we have the votes to sustain a veto in the Senate. We intend to keep fighting on this issue and to win.

...We believe nuclear power is a dying industry and the U.S. should phase it out as quickly as possible...

We can only wonder at how anthropologists will view our society in 5,000 years when our descendants will still be grappling with radioactive waste that was created in the 20th century. It is not the critics of nuclear power and nuclear waste policy who will receive the harsh critique. The criticism will be reserved for those individuals who were elected in a democratic process, but did not represent the interests of their constituents.

Future of Nuclear Power

NA: Public Citizen's recent report Stranded Nuclear Waste *indicated that deregulation will force premature shutdown of as many as 90 reactors nationwide. How would you express your overall position on the future of nuclear power in the United States? What should the U.S. do?*

Hauter: Well first of all, Public Citizen did not write this report. We co-released it with allied organizations. It was prepared by Bruce Biewald and David White of Synapse Energy Economics. But to answer the question, we believe nuclear power is a dying industry and the U.S. should phase it out as quickly as possible.

NA: How do you feel we should replace the power?

Hauter: We need to seriously begin pursuing public policies that encourage the use of energy efficiency technologies and the commercialization of renewable energy. We could dramatically cut our energy use and begin to replace polluting electricity generation if our elected leaders had the political will to create the public policies necessary for doing so. Natural gas, which is less polluting, can be a bridge fuel, although with the current consolidation in the industry, we do not want to become too reliant on it. We should begin to develop plans region by region to ensure there is enough power as we phase out nuclear plants, as they are now doing in Germany. We must also address the problems of coal-fired generation. In any comprehensive legislation to deregulate the electric utilities, we must bring old coal plants up to new plant standards. Unfortunately, our current approach in state deregulation legislation really does the opposite, by not addressing air emissions problems and by making it possible for nuclear plants to run longer and longer because consumers are forced to bail them out.

NA: Can you say what improvements need to be made to the current nuclear program in this country?

Hauter: The proponents of electric utility deregulation say they believe in the so-called free market and competition. But, in reality, the owners of nuclear plants want to be protected and bailed out. Nuclear power plants should really have to compete in the deregulated market. They should not be shielded like they have been in most states with bailouts, giving them future operating costs, or making them "must run" plants. There is little evidence that the many plants that should close really will.

The NRC should begin enforcing the regulations that protect the health and safety of Americans. The use of so-called "enforcement discretion" is allowing reactors to escape safety regulations that are important for preventing accidents. This is of particular concern because of the aging reactors that we have in the U.S. Licenses should not be extended and a plan should be devised for phasing out nuclear power as quickly as possible, before we have another serious accident.

NA: Are there conditions under which you would accept a role for nuclear power in meeting future energy demand?

Hauter: No. We see no role for nuclear power under any circumstances. Splitting atoms to boil water for running a turbine has always been foolish. Nuclear power is dangerous, too expensive, has always been subsidized by taxpayers and creates an intractable waste problem.

Aging reactors are becoming even more of a threat because NRC continues to "deregulate" and relax rules for reactors so

that they can compete in a deregulated electric industry. The public is being forced to bail out the nuclear industry state-by-state as electric utility deregulation proceeds. Consumers will pay approximately $200 billion dollars - a large part of it for the bad management of nuclear power plants. There continues to be no solution to the nuclear waste problem.

We have better alternatives for producing electricity. In the short term natural gas is an alternative fuel that can be used for generating electricity. We should also begin to seriously pursue energy efficiency technologies. We could dramatically cut our energy use, without sacrificing our quality of life. For instance industry accounts for 36% of total U.S primary energy consumption, and electricity accounts for one-third of the primary energy consumed by industries. There are many cost-effective opportunities that remain unimplemented today. If the right public policies are implemented, a tremendous energy savings opportunity could be tapped.

Today, residential and commercial buildings account for 37% of U.S primary energy use. If public policies were implemented to promote the uses of highly efficient building technologies—ranging from water heating and space cooling to lighting, the U.S could reduce energy consumption in buildings 11% by 2010 and 22 percent by 2030.

Report Card on the Clinton Administration and the 106th Congress

NA: How would you rate the Clinton Administration's policies and actions on commercial nuclear power in comparison with previous Administrations? How about NRC specifically?

Hauter: The Clinton Administration is always much too accommodating to the concerns and demands of large economic interests. Therefore, their position on the disposition of nuclear waste and the nuclear industry is mixed and there are many policies that must be criticized for not being in the public interest. We are appreciative of the Administration's strong stand against a needless interim storage dump in Nevada and their assistance in defeating the destructive nuclear waste bills. However, the Administration has failed to ensure the scientific integrity of the site characterization of Yucca Mountain. DOE scientists have systematically ignored the scientific evidence that indicates Yucca Mountain will not isolate the radionuclides from the environment for the necessary time frame. This Administration continues to push bad science.

Likewise, the Administration was unwilling to take the politically difficult stand and veto the Texas/Maine/Vermont Nuclear Waste Compact, which had to be consented to by Congress. Passage of the compact was necessary to establish a "so-called" low-level waste dump at Sierra Blanca, a poor minority community in Texas. Not only was the site unsuitable because of earthquake activity and the probability of groundwater contamination, it was also to be located in a low-income, Mexican-American community. Many serious environmental justice questions were raised about the site selection process. The town already has one of the largest sewage sludge projects in the world. This is clearly a violation of the Executive Order on environmental justice that was issued in 1994. It created serious doubts in the minds of environmental justice advocates about the commitment of the Administration in acting to stop the repulsive trend in this country of siting the most hazardous and undesirable facilities in poor communities, especially those with high percentages of people of color.

In another area, the Clinton Administration has demonstrated that they do not have the resolve to resist the lobbying efforts of the nuclear industry. The research agenda prepared by the President's Committee of Advisors on Science and Technology was too heavily weighted to industry supporters and did not have enough representation from organizations committed to sustainable energy policies. The outcome was predictable. It recommended that more U.S. taxpayer money be wasted on additional research for nuclear energy. Subsequently, the DOE requested $34 million for commercial nuclear power R&D in the FY 1999 budget and received $19 million. This is unfortunate. Along with taxpayer groups and fiscally conservative members of Congress, the environmental community had successfully helped eliminate commercial nuclear power R&D subsidies from the DOE's budget in FY 1998.

> ...The NRC has always been more of a cheerleader than a regulator...

Concerning the NRC, the agency has always been more of a cheerleader than a regulator. The agency is in the process of relaxing its regulations for nuclear power plants to assist the industry in getting ready for deregulation. While the NRC is in the best position of assessing safety and performance problems, it lacks the will to solve safety problems. The agency continues to allow problem plants to operate, despite the fact that they have failed to improve their safety performances. The NRC is also promoting the deregulation of radioactive scrap metal and other materials, so that it can be recycled into household products. We believe that this issue will become a major issue in the new millennium.

The NRC is going to allow nuclear plants to apply for a license, which will allow them to operate beyond the 40-year term of their current license. The license renewal rule has no foundation in safety. Merely relying upon the current regulatory process to protect the public while failing to require that reactors document compliance with the current licensing basis is an abdication of the Commission's responsibility. Absent any enforceable standard for renewal, the NRC's license renewal rule is little more than a rubber

stamp. If the Commission were truly concerned with safety, it would ensure that aging, unsafe and uneconomical reactors are shut down. Rather than extending the operation of nuclear reactors, the NRC should develop objective criteria on which to base a decision to retire reactors. The May 1997 General Accounting Office report *Nuclear Regulation, Preventing Problem Plants Requires More Effective NRC Action* is an important road map for assessing the agency. The report, which was requested by Senators Biden and Lieberman, discussed how the NRC's enforcement actions are too late to be effective.

Renewables and Energy Efficiency

NA: The Clinton Administration recognizes the potential of renewable energy technologies and energy efficiency in meeting future demand, having proposed a substantial jump in R&D funding in these areas. What portion of electric generating capacity do you project can be provided by renewable energy resources (solar, wind, geothermal, etc.)?

Hauter: Renewable energy should be able to support 14% of U.S. energy needs by 2010 and 32% by 2030. Use of energy efficiency technologies should reduce our primary energy consumption by 15% in 2010 and 42% by 2030. This would lead to a 10% reduction below 1990 levels of CO2 by 2010, would reduce sulfur dioxide to 64% of 1990 levels, reduce nitrogen oxide by 27%, and reduce other damaging pollutants. The technologies available to meet the challenges are integrated distributed generation, green building designs, advanced wind turbines, photovolataic modules, fuel cells, advanced gas turbines, membrane technology, and fuels and electricity from biomass resources (produced and managed in a sustainable way). It is not technology that is keeping us from a sustainable energy future where energy efficiency technologies and renewable energy begin to make up the largest part of our energy mix; it is the political will. As long as the polluting industries are able to guide public policy decisions, it will be difficult to shift our energy policy.

> ...It is not technology that is keeping us from a sustainable energy future...it is the political will...

Global Warming

NA: Could you tell us your views on global warming and how you feel the U.S. should proceed overall towards reducing greenhouse gas emissions?

Hauter: Climate change is one of the most devastating environmental threats facing humanity. Unfortunately, the United States and most other developed nations have failed to meet even the weak goal set out in the U.N. Framework Convention on Climate Change. In fact the United States, the world's largest emitter of global warming pollution, will be well over 10% above 1990 levels in the year 2000.

Unfortunately, policies surrounding the deregulation of the electric industry will lead to high emissions of greenhouse gases. Not only does deregulation take away the incentives for saving energy, in the short term coal-fired electricity is the cheapest source of energy. States are not providing any real environmental safeguards that will result in reduced emissions.

> ...Promoting nuclear power as a solution to climate change is like replacing cigarettes with crack cocaine in an attempt to stop nicotine addiction ...

We believe that no comprehensive federal legislation restructuring the electric industry should be passed without a floor of protections for the environment and consumers. The environmental protections must include bringing all old power plants to new plant standards. We also need a significant renewable portfolio standard of at least 10% by 2010, and a systems benefit charge of at least 7 mills per kilowatt-hour that will be used to provide public goods, including money to support energy efficiency technologies and renewable energy R&D.

We should encourage that innovative tax policies be used to achieve a sustainable economy—one that integrates long-term economic prosperity, environmental quality and social equity.

The nuclear industry is hoping that concern over climate change will result in support for nuclear power. Nuclear power has no future in solving climate change problems. Even solely on the grounds of economic criteria, it is too expensive to be a real option unless it is heavily subsidized. Nuclear power, with its high cost, long construction time, high environmental risk and problems resulting from waste management, is no viable solution. Promoting nuclear power as a solution to climate change is like replacing cigarettes with crack cocaine in an attempt to stop nicotine addiction.

NOTABLE QUOTES:
NUCLEAR WASTE MANAGEMENT POLICY

Barton: I think there is some common ground and we can meet [the Administration] half-way... We can agree to take title on a short-term basis until we prove the science is safe for the final disposal facility, then they agree to allow interim storage until the repository opens in 2010... For doing all those good things, we will work to make sure that these lawsuits are stopped... We need to do something on this issue in this session of Congress and we need to do it sooner rather than later.

Bingaman: [S. 608] sounds good in theory, but the reality is that you're not going from 72 sites to one site... but from 72 sites to 73... Meanwhile, the centralized storage in S. 608 would do nothing to stop the lawsuits against DOE... Having said that, I can't blame industry for trying to push some sort of legislation... But what's changed this year is that Secretary Richardson has come to the table with a serious proposal that involves more than just money… People…who have been pushing the industry bill for the past four years have to face the fact that the same old bill is not going to be enacted. They need to come to the table to work on a compromise solution.

Colvin: What we have said is that as a stand-alone provision, taking title, compensating utilities and managing the fuel at the site is not acceptable unless DOE fulfills its obligation to move the fuel off the sites... The concept of taking title, DOE owning it and compensating utilities, is probably reasonable. There's an issue of where the money comes from. To take the money from the Nuclear Waste Fund to compensate all the utilities...is unacceptable.

I'm very encouraged that the Secretary is engaging in the dialogue... We've got to come together in some way, either with the Administration coming to the table and negotiating with Congress or Congress passing legislation and mandating that the Administration perform... But if the Administration continues to say no storage until the repository actually opens for operation, then I don't think there's much room for discussion… If the legislation doesn't pass...you still have opportunities for the Department to take other action.

Domenici: The Administration's position of tying progress on interim storage in Nevada to final acceptance of Yucca Mountain as a permanent repository is sadly flawed… The very recent proposal from the Administration for the Federal government to take title to spent fuel at the existing reactor sites does not strike me as a credible step forward on this issue. Interim storage remains a vital step forward for the nation... I remain hopeful that interim storage bills can be crafted that will command a veto-proof margin.

Hauter: DOE should disqualify the site, and the United States should rethink its nuclear waste policies... Yucca Mountain is not a suitable site for a permanent repository and we should not make the site a *de facto* permanent dump by building a temporary storage facility… Until there has been a scientific breakthrough that makes it possible to isolate nuclear waste and which will prevent future generations from being exposed to radiation, or until all commercial nuclear power plants are closed, we will not support a centralized storage plan... The fact that we have prevented this bill from passing, even with all the money on the other side, shows that we have an excellent chance of defeating this outrageous legislation.

Holdren: Yucca Mountain appears to be a very difficult site to evaluate... [It] clearly faces some big obstacles in proving that it's safe enough... I'm concerned we're not going to have the definitive, positive site suitability certification for Yucca Mountain in 2001, 2003 or 2005. I think this has the potential for going on and on and on… There is no reason to think that satisfactory sites for geologic repositories cannot eventually be identified and satisfactorily characterized... But we need to look for an interim solution -- interim engineered storage of radioactive waste... The difficulty is, many people with responsibilities for this in the Federal government don't want to hear about interim storage because they fear it will derail…progress on a geologic repository... I actually don't think that will happen.

We've been screwing up this problem for so long in the political dimension that it's hard to recover... Falling back on one site was a big mistake.

Jackson: The NRC staff believes DOE is on the right track to deal with the issues [in assessing the Yucca Mountain site]... The staff has not identified any showstoppers that don't have at this point a path to resolution. But resolution doesn't mean that it's suitable.

Continued on-site storage for some period of time is okay. [Our regulation] provides for storage on site for as long as 90 years... But…a central interim storage facility, from an operation and an oversight point of view, could offer some advantages.

Markey: We have a chance of building a coalition amongst the pragmatists in the utility industry that would seek a real solution to their near-term problems while still preserving the Federal government's pursuit of a permanent, long-term solution in the form of an underground repository. I do not believe there should be interim storage at the Yucca Mountain site under any circumstances… Once we allow the pressure to be reduced, then the likelihood of a permanent nuclear waste repository being built is reduced almost to zero.

The problems that we have today are completely created as a direct result of the bad decisions made in the 1987 legislation that passed the Congress. If they had allowed for the scientific community to characterize all of the potential sites in the United States, we wouldn't be having this discussion today.

Murkowski: The industry is strangling on its waste simply because this Administration has refused to address waste disposal on its watch... To the credit of the Secretary of Energy, he's come up with a proposal, but...it doesn't address removing the waste... In order to take the waste, the government proposes to use funds collected from the ratepayers over the last 18 years [and] wants the utilities to drop their liability claims. From the standpoint of the nuclear power industry, what would they end up with?…

It's a question of what the nuclear industry can live with. If the Federal government refuses to take the waste, how long is it going to stay there?…It would be logical to proceed with interim storage. Unless there is a date certain for removal of waste from reactor sites, I don't think the industry will accept the Secretary's proposal, nor do I think the states will accept it.

Richardson: The Department is only at the beginning of the process of analyzing [its proposal] and discussing it with the utility industry and other interested parties. We believe it is a practical option that would provide a near-term solution to utilities' storage needs and would be relatively easy to implement. Differences remain [with Congress] over how to accommodate utilities' needs before a repository is available. The Administration is opposed to legislation siting an interim storage facility in Nevada. However, I want to enter into a dialogue on alternatives to interim storage, and we believe there are indications of interest in the Congress as well.

JOHN HOLDREN
HARVARD UNIVERSITY

Background

NA: Could I ask you to begin with an overview of your activities here related to energy policy and your advisory role with the Clinton Administration?

Holdren: Yes. Here at Harvard, I direct the program on Science, Technology and Public Policy within the Belfer Center for Science and International Affairs at the Kennedy School of Government. Working jointly with other programs in the Belfer Center, we have established two projects in particular which are strongly related to energy policy in general and nuclear energy policy in particular.

One of the projects is called "Energy Research and Development Policy for a Greenhouse Gas-Constrained World." It is linked to work I have done and am doing at the White House through the President's Committee of Advisors on Science and Technology (PCAST) and the Office of Science and Technology Policy. I'm a member of PCAST, and led its panel that reported in late 1997 on "Federal Energy R&D for the Challenges of the 21st Century." I'm now in the midst of chairing a new PCAST study, which the President requested and is due to him May 1st, on enhancing international cooperation in energy technology innovation. Our energy R&D project here at Harvard is looking at how various countries with large greenhouse-gas emissions could bolster their own R&D programs and their cooperation on energy end-use efficiency, renewables, advanced fossil-fuel technologies, carbon sequestration, and nuclear fission and fusion - as the ingredients of a portfolio for addressing the global warming problem.

The second research project here that relates to nuclear energy is called "Managing the Atom," and it's focused on a variety of issues where the future of nuclear energy and the management of the military atom intersect – for example, the management of excess weapons plutonium and highly enriched uranium. The project also works cooperatively with analysts in Japan, China, and South Korea on the evolution of the nuclear energy option in those parts of the world. That's where most of the expansion of nuclear energy is going to be in the decades immediately ahead, and we think it matters quite a lot how that expansion takes place. These projects relate closely to work my Harvard colleagues and I have done and continue to do with the government on questions of nuclear materials management and plutonium disposition. For example, I co-chair with Yevgeny Velhikov the Bilateral U.S.-Russian Independent Scientific Commission on Plutonium Disposition, which reports to Presidents Clinton and Yeltsin.

> ...We swallow with barely a hiccup expenditures of $4, 5, 6 billion a year on missile defenses whose prospects for success are questionable at best, while a tiny fraction of that [could disable] much of the material that could be flung at us...

Plutonium Disposition

NA: Professor Holdren, after the bilateral commission report that you issued in 1997, you organized the meeting between U.S. and Russian government representatives here at Harvard, which ultimately led to the negotiations where we are today. The main challenge in the negotiations that are going on today seems to be the cost of the Russian program. Do you have a sense that the G-8 is ever going to agree on a way to pay for that program?

Holdren: I worry that the G-8 may never come to agreement on it. I hope that if the G-8 doesn't, the United States will step up to the problem and do what needs to be done, because at the end of the day the costs that we're talking about here, while not

insignificant, are small compared to the investments we've routinely made in national security matters where nuclear weapons were involved. If you think about the relative cost of rendering inaccessible these large stocks of directly weapons-usable material, versus the cost of trying to intercept the same stuff once it is on missiles coming our way, you really begin to see what small amounts of money we're talking about here with a likelihood of much greater effect. It blows my mind that we swallow with barely a hiccup expenditures of $4, 5, 6 billion a year to work on ballistic missile defenses whose prospects for success are questionable at best, while we have available for a tiny fraction of the cost approaches to disabling much of the material that could be flung at us in warheads. It just is not proportionate.

NA: Can you comment on the dual track, the two ways of getting rid of weapons plutonium? I'm particularly interested in the ongoing NAS study that you're chairing on the can-in-canister concept.

Holdren: Well of course the original National Academy of Sciences plutonium disposition study recommended the dual-track approach in 1994-95 - that is, pursuing in parallel both the immobilization of excess plutonium with high-level radioactive waste, as well as embedding some of the plutonium in mixed oxide (MOX) fuel and using that in a limited number of currently-operating reactors on a once-through basis. At that time, we recommended that the immobilization track be done by blending the plutonium stream into the glass log production process that was already scheduled to begin at Savannah River. Both of these approaches would present a large radiation barrier and a large chemical processing barrier to getting the plutonium back out again.

The proposal for a MOX track, as you know, has been partly misunderstood in some quarters. Some said, in particular, that the MOX approach would be inconsistent with U.S. non-proliferation policy because it involves using plutonium in power reactors. But of course what U.S. non-proliferation policy is opposed to is taking plutonium that is already mixed intimately with fission products and separating it. That is, U.S. policy opposes the reprocessing of spent fuel, not the incorporation of already-separated plutonium into MOX fuel and irradiating in a reactor so the remaining plutonium ends up mixed with fission products. I think we've finally managed to convey that point and I think people within the U.S. government recognize that the dual-track approach is compatible with U.S. non-proliferation policy.

The can-in-canister approach to the immobilization track materialized when difficulties arose with the idea of mixing plutonium into the logs that are going to be produced at Savannah River. The problems with that include how you ensure against criticality problems in a very large log with a lot of plutonium being added to the molten brew. The concern arose that this important national program to stabilize existing defense high-level wastes might be delayed while trying to solve these problems of adding plutonium to it. So, somebody came up with this can-in-canister approach. The idea is to imbed the plutonium in ceramic pucks inside of small cans, put those into a lattice in a large canister and then fill that canister with molten glass containing radioactive waste. The concerns that have been raised about that are whether this can-in-canister approach is as resistant to extraction of the plutonium as the original scheme that the Academy study recommended. The argument has been made by some that it might be possible to take such a canister, cut a hole in the bottom, heat it and drain the radioactive glass out, or to attack it with shaped charges and escape with just the cans containing plutonium in the ceramic matrix, absent the radiation barrier. If that were so, it would be very questionable whether the plutonium in this approach is as well protected as plutonium embedded in spent fuel is - the so-called "spent fuel standard" which the Academy study recommended and the government accepted. So the DOE has now asked the Academy to examine the application of the spent fuel standard to the can-in-canister system and to look at the MOX approach on a comparable basis. That is still on-going, and I'm not in a position to say yet how it will come out.

I would add that our principal concern about recovery of excess weapon plutonium from either spent MOX fuel or waste-bearing canisters relates to sub-national groups - criminals, terrorists - trying to get their hands on it, maybe on behalf of countries of proliferation concern. It's not so much an issue of the owner state - the United States or Russia - recovering it, because obviously these countries could recover the plutonium from whatever form you put it in. It seems unlikely that they would choose to do this, because both the U.S. and Russia, as of now, plan to retain quite a lot of plutonium in warheads and reserve stocks and would not seem to need more.

Global Warming and Nuclear Energy

NA: In the PCAST report you wrote that the Administration should acknowledge nuclear power as an energy option that could contribute substantially to meeting greenhouse gas emissions goals if certain concerns are resolved. Do you see the global warming issue eventually leading to U.S. policies favoring non-greenhouse-gas-emitting technologies?

Holdren: I think the short answer is "yes." The climate change issue is likely to generate stronger and stronger pressures over time to very substantially reduce greenhouse gas emissions, and I think that will lead to policies that strongly encourage this. Whether the policies are in the form of carbon taxes or emission caps with tradable permits, I certainly couldn't guess right now. But I think we will get to the point of having very serious, very substantial government policies leading to a reduction in carbon emissions. Now what that will do for nuclear energy I think remains to be seen. It certainly could be significant, if nuclear energy is positioned to do well in competition with the other ways in which one can supply energy with reduced carbon emissions. Those other ways are principally a variety of renewable energy sources plus fossil-fuel technologies that capture and sequester some significant fraction of the carbon that they would otherwise emit. All of those options, as we understand them today, are likely to remain for some time more expensive than the cheapest fossil fuel technologies. But again, the moment the incentives really change about emissions of carbon, those cheapest fossil fuel technologies are no longer going to be so attractive, and there will be a competition for what options are going

to supplement them, and in what proportion.

As for specific policy approaches, what most analysts will tell you, at least academic analysts, is the most efficient way to reduce greenhouse gas emissions would be with a carbon tax, but that is anathema in the current political environment. There are very impressive studies out there by distinguished economists showing that if you tax carbon and offset it by reducing taxes on things that society values, like income and capital investment, you could reduce carbon emissions very substantially and have the economy do as well as or better than it would have done without any change. Politically this isn't on now, but who knows whether it will be on in 2002 or 2006.

I think there is a very considerable chance of the climate situation getting more urgent, getting more obvious to people in terms of the patterns of precipitation, floods, droughts, and the summer heat index in places like Washington, D.C. If one really looks carefully at the evolving climatic patterns, it's already quite clear that we're in a phase of rapid change, and we're only experiencing at any given moment a fraction of the climate change we've already caused because of the time lags built into the system. I think this is going to become powerfully persuasive to practically everybody in a decade or so, possibly even less. And then real policy to reduce greenhouse-gas emissions will follow.

...The climate change issue is likely to generate stronger pressures over time to very substantially reduce greenhouse gas emissions...Real policy to reduce emissions will follow...How much difference that will make for nuclear energy is up for grabs...

Future of Nuclear Energy and Reprocessing

Holdren: When that happens, how much difference it makes for nuclear energy is up for grabs. One of the arguments that I've made with my colleagues in Japan and South Korea about the future of nuclear energy is precisely that its future looks brighter the simpler, cheaper, safer, and more proliferation resistant we can make it. I believe that by making the right choices we can make it adequately cheap, safe, proliferation resistant and manageable from a radioactive waste standpoint to be a serious candidate for carrying part of this burden of reducing society's greenhouse gas emissions. I don't think it's automatic. I think we could also screw it up. The interest in pushing ahead with reprocessing in Asia is counterproductive, I believe, because it complicates, makes more expensive, and makes less proliferation resistant this enterprise whose prospects depend on it being simple, inexpensive and proliferation resistant. And there's no real reason to accept those burdens. If you really look and say, do we need to do this because of uranium availability? No. Do we need to do it because of economics? We don't. Do we need to do it because of spent fuel management? Well, only if we're really dumb and don't provide any other way for utilities to get rid of their spent fuel but to reprocess it.

One reason for the United States to stay active in research in this field is, do we want to have any influence on the ways in which nuclear energy is expanded elsewhere? If so, we need to be engaged in work on these subjects. And it's strongly in our interest that nuclear power plants that come into operation in Asia over the next 40 years be as proliferation-resistant as possible. And that's a public good, warranting government investment.

Nuclear Energy Research

NA: The PCAST report said we need a nuclear energy research initiative to determine whether fission could help meet goals of reducing greenhouse gas emissions by addressing these four barriers you identified to its expansion in the United States: cost, safety, radioactive waste management and proliferation. But who's going to decide whether those areas have been adequately addressed?

Holdren: A pragmatic answer is, can you pass the test of utilities buying more nuclear power plants? The purpose of this research is to try to improve the characteristics of fission in all these respects that together are going to govern whether this happens or not. And of course not all the uncertainties are on the fission side. We don't know what photovoltaics are going to cost in 2010 or 2020 or 2030, and we don't know what carbon-sequestering fossil fuel technologies are going to cost in those years either. Today we don't have many birds in the hand; they're mostly birds in the bush with respect to the technologies that can provide the energy that people need while not creating intolerable environmental or political burdens.

There is a challenge associated with deregulation and restructuring in the electricity industry, which is that when you turn everything over to the private market you do have to worry about what happens to public goods and externalities, which private markets are not so good at taking into account. A good example of a public good is the national security benefits of not being excessively dependent on imported oil, and a good example of an externality is greenhouse-gas impacts on climate. Those are issues that we need to be concerned about getting lost in the process of deregulation and restructuring of the electricity industry. The rationale for the government doing something there is precisely the standard market-failure rationale. The free market is a great thing except for the respects in which it doesn't take account of all of society's interests.

Funding for Fusion Research

NA: Let's move to fusion. Can you comment broadly on the status of fusion research and its prospects?

Holdren: I should admit to a bias in favor of fusion. My own technical roots are in fusion. I did my Ph.D. in plasma physics, worked at the Livermore Lab in the U.S. fusion

program in the 70's, and have been a consultant to the fusion program in various ways ever since. My interest in fusion is ultimately based on much the same concerns that make me want to keep the fission option alive: namely, that we don't have that many sure things in our energy future, and fusion has the possibility of being an attractive long-term energy source and quite possibly more attractive than fission. But we won't know unless we figure it out.

Fusion has the liability of being very difficult. We've probably spent worldwide now something in excess of $15 billion current money on fusion research over nearly half a century, and still we haven't got a fusion reactor. Of course the governments who are making these appropriations are getting impatient and as a result fusion is in difficulty in this country. We no longer have enough money in the budget both to maintain an adequate program in fusion science and to maintain progress in fusion energy technology on the required number of fronts, including advanced materials research, Tokamak research, alternative concept research, and participation in ITER. I think it's too bad. In 1995 I led a PCAST study of the U.S. fusion R&D program, with the assignment of figuring out how much the program could be cut without completely ruining it. It was then funded at $370 million per year and it was clear that the Congress was not going to continue to support it at that level. We recommended that the program be stabilized at $320 million per year, retaining a strong fusion science base, some alternative concepts as well as Tokamak studies, and participation in a downsized ITER. That advice was not taken; in the meantime, the U.S. fusion budget has fallen to around $230 million a year.

...Fusion has the possibility of being an attractive long-term energy source and quite possibly more attractive than fission...

Fusion has got to be the most reviewed energy research program on the planet. The reviews keep saying we should keep it going, and the politicians keep saying we're not going to spend that much money. It's an awkward and painful situation. If the entire energy R&D budget of the United States is going to be $1.3 or $1.5 billion, which in terms of actual applied energy technology (as opposed to basic energy sciences) is about what it's been lately, then I'm not going to argue that fusion deserves a quarter of that given the other energy problems and priorities that need to be addressed in a shorter time frame. But my argument is rather that the total is much too small, and that if we were spending, as PCAST recommended in 1997, $2.3 or $2.4 billion per year, then $300 million for fusion would be perfectly reasonable and would enable a coherent and sensible fusion research program to go forward.

Our problem is, we're not willing to spend, on Federal R&D related to energy, even half a percent of the more-than-$500 billion per year that this country spends on energy altogether. Private and public expenditures together on energy R&D don't add up to 1% of this - which would be $5 billion a year - and that makes energy the least R&D-intensive high-tech enterprise in the country. The average in industry as a whole is something like 3% of total revenues getting spent on R&D. Many high-tech industries - software, biotech, drugs and so on - are in the range of 10-15%, and here's energy sitting at less than 1%. We're just not thinking about this in the right way.

NA: Is there a simple reason why energy is so far behind the others?

Holdren: I think there are a lot of reasons for it. Energy is a commodity in a sense, and as a commodity the profit margins are very thin with corresponding low incentives to invest in R&D. Energy prices themselves are low, which reduces R&D incentives. Also, the public goods and externalities issues are very large in energy, which means inevitably that the private sector's interest in R&D is going to be smaller than society's interest as a whole, and so we need Federal engagement. But we've had all these pressures on the Federal budget in general, as well as on the DOE budget in particular (because DOE has been seen by some in Congress as an especially ineffective government bureaucracy, and they have targeted it for attack). So there are many reasons for this energy R&D drought, but in the end they don't add up to a sensible position for society.

Spent Fuel Storage and Disposal

NA: Let's turn to the waste issue. From what you know now about Yucca Mountain, what is your sense about the suitability of that site and generally whether it is possible to have safe nuclear waste disposal?

Holdren: Yucca Mountain appears to be a very difficult site to evaluate. That in itself is a problem, and reminiscent of some of the debates about reactor safety. It isn't sufficient that something is safe enough, you have to be able to *prove* that it's safe enough. Yucca Mountain clearly faces some big obstacles in proving that it's safe enough. I'd also note we have consistently underestimated the complexity of proving to the satisfaction of even the technical community - never mind the public - that any given approach to waste management will remain adequate over the timescales for which people want assurance that the waste will remain isolated. It is an enormous challenge to establish that you know anything about what any kind of system is going to do over those kinds of timescales. To address that sort of challenge really persuasively, we would need better science than we've now got, in terms of characterizing the interaction of complex chemical forms with complex geologic environments.

Now, in my view, there is no reason to think that satisfactory sites for geologic nuclear waste repositories cannot eventually be identified and satisfactorily characterized. That is, if you step back from the problem and ask yourself, "Could this really be insoluble?," I doubt it very much. I really have trouble believing that the radioactive waste management problem is even the hardest part of nuclear energy. I think minimizing proliferation links is harder, for example. But, on nuclear wastes, we need to look for an interim solution - interim engineered storage of radioactive waste, which is not technically hard to do - rather than betting everything on early certification of geologic repositories, which I think is problematic.

The difficulty is, many people with responsibilities for this in the Federal government don't want to hear about interim storage because they fear it will derail the whole attempt to make progress on a geologic repository on any reasonable time scale. They fear that once people have interim storage they'll say, "well, it's already been solved, we don't need to invest any more money." I actually don't think that will happen. I think society's interest in having a permanent solution is sufficient that we'll keep spending money characterizing geologic repositories and trying to improve the science needed to characterize them.

NA: But where would you want to interim store if we go with that approach?

Holdren: One of the attractions of interim storage is that there a lot of places where you can do it, technically. Politically is obviously harder, and in a way we've been screwing up this problem for so long in the political dimension that it's hard to recover. I think it was a tremendous screw-up in the Reagan Administration when they decided against the plan to have two U.S. repositories - one in the West and one in the East - and said we're just going to have one. In politics, singularizing anybody to bear all of the burdens is usually a mistake. This really energized Nevada's opposition to Yucca Mountain.

So falling back on one site was a big mistake. And I must admit I'm not sure how we're going to recover from it. But it does seem to me that there are communities in the United States that would not reject an interim waste storage facility in exchange for the various kinds of employment benefits and tax benefits it would bring. I just think we have to put more energy into this interim approach. Doing it this way would also buy us a very important sort of compromise with respect to the controversy over whether spent fuel ought to be reprocessed or treated as waste. Interim storage keeps your options on this open, so the reprocessing issue doesn't have to be settled immediately. I personally don't think it's going to be economical to reprocess this stuff and recycle its plutonium even in 2050, but I can't prove it because nobody's got a crystal ball that clear and that persuasive. So if you put it in interim storage and I turn out to be wrong and it is economical to reprocess and recycle in 2050, it can easily be done.

NA: Do you think it makes sense to authorize interim storage in Nevada? Would you favor waiting until the site suitability determination is positive, or making it contingent on a positive site suitability determination?

Holdren: I'm concerned that we're not going to have the definitive, positive site suitability certification for Yucca Mountain in 2001, 2003 or 2005. I think this has the potential for going on and on and on. I don't want to tie the possibility of moving forward with an interim storage solution to that particular outcome, because again, we know enough about Yucca Mountain to know that at the very least it's very complicated to prove that it's OK. I don't want to put too many eggs in the basket of proving it for that particular site.

..I'm concerned that we're not going to have the definitive, positive site suitability certification for Yucca Mountain in 2001, 2003, or 2005. I think this has the potential for going on and on and on...

Delay in getting that proof tends to promote the perception that this problem is insoluble, which I just don't buy. You could persuade me a lot more easily that the proliferation linkages are close to insoluble than that the waste problem is, and I don't even think *they* are. I think we can ultimately get our hands around the proliferation linkages, although again, if other technologies develop in such a way that we didn't have to do it, that would be all right with me too. I'm not wedded to nuclear energy in the sense that I cannot imagine a long-term future without it. I can imagine one without it, I'm just not sure we're going to get there, or that we're going to get there in a way that will be overall as affordable and attractive as a mix that has nuclear energy in it.

SHIRLEY ANN JACKSON

CHAIRMAN, U.S. NUCLEAR REGULATORY COMMISSION

Reactor Safety and Performance

NA: Chairman Jackson, could you please tell us how you feel the U.S. fleet of reactors is doing today from a safety point of view in comparison with five years ago when you took the helm here?

Jackson: Since I've been here I've pushed the agency to have a more structured focus on maintenance of the design basis of the plants, both in the physical sense as well as design basis information. The licensees have made corrections in that area and that gives us higher confidence. I think that the industry performance indicators indicate overall improvements.

And I think as we have pushed to become more risk informed and make more systematic and consistent use of risk information, it gives us higher confidence that the right things are being focused on. So that, coupled with the actual performance, means that on the average things have improved. You know, though, that within any averages there are those plants that move away from the average, and those are ones where we have to give some increased attention.

NA: One thing the anti-nuclear groups claim is that reactor performance is up simply because NRC has shortened the list of equipment that had to be in perfect working order for reactors to run. How do you respond to that criticism?

Jackson: I don't believe that is true. We have asked and had our licensees focus more in the area of design basis in terms of the behavior and functionality of key equipment. And they have given increased attention to it and I would particularly argue that the use of a risk-informed approach gives higher confidence that the right things are being looked at.

NA: In the increasingly deregulated market where operators have to stay competitive, can you comment on how they can continue to improve safety while reducing cost?

Jackson: One, I've always maintained that good economic performance and good safety performance are not mutually exclusive. If you look at a number of the plants that over time have shown good performance, they also are competitive in an economic sense. It's not our job, of course, to tell people how to operate their facilities. Our focus is on safety.

But, again, having a risk-informed approach helps to give comfort that the right things are being focused on. And the plants represent an investment for the licensees and they have to take care of that investment. The key equipment that needs to be in good working order and the key processes and approach to operations that will satisfy us are based on things that have to be done to have a good operation.

> ...Good economic performance and good safety performance are not mutually exclusive...

Utility Industry Restructuring

NA: Do you feel that the consolidation of plant operators and the formation of joint management companies which are now under way will have positive consequences for the safety of U.S. reactor operations?

Jackson: I don't have a particular point of view from the safety perspective. I don't have a bias that these changes are necessarily bad, because people have asked me that. And I don't believe any given business arrangement dictates what the safety performance of a licensee will be. We have examples where we have small single-unit utilities; some of them have run into problems. We also have large multi-unit utilities that have run into problems. So there is no bias one way or the other.

The important thing is that in whatever the entity may be, you need people who are high quality, and you need follow-through when there is a need for corrective action. What we focus on in these operator changes are certain specific things--license transfers, financial qualifications and foreign ownership issues.

Then in the general deregulation and restructuring we have to focus on three areas. Maintaining safety; grid reliability as it affects nuclear operations and challenges to plant safety systems; and the assurance of funding for decommissioning.

NA: Do you expect the consolidation going on in the industry to lead to the existing fleet of reactors having more renewals and even possibly leading to future orders, more than without that consolidation?

Jackson: I think there is going to have to be a shakeout in the industry and until it is done it's hard to predict. I think we are seeing some operators trying to get out of the nuclear business, but you have an emergence of a number of entities who have decided that nuclear is their business. And so I think that you'll see larger entities on the go-forward basis.

Regulatory Reform

NA: On regulatory reform we have two questions: (a) do you see any problem with these reforms continuing after your tenure here; and (b) do you think Congress is going to take any major steps on regulatory reform?

Jackson: I believe that we have substantially put building blocks into place to institutionalize the change. Our regulatory regime rests on various pillars. One has to do with the overall policy guidance the commission provides as well as the regulations in consonance with that guidance. And we have some fairly significant rulemakings that are meant to risk-inform the regulations as much as we can at this stage and/or provide greater clarity and stability and consistency.

The second part of institutionalizing the change has to do with ensuring that the staff has the tools that it needs. That relates to development of various guidance documents coupled with regulatory guidance for our licensees as well as training that we are providing the staff, particularly in PRA and in areas related to the use of risk in regulatory decisions.

The third fundamental piece of institutionalizing change has to do with re-engineering the actual processes. We have reinvented our reactor oversight program in a way that links it to fundamental cornerstones of safety. There is clear definition of what needs to be inspected within those cornerstones in a risk-informed way. It makes more direct use of performance indicators and a performance-oriented approach. And it links regulatory action to clear thresholds of performance.

The final pieces of institutionalizing change are that first you have to have the right people in place, and I think we now have a team of managers and an organizational structure under those managers that is aligned to do our work more effectively. Finally, we've taken overall a more strategic approach to how we plan and budget our activities. The staff has been working with Arthur Andersen to flesh out that framework. We call it PBPM - planning, budgeting, and performance management.

Next, do I think the Congress is going to do something on regulatory reform? They could. I think there are some issues having to do with anti-trust reviews, foreign ownership, et cetera, but I have a good feeling that those in the Congress who were worried about where the NRC was a year ago have gotten good evidence that we have made the bend in the road, but in a responsible way.

The feedback we have gotten is that people feel that we are moving down the right track. But the fundamental thing is my first point having to do with commission guidance, and I think we have the commission on board. The whole commission is part of this process and that is where the continuity will exist.

...Those in the Congress who were worried about where the NRC was a year ago have gotten good evidence that we have made the bend in the road, but in a responsible way...

International Cooperation Among Regulators

NA: Chairman Jackson, you have taken a leading role in establishing improved coordination among national nuclear regulatory agencies. What progress do you feel has been made and what results do you anticipate to come from this cooperation?

Jackson: Besides our ongoing bilateral and multilateral relationships, such as through the International Atomic Energy Agency, the International Nuclear Regulators Association is something that I was involved in spearheading and have chaired for the last two years. It provides a forum for discussion with senior officials. If you think of a number of the activities that arose in the aftermath of Chernobyl and the breakup of the former Soviet Union, there are several safety assistance activities and the like that were begun and many continue.

In fact that is a second mechanism, working through other agencies of our government, the USAID, to work with the former Soviet Union and central and eastern Europe to strengthen their regulatory regimes. That's important because if you want to institutionalize the safety focus, you need an

infrastructure to do it. And a regulatory framework helps to provide that. It is no substitute for operators of nuclear facilities themselves to have the right focus and safety culture. But to lay out baseline requirements and to examine the performance of operators relative to those is a regulatory function and I would say it is complementary to organizations like the World Association of Nuclear Operators, which is an outgrowth of the Institute for Nuclear Power Operations here in the U.S. And I view the INRA as being a similar kind of a focus.

NA: Are you finding good receptiveness from the countries in the former Soviet Union and elsewhere to that sort of assistance, helping them to institutionalize their safety culture?

Jackson: There are many countries whose nuclear infrastructure is organized like our former Atomic Energy Commission, within which was a licensing and regulatory office, but it was not disjoined from the promotion and also the weapons part. Many countries seem to start out with that kind of focus and then over time they realize the need for an independent regulatory agency. In fact there are over 170 countries that have joined and ratified the convention on nuclear safety. We are, in fact, the only one with a major nuclear program who has not, at this point. [Note: The U.S. Senate ratified the Nuclear Safety Convention shortly after the interview on March 25, 1999.] And that convention requires and says that the countries will create independent regulatory bodies with the technical and human resource capabilities to carry out their health and safety role.

So I would say yes, there has been benefit, partly because the U.S. pushed and provided a lot of input on the development of the actual convention on nuclear safety, and that is why it is ironic that to this point we have not ratified it. But that kind of realization and the joining together of countries around the world to create and ratify that is an achievement in itself. In addition, we have provided and we continue to provide very specific training to regulators in central and eastern Europe and in the former Soviet Union through bilateral assistance primarily funded through USAID.

Then the last thing I would mention is that the Vice President has spearheaded a very unique mechanism for interacting in a coherent and a consistent way with a number of countries, and that is through bi-national commissions. As you know, the Gore-Primakov Commission is meeting this week in Washington. There are similar commissions with South Africa, Ukraine and others. These groups have committees that are chaired or co-chaired by very high level officials in each of the countries, who can bring the wherewithal to bear to make progress on some very difficult issues, whether you're talking nuclear non-proliferation, economic development, energy sector development, health, or other issues. I think that's been a very exciting development and opportunity to have an influence.

Nuclear Energy Research

NA: You're familiar with the NERI and NEPO programs that were first recommended in the PCAST report in 1997. In connection with those programs it would be helpful to get your views in the safety and waste management areas, which were among the areas where PCAST recommended research. If you were advising DOE on what needed to be done to improve safety and waste management for the sake of the nuclear option, what are the particular areas from the regulatory perspective that you feel the Federal government should fund?

Jackson: I think one area would be research on issues having to do with plant aging, and understanding material behavior over time in a more microscopic way that allows us to make macroscopic projections of the behavior of certain systems. In addition, development of further sophistication with respect to risk assessment methodologies is a particular interest of mine.

I think there is opportunity with respect to high burnup fuel issues and that is relevant in terms of the fuel cycle and where licensees are trying to go. It has implications not only for operational performance, but also with respect to source term issues. And I think that there is going to need to be some research *vis-à-vis* MOX.

And then in the environmental arena there is the whole issue of performance modeling in a geologic environment. It is part and parcel to what is going on anyway within the DOE. NERI is a *de minimus* program. But I think there are some opportunities for appropriate leveraging in two ways. One, I think we all need to think a little more about where in the research arena - as opposed to some other arenas where you have to have a clearer separation - where there is some opportunity for joint research programs between government and industry.

We should also think more about international collaborations that allow us to leverage resources, but also to build on specific strengths that have been developed in some countries that have not been developed in others. I am a big believer in partnerships of the right kind. I think that the regulator has to be a little careful with those it regulates. But if there is a group like an EPRI, I think there is an opportunity for that kind of cooperation.

NA: So even if there is just a little bit of seed money there to create cooperation, then this could go somewhere.

Jackson: That's right. Because $20 million is not a lot of money.

NA: You have a regulatory research program that's much larger than the kinds of things they are talking about here.

Jackson: That's right and we don't begin to cover the waterfront.

Erosion of Nuclear Educational Base

NA: The educational base of the U.S. nuclear industry has eroded substantially in the past decade or so as fewer universities maintain nuclear engineering programs and research reactors. I guess in the next part of your career you're going to work on this problem from a different angle.

Jackson: In a very direct way.

NA: When do you feel this is likely to reach a critical point where there are not enough new engineers coming out with degrees to replace retiring personnel? What actions do you feel would be appropriate for NRC to take in this regard?

Jackson: Let me answer the second part of your question first because in some ways it is the most straightforward one, but it presents the greatest difficulty for us. NRC does support, through limited fellowships and scholarships, educating people in areas that are relevant to our nuclear safety regulatory program. At the same time NRC is operating very much in a resource-constrained environment. But what we have done is to urge universities not to dismantle nuclear engineering programs. You know, there have been a number of programs that have been dismantled or eliminated or subsumed into other departments. If a university cannot justify keeping a stand-alone department, then a nuclear engineering program within another department must have a vitality of its own to remain viable. I think the nuclear industry could be helpful relative to both focusing on the need to keep the pipeline flowing in this area, and also providing some support at whatever level. If the nuclear industry expresses a concern that there is not a pipeline, it will get attention. Other industries, such as the semi-conductor industry, and industries rooted in information science and technology, do provide support.

...It is premature to determine the suitability of the [Yucca Mountain] site...

So the universities are making some fundamental decisions about trying to maintain viable programs, but they can't do it in isolation. There have to be others speaking out and supporting the programs. And NRC does what it can in a limited way, but it is limited because of our own resources.

NA: You could see the utilities doing what it takes to ensure that there is a steady supply of engineers to run the plant. But beyond that, with respect to new reactors and new designs, it's not clear especially in the deregulated environment that these utilities have the incentive to do that. So where is that going to primarily come from?

Jackson: This is an issue for those in educational leadership positions, and I am very interested in it. But I think with industry there needs to be a group that comes together to talk about, "Is nuclear power part of the energy mix we want to have in this country?" And I think those on the Hill and the like have indicated that that is what they want. But there has to be a policy framework that develops the rationale for that.

We've been the object of a lot of focus on regulation. I think we have shifted the regulatory paradigm, although change is not complete and we have a long way to go. But if you fix everything that needed to be fixed on the regulatory side, that does not answer the broader question of "what is the policy perspective and framework that nuclear power fits within." What has to happen across the spectrum, not only in regulation, but in research, in education, as well as any laws that have to be promulgated to make that happen? That kind of holistic, comprehensive approach, I am not sure I have seen. It really has to be a major policy piece.

Yucca Mountain

NA: The NRC has recently published proposed regulations, 10 CFR Part 63, for the disposal of high level waste at Yucca Mountain. From what you now know, what is your overall feeling about the site and what are the principal issues NRC is concerned about there?

Jackson: We're at the point of viability. And all the viability assessment is is a snapshot in time on whether there are any showstoppers or whether we feel DOE is on the wrong track. The staff has proposed comments on the viability assessment in a paper to the Commission. There are some technical issues that the staff had identified before the viability assessment that need more attention, having to do with water flow in the saturated zone, effect of the environment on waste packages, igneous activity, et cetera, coupled with an overall need for the DOE to have a real quality assurance program. I think the staff believes, nonetheless, that DOE is on the right track to deal with the issues and to have some path for resolution of those issues.

NA: Public Citizen says the viability assessment provides conclusive evidence that the facility should be rejected.

Jackson: Well, again, the viability assessment is a snapshot in time examining whether DOE's program is focused in the right way to give answers to the key technical issues. And I think our staff believes - the Commission hasn't officially blessed it - that they are focused in the right way. But it is premature to make a judgment. So I mean, whether you're on the side of "it's not suitable" or you're on the side of "it is suitable," I still come down in the middle because it is premature to determine the suitability of the site. That is a decision that we have to make at a point sometime hence. The

staff has not identified any showstoppers that don't have at this point a path to resolution. But that is a different story. Resolution does not mean that Yucca Mountain is suitable.

NA: So NRC concurs that there are no showstoppers?

Jackson: Let me explain what a showstopper is. It is an issue for which a path to resolution has not been identified. The viability assessment is more a statement about DOE's programmatic approach as opposed to an answer as to whether a given technical issue will allow the repository to be licensed or not. We are not at the licensing stage. Issue resolution does not necessarily mean that a decision is made that igneous activity, for example, would or would not keep the repository from being licensed. All we are saying is, if igneous activity is an issue, does DOE have an approach that we think will allow us to make a judgment one way or the other on that issue.

> ...Continued on-site storage for some period of time is okay. If you really look at what we say, we have provided for storage on-site for as long as 90 years...

NA: Can you comment on your moving forward with the proposed Yucca Mountain regulations when the EPA standards are still pending?

Jackson: You know, the NRC is a creature of the law. The existing laws say that EPA will promulgate the standards for Yucca Mountain. Nonetheless, there are fairly stringent timelines, particularly when there is parallel continuing work on a repository and on an interim storage facility. Therefore the Commission felt it prudent to have the staff develop and implement regulations for Yucca Mountain. They had to be referenced to something, and so we referenced it to a standard that we feel is protective of public health and safety.

We have well-documented disagreements with EPA on how you approach standards that relate to risk in a radiological context. Because it is radiological risk that is the issue, then we believe our radiological dose criteria make sense. We also believe that the all-pathways approach makes sense, because what you want is, relative to some reasonable standard, to minimize the dose from all sources. The standard that we have is a fraction of the overall public dose standard that we have operated under for years.

Interim Storage

NA: Let me move onto some questions related to spent fuel interim storage. From a safety perspective, do you feel that a centralized spent fuel storage facility either provided by the Federal government or the private sector is needed now or will be needed at some point prior to the opening of a final repository?

Jackson: What we've said is really two things. One is that continued on-site storage for some period of time is okay. If you really look at what we say, we have provided for storage on-site for as long as 90 years, because we say 30 years beyond the end of a license, including 40-year licenses that may be extended for an additional 20 years. That's 60 plus 30, so there is some time.

But having said that, we also say that a central interim storage facility, from an operational and an oversight point of view, could offer some advantages. But we do not necessarily argue for it because we are not at any crisis point at this stage of the game from our regulatory oversight point of view.

NA: So, our reactor storage is safe and the licenses could allow it to go on for as long as 90 years.

Jackson: We would have to do some work relative to the certification of the storage casks for that extended a period, because those casks are only licensed and/or certified for 20 years. And so there is some additional analysis that we need.

NA: How about the waste confidence rulemaking? Is there any risk there in terms of the basis for continued operation of reactors?

Jackson: The last time the Commission examined waste confidence, the decision was predicated on there being a repository constructed and operated within the first quarter of the next century. And so one could argue that if we are on the timelines we are talking about for the repository, even with the construction period, we are not quite at the point where we would have to revisit waste confidence.

> ...It's really not NRC's role to guarantee that nuclear power remain an option, but it's not NRC's role to be an impediment beyond what is required to ensure safety...

However, if we do not settle down and decide what the path forward is, such that things seem to not be tracking to some resolution within a few years, it may require us to revisit waste confidence.

Accomplishments

NA: Can I ask you to identify what you feel your main accomplishments as well as your main frustrations at the Commission or areas where you wish you could do more? Jackson: Well, there are accomplishments of vision, accomplishments of framework, and accomplishments of process. On vision, I have had a three-part vision: reaffirming our fundamental health and safety mission, enhancing our effectiveness as regulators, and positioning the NRC for change. And in a nutshell I feel I've done all those things with the support and help of the staff and, of course, the Commission.

Reaffirming the fundamental health and safety mission relates to activities and steps that we have taken with specific licenses, Millstone being the famous example. Enhancing our effectiveness as regulators really relates to activities we have undertaken to risk-inform the regulatory framework to improve our processes.

Positioning the NRC for change includes responding to changes I saw coming down the pike in the restructuring of the electric utility industry, and recognizing that government agencies need to operate in a more business like way, and enhancing the transparency and scrutability of NRC.

But there is another way to answer it. We have been asked, "what can NRC do to ensure the continued viability of nuclear power?" And the answer I have given is that it is really not NRC's role to guarantee that nuclear power remains an option, but it is NRC's role not to be an impediment beyond what is required to ensure safety. And the issue then becomes, how do we do our health and safety job in a way that does not bias the playing field relative to nuclear power.

How do we go about doing our work? Being more open with all of our stakeholders, those we regulate, and public interest groups. Allowing for the continued operation of existing facilities, providing they are safe.

License Renewal

We've given a lot of attention to license renewals. This means putting a whole infrastructure into place, starting from commission policy guidance to disciplining the adjudicatory process including laying out adjudicatory schedules. Overseeing the group that is processing the license renewal applications. Laying out clear milestones, and adhering to them. In fact, the staff has just issued the Safety Evaluation Report for Calvert Cliffs. That is a major milestone, and we expect the one for the Oconee plant within the next two months. We are most likely going to get it done in about 25 months, and it could be a little earlier. We are hoping to use the lessons learned from the first couple of applications to improve the process. We have a number of plants that are now lining up in the queue.

We also have to be able to respond to changes in the electric utility industry, to these new business arrangements and the like. We have done that in a couple of ways. One has to do with aligning ourselves to evaluate license transfer applications. We did a rulemaking to allow more "legislative style" hearings as opposed to the normal full panel-type adjudicatory hearings on the record. But we have also created standard review plans in all the key areas that one has to review. They lay out clear expectations for the applicants, for the people who submit license transfer applications, et cetera. They give the staff clear guidance and an ability to develop operating plans, structured on those review plans. We have laid out key guidance documents in those areas, financial qualifications, foreign ownership control and influence, even anti-trust reviews which we are still required to do at this point under the law.

Decommissioning Funding; USEC

Another area of improvement has to do with assurance of decommissioning funds regardless of whatever happens in terms of restructuring in the industry. We did a rulemaking that on the one hand offered more flexibility, but on the other, made sure we had access to information we needed to make our judgments about the adequacy of decommissioning funding. The flexibility means, for example, that we allow there to be some credit for earnings on prepaid decommissioning funds.

Other improvements have to do with making sure that we remain publicly credible, and finally, of course, institutionalize changes by our own structure and planning mechanisms.

I also view the work relative to the privatization of the U.S. Enrichment Corporation as being critically important. There are two aspects to the USEC experience, which I think, in itself, is a lesson. One has to do with the certification of the USEC gaseous diffusion plant. How do you bring into a modern regulatory framework a set of facilities that are already 40 years old? And certification was the way that allowed us to ramp them up into our regulatory regime. It was a test of how risk-informed our process really was, not in the PRA sense, but in looking at where the key safety features are, and we've learned a lot.

But the second part which relates specifically to USEC privatization, had to do with taking the responsibility that we had as laid out in the Privatization Act, having to do with assuring an economic supply of domestic enrichment services, looking at foreign ownership control and influence issues, and deciding how could we posit what we have to do from a safety perspective in a way that would allow an initial public offering or a merger or acquisition of USEC, for it to become a private entity.

We did that through a standard review plan. Why was that important? Because it created the box within which an IPO

could happen. We worked with the National Security Council, with the Securities and Exchange Commission, and even with the financial community. We brought in our own advisor on investment banking and we got it done. That allowed USEC to pass through that screen and for us to be able to do the reviews that needed to be done because the deal could be structured in a way that would satisfy requirements. I am actually quite proud of that.

Future of Nuclear Power in the United States

NA: A closing question: your observation about the future for nuclear power in the U.S. How long do you think it will be before we see the first ALWR orders here, and what do you feel has to happen before that can occur?

Jackson: I have heard some utility executives and other executives in the nuclear arena beginning to talk about new orders. So that's an interesting sign. But what has to happen, I think, is that we have to have this shakeout in whatever manner the industry is going to restructure itself. That is probably going to take a number of years. In the meantime, I think we have to keep evolving our regulatory process to ensure that we can do our health and safety job, but without biasing things.

And we, from the NRC side, have to begin to flesh out what the actual regulatory framework is for licensing a new plant. We have the regulation, 10 CFR Part 52, we have done the design certification of two designs and the final design approval for the Westinghouse design and we will do the design certification over the next year or so. We have been giving more attention to license renewal and license transfers, and upgrading the regulatory framework. Some of this is driven by the apparent interest. I think once we get a clear signal that there is a definitive interest in a timeframe that we can identify and that can be pinned down, then we will build that into our plan.

NA: Do you feel there are any other necessary conditions like a carbon policy or gas prices going up?

Jackson: I think there is an opportunity to level the playing field relative to emissions-free electrical generation. I know that there are discussions among some in the industry, with the Congress, and with EPA about doing that kind of thing. An emission-free generation source, if the issue is to have clean air, needs to be able to play in that game. You are asking me whether I think there are some broader issues in terms of regulations on a front that does not involve us, and some legislation in terms of taxation and incentives and so forth. Absolutely. That needs to be coupled with the industry shake-out, I think.

NA: NRC has enough confidence to keep reactor licenses going as long as there is a repository in the first quarter of the century. But do you feel that the industry will place orders if there isn't public confidence over the waste problem?

Jackson: Well, I think there are two things. I think the nuclear industry itself is going to be skittish if there is not some resolution to the high level waste issue, but I also believe the public is going to be skittish about new plants that generate new spent fuel if we have not figured out what to do with the existing waste. When people give glowing statements about the future of nuclear power *vis-à-vis* global warming and mitigation of greenhouse gases, the Achilles' heel is high level waste management and disposal.

NOTABLE QUOTES:
THE FUTURE OF NUCLEAR POWER

Barton: At some point in the next century I think nuclear power will become very viable again. Environmentally, nuclear is as clean as there is. If global warming is a reality, then we're going to need nuclear power in a big way and we're going to need it sooner rather than later... In the best case, we should get the technology and change the regulatory environment so that we can build more baseload nuclear power 10 to 15 years down the road.

Bingaman: I support nuclear power and I believe it will continue to play an important role in our electricity supply. Nuclear power offers significant clean air and climate advantages over fossil fuels... But it is up to the utilities, not Congress, to decide what type of plants they are going to build. They aren't ordering nuclear plants and haven't for a quarter of a century. Nuclear plants are expensive to build and maintain... Congress can't repeal the laws of economics...

I don't expect to see another new reactor order anytime soon. Indeed, the changes occurring in the electric utility industry will make one more unlikely.

Colvin: If you look at competition, the environment, and the growth in energy demand that is going to take place over the next 15-20 years, you realize that we will build more nuclear plants, unless there's some fantastic breakthrough in technology where fusion becomes the technology of choice.

As recently as five years ago, no CEO would admit that they would order a new nuclear plant in the U.S., but in the past year I've had four or five CEOs talk to me about that concept... I don't think that we'll be able to see the next order for a nuclear plant until at least 2005.

Domenici: Perhaps other future energy sources can replace the clean energy that nuclear provides now, but we cannot identify such sources today. Nuclear energy obviously plays an essential role in [greenhouse gas emissions] reductions.

Future new construction requires development of new generations of plants that can compete on capital as well as operating costs. This will become especially critical as deregulation progresses.

Hauter: We believe nuclear power is a dying industry and the U.S. should phase it out as quickly as possible... We have to develop plans region by region that ensure there is enough power as we phase out the nuclear plants, as they are now doing in Germany. Unfortunately, our current approach really does the opposite, by making it possible for nuclear plants to run longer and longer because the government has been bailing out nuclear power… We see no role for nuclear power under any circumstances... Promoting nuclear power as a solution to climate change is like replacing cigarettes with crack cocaine in an attempt to stop nicotine addiction.

Holdren: The climate change issue is likely to generate stronger and stronger pressures over time to very substantially reduce greenhouse gas emissions... We will get to the point of having very serious, very substantial government policies leading to a reduction in carbon emissions. Now what that will do for nuclear energy I think remains to be seen. It certainly could be significant... By making the right choices we can make it adequately cheap, safe, proliferation resistant and manageable from a radioactive waste standpoint to be a serious candidate for carrying part of this burden of reducing society's greenhouse gas emissions. I don't think it's automatic. I think we could also screw it up. The interest in pushing ahead with reprocessing in Asia is counterproductive, I believe.

Jackson: I have heard some utility executives and other executives in the nuclear arena beginning to talk about new orders... But what has to happen is that we have to have a shakeout in however the industry is going to restructure itself. That's probably going to take a number of years. And in the meantime, I think we have to keep evolving our regulatory process to ensure that we can do our health and safety job, but without biasing things.

I think there is an opportunity to level the playing field relative to emissions-free electrical generation... An emission-free generation source... needs to be able to play in that game.

Markey: Price-Anderson has distorted the free market for 40 years, skewing investment away from technologies that would have by now produced energy in substitution for the false promise that nuclear power offered... There is a "Waiting for Godot"-like quality to public policy makers in terms of their belief that nuclear power will return. There is almost no chance that we will see a new nuclear power plant completed in our lifetimes.

Murkowski: Twenty-one percent of our power generation is from nuclear energy. What's the alternative to that? Nobody seems to have one. Nuclear power, clearly, can make a contribution [to reducing greenhouse gas emissions], but who in the world would want to build a nuclear plant in this country today? Nobody. Yet they're willing to try and extend the life of the existing nuclear plants, which is a positive contribution.

Richardson: With 104 nuclear units operating today, nuclear energy supplies about 20 percent of the nation's electricity... These plants are essential to meeting demand for generating capacity in the future and also for meeting our existing emission laws and international goals on controlling greenhouse gas emissions. The Administration supports the continued operation of these plants and is committed to maintaining a flexible portfolio of energy supply options, including maintaining nuclear energy as a viable option for the long term.

Between the present and 2010, the largest opportunities for reducing greenhouse gases related to energy use are in making more efficient use of fossil and nuclear fuels...

ED MARKEY
U.S. HOUSE OF REPRESENTATIVES

Interest in Nuclear Issues

NA: First I'd like to ask you about your background and interest in nuclear issues. There are no nuclear plants in your district but you've always been a very strong critic of the industry as well as the NRC. Can you say how you developed that interest?

Markey: The Seabrook nuclear power plant is about 20 miles north of my Congressional district as the crow flies, and the Pilgrim plant is about 10-12 miles south. So I have a natural interest in the subject. In 1978 in my first term in Congress, a proposal was promoted to allow for away-from-reactor storage of spent nuclear fuel. That was the first time that the question of how to handle spent nuclear fuel away from the site where it was generated had been debated in Congress. I took a great interest in the issue at that time, and over the course of the next year began to take on nuclear power safety issues as an area of particular interest.

Evolution of Nuclear Power in the United States

NA: Congressman Markey, as you know some nuclear plants have shut down in this country and many people think there will be no new orders in the foreseeable future. This is mostly due to economics. If the economics improve, how would you express your overall position on the use of nuclear power in this country?

Markey: That's a highly speculative question. I don't think that the economics of nuclear power will ever be very good unless the Federal government intervenes to ensure the conditions within which the industry operates. Absent the Federal government guaranteeing through Price-Anderson type legislation that the industry is not liable for the damage that it would cause, the industry cannot exist. As a result, I don't think that there can ever be a fair question asked about whether or not the industry can survive in a free market. Only if you stipulate that it is given extra protection by the Federal government and then forget it and pretend that it is competing against all kinds of energy sources can you have that question asked.

I do not favor extension of Price-Anderson. I don't believe that it's a fair measure of how the free market should operate. As a matter of fact, Price-Anderson has distorted the free market for 40 years, skewing investment away from technologies that would have by now produced energy in substitution for the false promise that nuclear power offered.

NA: Do you feel that the nuclear industry and the NRC have improved operations over the years?

> ...The NRC was a lap dog, not a watch dog, of the nuclear power industry in the 1970s and 1980s. There have been dramatic improvements...

Markey: They have definitely improved. Without question, the NRC was a lap dog, not a watch dog, of the nuclear power industry in the 1970s and early 1980s. There have been dramatic improvements, but the NRC and the industry still need very close monitoring, because there is a temptation to allow cozy cooperation to substitute for real monitoring by the NRC of particular activities in the industry.

NA: Are there certain improvements that you think need to be made to the current nuclear program in this country that might lead you to support a role for nuclear power? Are there conditions under which you would accept a future role?

Markey: I think it's very bad policy for the United States to continue to support a technology that has not added a single kilowatt of electricity to the grid in almost a decade. My greatest fear is that we cling to the promise of a failed

technology while losing our ability to argue to other countries that they should foreswear investment in nuclear power.

In other words, the United States should take advantage of the reality that we are unlikely to invest in any additional nuclear power plants, and make the argument to other countries in the world that they should not use nuclear power, because it is not safe and could lead to proliferation questions that would threaten the security of the planet.

> ...There is almost no chance that we will see a new nuclear power plant completed in our lifetimes...

I have been unable to understand for the last ten years why the United States refuses to take this position. There is a "Waiting for Godot"-like quality to public policy makers in terms of their belief, instilled 30 or 40 years ago, that nuclear power will return. There is almost no chance that we will see a new nuclear power plant completed in our lifetimes. My question is, why should American policy be shaped so powerfully by an unlikely future event?

Global Warming

NA: A lot of people are citing global warming, and a number of your colleagues in the House have made statements recently about how global warming is part of the justification for a future role for nuclear energy. And there was the 1997 PCAST report that recommended that it is important to establish fission energy as an acceptable and viable option, if at all possible. So do you expect that issue to lead to a U.S. policy in favor of energy technologies that do not emit greenhouse gases?

Markey: Global warming is a very serious problem. Nuclear power is not the best solution. Sustainable development should rely mostly on a variety of smaller, more flexible plants and renewable sources.

It's important to remember that the countries with the greatest growth in electricity demand over the next generation, China and India, are also the countries with the greatest nuclear proliferation risk to their neighbors and the rest of the world. We must not provide the raw materials that could be used for the creation of a massive nuclear weapons capacity in the hands of the Indians, the Pakistanis, the Chinese and others.

Also, it is important for the United States to make a much stronger commitment to the development of renewable energy, to energy efficiency in automobiles and industrial plants and homes, and to export those technologies around the planet.

There are efficient, cheap, clean alternatives to nuclear power that, I think, will be viewed 100 years from today as the much more preferable route for the safe, clean, inexpensive generation of electricity. I put wind power at the front of the list, along with solar, but our national government and private sector policy would have to be significantly changed to telescope the timeframe that it will take for our country and the world to derive the full benefit from the power and the promise of those sources of energy.

Renewable Energy Technologies

NA: What portion of our total electricity generation do you think we can expect to see coming from things like solar and wind?

Markey: A hundred years from now, I believe that most of our electricity will be generated from renewable sources. It may be power wheeled in from deserts all across the United States. It may be wind power wheeled across the country from the plains of the Midwest. It may be more efficient satellite-based delivery of power from the sun, but inevitably, eventually, those sources will substitute for the carbon-based and nuclear fuel-based generation of electricity today.

> ...A hundred years from now, I believe that most of our electricity will be generated from renewable resources...

NA: How about nuclear fusion?

Markey: Nuclear fusion has been a technology which is only 50 years away for the past 30 years, and I think it will continue its historic track -- a pipe dream in the minds of nuclear industry researchers.

Spent Fuel/High-Level Waste Management

NA: Let's turn to the spent fuel and waste issue. As you know, Secretary Richardson has put forward a proposal to take title to commercial spent fuel at the reactor sites and manage it there until the final repository opens. Many members of Congress have expressed opposition to that, and continue to push for a bill authorizing interim storage in Nevada. You commented at an Energy & Power Subcommittee hearing that you wanted to hear more specifics about the Administration's proposal. Do you feel that there is hope for a compromise here, heading off a Presidential veto, or do you see the "legislative train wreck" proceeding that Secretary Richardson said he's trying to avoid?

Markey: The utility industry is split. Some are in favor of the

Richardson proposal, some are opposed. That's good news. That's actually progress. We have a chance of building a coalition amongst the pragmatists in the utility industry that would seek a real solution to their near-term problems while still preserving the Federal government's pursuit of a permanent, long-term solution in the form of an underground repository.

...We have a chance of building a coalition amongst the pragmatists in the utility industry that would seek a real solution to their near-term problems while still preserving the Federal government's pursuit of a permanent, long-term solution in the form of an underground repository ...

I do not believe that there should be interim storage at the Yucca Mountain site under any circumstances. I especially would oppose it if there was a decision made based upon good science that Yucca Mountain was an appropriate place for a permanent repository. The reality is that a good percentage of the nuclear industry is not concerned about the permanent storage of nuclear waste. They are really only concerned with getting it off of their property. We should not allow for the pressure on the industry to be removed until a permanent repository has been built. Once we allow the pressure to be reduced, then the likelihood of a permanent nuclear waste repository being built is reduced almost to zero.

NA: So it's about keeping that pressure on for the repository to be built?

Markey: The deadlines that have been set for the construction of the repository were established by the lobbying of the nuclear power industry in the 1982 legislation, and we should hold the industry to their own standard. We should not allow them to change what it was that they asked Congress to construct for them as the solution to their problem.

Congressional Interest in Nuclear Issues

NA: A final question. I would say that you're not quite a lone warrior here on Capitol Hill in your criticism of nuclear power, but you are certainly leading nowadays the watch on work over NRC and the industry. Has anti-nuclearism diminished on the Hill?

Markey: No. I think, if you look back at the 1982 Nuclear Waste Policy Act, you'll find that very few of us voted against it. Only a small handful voted no in 1982. Only a tiny band of nuclear critics raised the issues then that are being raised today about the likelihood that a politically driven process could find a permanent repository. So conditions are pretty much the same today politically as they were then.

The problem that the industry has is that the only way in which they can successfully win a debate is if nobody is on the other side of the argument. As long as anyone stands up and points out the obvious deficiencies in their arguments and the contradictions in their historical position, then they have trouble winning a public discussion about the issue. So the role that I play today is no different than the role that I played in 1978 and '79 and '80 and '81 and '82, right through the 1987-88 period when they had to amend their '82 bill in order to select Nevada as the location, over my objection again at that time, because it was not based on anything other than the fact that they were going to hand the nuclear Queen of Spades to the state with the smallest number of Congressmen in our country.

I think that the selection of the repository site should be made based upon science and geology. I don't think that the decision should have been made based upon the political needs of the nuclear industry and the Congress. The problems that we have today are completely created as a direct result of the bad decisions made in the 1987 legislation that passed the Congress. If they had allowed for the scientific community to characterize all of the potential sites in the United States, we wouldn't be having this discussion today. But the industry and Congress didn't have the nerve to allow New Hampshire and Louisiana and Texas and Washington all to be simultaneously viewed as potential sites for nuclear waste materials.

...I do not believe that there should be interim storage at the Yucca Mountain site under any circumstances...We should not allow for the pressure on the industry to be removed until a permanent repository has been built ...

As a result, there is almost no likelihood of the Yucca Mountain site ultimately being successfully characterized as an appropriate site for a permanent waste repository, because our committee, while comprised of Congressional experts, also has to take note of the fact that that is an oxymoron. We are only experts compared to each other, not compared to scientists and geologists who should have been making the decision, not the members of our committee.

FRANK MURKOWSKI
U.S. SENATE

Nuclear Future

NA: Senator, we'd like to start out by discussing the future of nuclear energy on a very broad scale. As you know a number of U.S. nuclear reactors have shut down in recent years, and the prospects for new reactor orders still appear dim. As a leading supporter of nuclear energy in Congress today, what are your main priorities in the nuclear arena?

Murkowski: First of all, 21 percent of our power generation is from nuclear energy. What's the alternative to that? Nobody seems to have one. They say renewables are an alternative, but only one-tenth of one percent of our energy comes from renewables. The reality of having effective renewable energy technology and putting it into place to achieve a significant role in energy output is still some time off. You can bring in renewables as "green power," but at what cost? Is the consumer going to be willing to pay that cost?

As we look at the role of nuclear power in this country, we have to recognize that the most significant current limitation is waste. The industry is strangling on its waste simply because this Administration has refused to address waste disposal on its watch.

If you look at the electric deregulation bill that the Administration submitted to Congress last year and again this year, there is no role for nuclear power. If you look at their plan for implementing the Kyoto Protocol and the reduction of greenhouse gases, there's no role for nuclear power. The government has not met its contractual obligation, entered into almost two decades ago, to take waste off the reactor sites, which it was due to take in 1998. The government is in violation of its contractual commitment. There is considerable liability that is accumulating as a consequence of the government's inability to take that waste. Further, the reactor sites are regulated by the states as to how much waste can be stored on site. You can clearly come to the conclusion that this Administration is not going to address nuclear waste on its watch.

Spent Fuel/High-Level Waste Management

To the credit of the Secretary of Energy, he's come up with a proposal, but if you scrutinize and evaluate his proposal, you find that it doesn't address removing the waste. On the other hand, if you review the recent court decision, the court deemed that the government was in violation of its contract in 1998 and therefore, technically, the government was then responsible for the waste. So isn't it a fact that, in effect, the government already has the waste at the site but refuses to remove it?

> ...If the Federal government refuses to take the waste, how long is it going to stay there? That's what everybody's concerned about...

In addition, in order to take the waste, the Administration proposes to use funds collected from the ratepayers over the last 18 years. That's about $14 billion that was supposed to be funneled into building a permanent repository for the waste, at Yucca Mountain. In addition, they want the utilities to drop their liability claims. So if you look at it from the standpoint of the nuclear power industry, what would they end up with? They would lose the ability to sue the Federal government for being in violation of their contractual obligations. The waste would still be on-site, and the on-site storage is still subject to state laws unless the government intervenes.

NA: Are you looking for a compromise with the Secretary, and do you think there's a basis for compromise?

Murkowski: Well, it's a question of what the nuclear industry can live with. If the Federal government refuses to take the

waste, how long is it going to stay there? That's what everybody's concerned about. That's why I think our legislation is quite practical. It suggests that you take the waste away from the reactor sites and put it in the Nevada desert where you have 50 years of nuclear experience, including nuclear weapons tests, until you figure out what to do with it permanently.

It would be logical to proceed with interim storage. Unless there is a date certain for removal of waste from reactor sites, I don't think the industry will accept the Secretary's proposal, nor do I think the states will accept it. The fact that the Administration has not seen fit to live with the given date certain in 1998 is obvious. How many times do you cry wolf? There's got to be a "carrot and stick" in there somewhere to force the government to move it. One of the advantages of retrievable storage is that advances in nuclear technology may take place. The French, for instance, aren't burying their waste - they are reprocessing it. If you reprocess the waste, separate out plutonium, and then turn the plutonium into MOX fuel for reactors, you substantially reduce the proliferation risk.

The Japanese are proceeding with this approach, as we should, but the mood of the country and the environmental opposition suggests that we can't get enough support to do that. Still, if you move all the waste to one centralized location where it can be observed and maintained with little or no risk, then it's certainly safer than it is at the reactors. That would be logical. Then if you develop the technology to recover the plutonium, and vitrify your remaining waste, the waste would have a shorter half-life.

...Nobody wants the stuff...You're left with a dilemma – you can't throw it up in the air, because it's got to come down somewhere...

NA: Today the idea of storage is focused primarily around interim storage in Nevada adjacent to the planned repository site. Would you consider other alternative sites if volunteers could be found?

Murkowski: First of all, you're not going to find a volunteer. Nobody wants the stuff - nobody. You can propose some of the Pacific atolls, and you might find some group willing to take and store the waste, but you immediately get a reaction from the Hawaiian delegation that there's no way it could happen. So you find yourself circling the globe. Nobody wants it. Indian reservations have been proposed from time to time, but they haven't been able to do it either because of state pressure. You're left with a dilemma - you can't throw it up in the air, because it's got to come down somewhere.

Global Warming

NA: Getting back to global warming, it seems that the Kyoto Protocol is not moving -

Murkowski: It's moving in the Vice President's mind.

NA: Do you feel that eventually we are likely to develop policies that will favor non-greenhouse gas emitting technologies in this country?

Murkowski: Let's go through them. Hydroelectric power is great, but the Secretary of Interior would like to tear down a few dams, and it's pretty hard, from the standpoint of environmental opposition, to prevail on any major hydroelectric development project in North America. There are a few potential sites, in Canada, as well as huge potential in Alaska, but it's quite doubtful that you could ever get support for it.

Then we can look at renewables. Well, you know, the wind doesn't blow all the time, the sun doesn't shine all the time, and all the storage capabilities we have for energy are relatively inefficient. There's potential hydrogen development, but that's still only potential. So how are you going to get five to seven percent of your electricity from renewables? This Administration says that's our goal and our objective. We're going to put it in the bill. But they won't be around to be held accountable to achieve those goals in the next decade.

Nuclear power, clearly, can make a contribution, but who in the world would want to build a nuclear plant in this country today? Nobody. Yet they're willing to try and extend the life of the existing nuclear plants, which is a positive contribution.

By the time you're through with this circle, maybe we can do a better job with clean coal technology. I think the prospects are quite good there, but we're not spending many research dollars on it. If you look at the budget, most of the expenditures are on renewables, while we spend only a very small percentage on the technologies that we rely upon for 80 percent of our power. That is inconsistent with reality, but nevertheless, that's what the Administration has proposed to do.

NA: Would you prefer to see it all inverted?

Murkowski: I think we should be putting Federal research in those fuels that have the capacity now to help lower emissions, and coal is certainly one. Now there's another "savior" out there, and that's gas turbines, which are relatively inexpensive. I understand you can't get a gas turbine delivered now for four years, they're so far behind in filling orders.

The difficulty with that is you may be misleading yourself. You remember twelve years ago we couldn't use gas for power, because there was a perceived shortage. Then that flip-flopped. Now gas is the savior, but do we have the infrastructure to deliver the volume of gas necessary to rely upon it? Do we have a readily available domestic gas supply? We don't know these answers. We should be spending a little time and money evaluating that.

We're going to hold hearings on that issue very soon, and while gas is a substantial addition to reducing emissions, it too has a certain emission association that we have to maintain some concern about. So I would say that to suggest that we can just switch over to gas is fraught with some exposure to problems such as price, supply and infrastructure to deliver.

...To suggest that we can just switch over to gas is fraught with some exposure to problems such as price, supply and infrastructure to deliver....

NA: Are you interested in policies to help level the playing field for power generating technologies that don't emit greenhouse gases? What things do you think the Federal government ought to do?

Murkowski: First of all, address the issue of waste. Why should this Administration, after eight years, two terms, simply walk off and leave the taxpayer with the liability associated with these suits for failure of performance of a contract? Second, they don't have nuclear energy in their portfolio. It should be in their portfolio, particularly as we address international accords such as Kyoto, because nuclear power has a role to play.

If we get into trading carbon chits with, say, the French, who are very dependent on nuclear, they're going to have all kinds of benefits because they're already generating their power with relatively low emissions. We're going to be somewhat at a disadvantage. And you know, the French basically stamp out one nuclear plant after another as opposed to our mentality, which is to improve reactor designs each time. I think that's a problem we're going to have to address, but that's an engineering problem.

Then we need to address the extended liability associated with the existing plants. Price-Anderson has to be re-authorized.

Nuclear Energy Research

NA: One area where the Administration seems to be opening the door again to nuclear is in proposing, after zeroing out all nuclear R&D funding in 1998, a Nuclear Energy Research Initiative (NERI) as well as the Nuclear Energy Plant Optimization (NEPO) program.

Murkowski: To extend the life of the plant.

NA: They've proposed $25 million for NERI, and $10 million for NEPO.

Murkowski: That funding level is inadequate.

NA: Do you feel that there would be support in Congress to go to substantially higher funding levels?

Murkowski: I don't think you can piecemeal the nuclear issue. I think you have to recognize that it has the capability of making a significant contribution, and if you have an alternative, then come identify whether it is capable of making a contribution that's significant. We talk a lot about renewables, but when you identify what they are and the percentage of the power that's generated from them, you find they're very insignificant, and you find that they're higher cost. Maybe the consumer will pay higher costs for green power. Certain consumers will. A lot of consumers want the cheapest power they can get, wherever it comes from.

...Barring a major breakthrough in technology, nuclear energy has to play a major role in power generation in this country as we concern ourselves over emissions control and air quality...

I think we have to look comprehensively and recognize that, barring a major breakthrough in technology, nuclear energy has to play a major role in power generation in this country as we concern ourselves over emissions control and air quality, greenhouse gas reduction. We have a policy in this country that's anti-nuclear because environmental groups are opposed to it. But if you look at it from a positive point of view as to what is the contribution to clean air, it's measurable and most significant. However, this Administration is not going to address it on their watch.

Utility Industry Restructuring

NA: Senator Murkowski, you've indicated that you're going to be introducing a bill on restructuring the electric utility industry. Can you comment on your priorities for that bill

and how it affects the nuclear industry?

Murkowski: We're now told that the Secretary will offer the Administration's proposal probably after the recess. Then we will take a look at the existing bills that we have before the Committee, start some hearings, and make a decision as to whether we want to move a bill at some point in time. But the question is, will the Administration address some of the tough issues, such as the power marketing associations, Bonneville, TVA? Will they address the difference between investor-owned and municipally-owned power that enjoys certain tax incentives and so forth? Is there a tax going to be associated with it, because in the first bill they threw about a $3 billion tax in there? Can we get a comprehensive deregulation bill through that doesn't add to the cost of electric power to rural consumers in this country? I don't know. But we're going to try. I'm not going to go down an endless trail if we can't. We're going to recognize it up front, and then we'll try and deregulate what we can.

NA: Do you feel that, if deregulation increases competition and downward cost pressures on power utilities, that something will need to be done to look out for technologies like nuclear that, in the short run, might have problems staying competitive?

Murkowski: Yes. Clearly, it is noncompetitive for new nuclear power plants to come in. That's why I say, to address the role of nuclear in a meaningful way, you've got to make a decision whether the Administration will support a role for nuclear power nationally, including disposal of the waste. Right now, we can't even decide what we're going to do with the waste, let alone address the role of the industry.

Some other countries have moved rapidly ahead with technology. Then there are countries like Sweden that bury their head in the sand. They are significantly dependent on nuclear, but they've decided to phase out nuclear power, which they're going to have to extend because they can't get along without it.

Russian Nuclear Submarine Decommissioning

NA: The last topic I wanted to touch on is the decommissioning of the Russian nuclear submarines in the Arctic and Pacific, a problem on which you've spoken. What's an appropriate role for the U.S. government to assist in that effort?

Murkowski: As you know, we're disassembling Russian warheads and removing the plutonium. So we seem to be able to take care of Russian waste that comes to us in that form, but the reactors associated with the submarines and the cost of breaking them up, unfortunately, has been "out of sight, out of mind." The Russians, in the meantime, are too strapped for cash to take responsibility for this. While their scientists have a concern about disposal, the convenient thing is to dump them in the Barents Sea.

I would like to see an international consortium go in and take a responsible position to see that the Russian nuclear subs and their spent fuel are properly disposed. But it's pretty hard to go into a sovereign nation when you're not necessarily welcome. I would hope that the scientific community can rally enough concern to generate an international effort to address this, because to dump it at sea suggests that over a period of time the protective shield around the reactors is going to degenerate, and you're going to get substantial levels of radioactivity in the marine ecosystem. Then you've got a problem. I think an international effort has to happen there.

...I would like to see an international consortium go in and take a responsible position to see that the Russian nuclear subs and their spent fuel are properly disposed...

BILL RICHARDSON
ENERGY SECRETARY

Transition to DOE

NA: Mr. Secretary, after six months now heading up the Department of Energy, how would you describe the transition into running this very large organization and what do you see as the greatest challenges ahead?

Richardson: When I took this job I knew I was taking on a challenge. I knew this Department was being asked to do more with less, and that this agency needed a top to bottom examination. And in these past six months, I think we are well on our way to making the changes necessary that will allow us to be one of the best cabinet agencies.

We've been busy since day one. I've already traveled to 30 of our facilities, meeting with our employees and contractors. I have had to make some tough decisions: on tritium production; on Yucca Mountain; on our contracting procedures. We've had some pretty tough challenges placed upon us. But I have acted decisively - whether it was implementing a series of stringent counterintelligence measures at our laboratories or my setting up an emergency oil and gas task force which led to the implementation of a series of measures intended to help the beleaguered oil and gas industry.

This Department has no shortage of challenges and unfinished work. At home, we need to continue making progress in cleaning up the environmental legacy of the Cold War. Abroad, we have to do a lot more to ensure that weapons-usable nuclear material from the former Soviet Union never falls into the hands of terrorists, criminals or rogue nations. I am confident that we are providing our scientists and engineers with the tools, facilities and personnel needed to keep our nation safe and secure in the new millennium.

National Energy Strategy/ Nuclear Future

NA: As you know, in recent years a number of U.S. utilities have shut down nuclear power plants they find uneconomical to keep running, and there could be more of this as deregulation advances. Meanwhile there are unlikely to be orders for any new reactors in this country for several years. In the long run, do you feel that nuclear energy should play a bigger role in the United States than it does today? What do you think should be the government's role?

Richardson: With 104 nuclear units operating today, nuclear energy supplies about 20 percent of the nation's electricity, the second largest source of electricity behind coal. These plants are essential to meeting demand for generating capacity in the future and also for meeting our existing emission laws and international goals on controlling greenhouse gas emissions. The Administration supports the continued operation of these plants and is committed to maintaining a flexible portfolio of energy supply options, including maintaining nuclear energy as a viable option for the long term. As far as your question on whether nuclear energy should increase market share in the future, this is a decision best left to the market and one that I believe will be made based on plant economics. Nuclear power plant operations are today competitive with coal and other energy supply options and I expect that plant efficiency will only get better as time goes by.

…[Existing nuclear units] are essential to meeting demand for generating capacity in the future and also for meeting our existing emission laws and international goals on controlling greenhouse gas emissions...

Clearly, there is a role for both government and industry in advancing nuclear energy in the 21st Century. Industry must

do their part, principally carrying the burden of short term research and capital investment to operate existing plants efficiently and safely into the next century. And I believe industry is meeting this challenge, with a research investment in excess of $80 million annually. Likewise, U.S. leadership in nuclear science and technology at home and abroad is critical to advancing the nation's nonproliferation interests and our interests for safe and secure access to energy. The President's fiscal year 2000 budget reflects these priorities -- we intend to continue important R&D to advance nuclear energy in the long-term, we propose a new initiative to address critical issues associated with operation of existing nuclear plants, and we'd like to help our universities sustain our nuclear science and technology infrastructure. In the future I hope that through some of our research work we will be able to re-focus on further improvements that would reduce capital costs associated with construction of advanced technologies.

NA: Aside from nuclear, what other technologies in the portfolio should be on the rise to support growing energy demand and to replace greenhouse gas-emitting technologies?

Richardson: Between the present and 2010, the largest opportunities for reducing greenhouse gases related to energy use are in making more efficient use of fossil and nuclear fuels. These energy sources account for over 90 percent of current energy use and will continue to dominate energy markets for some time. For this reason, the largest single element of the President's climate change strategy is energy efficiency. Technologies such as advanced automobiles and trucks, high efficiency motors, industrial combined heat and power systems, and high efficiency lighting and buildings can substantially cut the rate of growth in greenhouse gas emissions. While some clean energy technologies - including wind power, biomass energy and higher capacity factors at current nuclear plants - will also play an important role in this timeframe, most of the low-cost emission reductions are likely to be due to investments in energy efficiency. Energy efficient technologies are increasingly in demand by businesses and consumers as they discover that saving energy and cutting emissions can be profitable.

For the slightly longer term, the strategy focuses on a portfolio of clean energy technologies, including fuel cells, high-efficiency coal power, improved nuclear power technologies, and an array of low-cost renewable energy technologies such as solar photovoltaics, bioenergy and wind power. Renewable energy technologies represent the single largest investment in this group, as they are judged to have the greatest potential for low-cost, zero-emissions energy. After 2020, a new generation of energy technologies - made possible by R&D investments we begin today - will enable even greater emission reductions. These technologies include carbon separation and sequestration; advanced nuclear fission; very low cost advanced renewable energy; energy complexes that produce power, clean fuel and chemical products; advanced industrial processes; and others that we cannot foresee.

Nuclear Energy Research

NA: The 1997 PCAST report recommended an R&D program, the Nuclear Energy Research Initiative, to address problems with nuclear waste, proliferation, safety and economics, and recommended Federal funding eventually reaching $100 million per year. As you know the NERI program has moved forward, but Congress only approved $19 million for FY 1999 and you have only requested $25 million for FY 2000. Do you see $100 million per year as a possible or desirable level of funding for NERI? Do you believe there is support on the Hill to go to such levels in coming years?

...Although our nuclear research funding levels do not approach the levels recommended by PCAST, there is good support for these programs by Members of Congress and we are optimistic about the future of our nuclear energy R&D as we demonstrate the value to the nation...

Richardson: As you know, in the 1980's and 1990's the Department cost-shared research with industry that developed the advanced light water reactors. With the completion of the program in the late 1990's and three designs brought by the private sector to commercialization, our R&D efforts today are refocused on innovative, peer-reviewed engineering and science research. This year, Congress funded the new NERI program to address the key barriers affecting the expanded future use of nuclear energy in the United States that you mentioned. In fiscal year 2000, encouraged by the level of response we are seeing to this program, we are proposing an increase of $6 million to $25 million. The Department received well over 300 proposals for this program this year, many of which came from our universities or proposed in collaboration with our universities. We look forward to seeing this program grow as we demonstrate its value to the nation.

Additionally, in fiscal year 2000, the Department proposes to launch a new research initiative, the Nuclear Energy Plant Optimization program (NEPO), to be conducted in cost-shared cooperation with the Electric Power Research Institute, and in coordination with the Nuclear Regulatory Commission. NEPO is designed to help ensure that existing nuclear power plants can operate safely and efficiently for the long term. This program will create advanced technologies needed to manage

the long term effects of nuclear plant aging, improve plant capacity factors from 71 percent in 1997 to 85 percent in 2010, and optimize generation of electricity through efficiency and productivity improvements.

Although our nuclear research funding levels do not approach the levels recommended by PCAST, there is good support for these programs by Members of Congress and we are optimistic about the future of our nuclear energy R&D as we demonstrate the value to the nation.

Global Warming

NA: Is the global warming issue likely to lead to a U.S. policy favoring energy technologies that do not emit greenhouse gases? What will it take to get the United States to build a power generation base that emits less greenhouse gases?

Richardson: This Administration has been a consistent and strong advocate of flexible, market-based mechanisms for constraining greenhouse gas emissions. The provisions for international emissions trading and the Clean Development Mechanism incorporated into the Kyoto Protocol are the types of flexible mechanisms capable of providing broad, market-based incentives for all technologies capable of reducing emissions. Technologies that do not emit greenhouse gases will have a distinct advantage in the marketplace. If we are to build an economically competitive power generation base that emits less greenhouse gases, we will need to put in place the type of flexible, market-based mechanisms proposed by the Administration.

NA: Also, can you comment on the prospects for the Treaty's Senate ratification? Will you push ratification?

Richardson: The President has indicated that he will not seek the ratification of the Kyoto Protocol until developing countries have made meaningful commitments to participate in global efforts to limit greenhouse gas emissions. One of my top priorities is to work with developing countries to help them realize that joining in global efforts to limit greenhouse gas emissions need not slow their economic growth and could actually result in economic, as well as environmental, benefits. Once we have obtained the meaningful participation of developing countries and established the international rules necessary to successfully implement the flexible mechanisms contained in the Kyoto Protocol, I expect to be a strong advocate of ratification.

Erosion of Nuclear Workforce/Educational Programs

NA: The educational base of the U.S. nuclear industry has eroded substantially in the past decade or so, as fewer universities maintain nuclear engineering programs and research reactors. What, if anything, will DOE do to stop this erosion?

Richardson: Government, industry and academia alike face similar challenges as we seek to sustain our critical science and technology infrastructures - our facilities and our human resources. Like much of the industrial base that took shape during and after World War II, the nuclear industry is a mature industry of scientists and engineers, many of whom are retiring in increasing numbers. As you noted, along with this, our nuclear science and engineering programs at our universities and colleges are challenged by declining enrollments, decreasing numbers of new faculty, and aging facilities, namely research reactors. To strengthen our knowledge base and sustain research reactors at universities and colleges, the Administration has proposed more than $11 million in next year's budget to enhance nuclear research and education programs across the country. Under our University Reactor Fuel Assistance and Support Program, we work with universities and colleges, with assistance from industry, to maintain nuclear education programs, undertake innovative nuclear energy research, continue operation of their research reactors and provide scholarships to outstanding students. There has been broad support for this program by Congress over its short lifetime, support I expect to continue in the future.

...I want to enter into a dialogue on alternatives to interim storage, and we believe there are indications of interest in the Congress as well...

Spent Fuel/High-Level Waste Management

NA: You have indicated that you are preparing a proposal to take title to commercial spent fuel at the reactor sites and manage it there until a final repository is ready. Many members of Congress have expressed opposition to that and continue to push for a bill authorizing interim storage at Yucca Mountain. What is the status of the proposal? Do you feel there are good prospects that a compromise will be reached, heading off a likely Presidential veto of the Yucca Mountain interim storage bill and a possible subsequent override?

Richardson: The Department is only at the beginning of the process of analyzing the idea and discussing it with the utility industry and other interested parties. We believe it is a practical option that would provide a near-term solution to utilities' storage needs and would be relatively easy to implement. The recent opinion expressed by congressional members indicated that differences remain over how to accommodate utilities' needs before a repository is available. The Administration is opposed to legislation siting an interim storage facility in Nevada. However, I want to enter into a dialogue on alternatives to interim storage, and we believe there are indications of interest in the Congress as well.

NA: If Yucca Mountain is found suitable in 2001, when a decision is scheduled, and the President recommends the site to Congress, do you feel an interim storage facility should be built at Yucca Mountain at that time?

Richardson: No. The Administration is opposed to interim storage.

NA: Would the Administration consider centralized interim storage at an alternative site, if a volunteer could be found (e.g., private proposals to build such a facility in Utah or Wyoming, or DOE sites)?

Richardson: The Department does not have an opinion on the private proposals to build interim storage facilities such as the efforts in Utah or Wyoming. These efforts to construct an independent spent nuclear fuel storage facility are private initiatives. The Department has no role in this matter. The Nuclear Waste Policy Act does not preclude the building and operating of a spent nuclear fuel storage facility by a private party.

NA: You announced at the IAEA last September that you intended to host a high-level international conference concerning nuclear waste disposal. We understand that meeting is now scheduled for early November in Las Vegas. Can you comment on your goals for that meeting, and the intended outcome and next steps?

...I believe that an agreement can be concluded this fall to enable plutonium disposition to proceed in the United States and Russia...

Richardson: I am convening the conference to discuss global efforts to dispose of nuclear materials in geologic repositories. The Department will share the results of our experience and progress and welcome the input of others. The invitation was extended to all IAEA member states to join in the conference. The goal of the conference is to address the policy and technical aspects of geologic repositories in the three topic areas of: repository planning, intergenerational issues, and stakeholder interactions. The outcome is to highlight the progress made globally on the management of nuclear materials and waste and provide the opportunity for countries to discuss their ongoing or planned activities.

Electric Utility Restructuring

NA: You have indicated that you would submit an electricity reform bill to Congress by about mid-April. What do you see as the prospects for Federal energy deregulation moving forward in this Congress? If it does not, would you see PUHCA reform going forward as a stand-alone item?

Richardson: I believe the prospects for congressional action on electric restructuring legislation are improving. As the states continue to proceed to move forward with their retail competition programs, there is increasing pressure that Congress act to remove the Federal impediments to competition and address the subjects that are beyond the effective reach of the states, such as the competitiveness and reliability of the interstate transmission grid. While there is not yet a consensus approach on how to proceed, I believe that it is encouraging that both the chairman of the House Commerce Committee and the chairman of the Senate Energy Committee have stated that they would like to move restructuring legislation this year.

With regard to PUHCA, DOE opposes the enactment of stand-alone PUHCA legislation. While we support PUHCA repeal, we believe that it needs to be done in the context of more comprehensive legislation that also includes provisions guarding against market power abuses. If PUHCA is repealed, it is very possible that there will be an increase in mergers that could endanger the competitiveness of power markets. It is essential that FERC be provided with adequate authority to guard against market power abuses.

WIPP

NA: Turning to defense nuclear issues, the WIPP facility in New Mexico has finally just opened. What initial shipments of waste do you anticipate, and will the shipments from Idaho be able to start in April?

Richardson: March 1999 was a great month for WIPP. First, we had a series of court rulings and the message was clear -- there is no legal reason to delay the shipments to WIPP any longer. And as a result just a few days after the court rulings, the first shipment of waste arrived at WIPP. This shipment represents the beginning of a long overdue promise to America to clean up our nation's Cold War legacy of nuclear waste. Over the next several months, we anticipate sending additional shipments from Los Alamos, Idaho and Rocky Flats. As to the first shipment from Idaho, I am committed to meeting the court ordered agreement with the State of Idaho. That agreement calls for the first shipment of transuranic waste to begin by April 30, 1999. We are vigorously working several options to assure the first shipment will occur by April 30, 1999.

Plutonium Disposition

NA: Mr. Secretary, Presidents Clinton and Yeltsin issued a statement at their Moscow summit in September indicating that each country would convert about 50 tons of weapons plutonium into forms unusable for nuclear weapons, and committing to begin negotiating a bilateral agreement. Those negotiations have been delayed and the new target date appears to be the end of 1999. What is holding up the negotiations, and do you feel the new target date will be met

in light of Duma elections coming up this December?
Richardson: Following an initial period of preparations in both countries, negotiations with Russia on a bilateral plutonium disposition agreement are under way, and conversations with our Russian counterparts reveal a significant commonality of vision on the content, structure, and timing of this agreement. In large part as a result of these early preparations and despite the upcoming Duma elections, I believe that an agreement can be concluded this fall to enable plutonium disposition to proceed in both countries.

NA: Senator Domenici's inclusion of $200 million for the Russian disposition program in DOE's FY 1999 funding seems to have offered some hope of jump-starting a stalled process. What do you see as the main prospects at this time for paying for the Russian program? Do you expect other G-8 governments to contribute, and will it be enough?

Richardson: We intend to help Russia implement plutonium disposition initially through the emergency $200 million appropriation. But, these funds will not be enough. Russia will need to contribute some resources, and the Administration plans to seek financing for a portion of this program from the international community, both the private and public sectors. If, however, the program requires future appropriations, the Administration will consider such needs in the course of its normal budget process.

Russian Nuclear Security

NA: President Clinton stated in his State of the Union address this year that funding for safeguarding nuclear materials and technology in Russia and elsewhere would increase by almost two-thirds over the next five years. What steps do you feel are necessary to improve the NCI and IPP programs to help ensure that we avoid a brain-drain as well as nuclear materials diversion from the Russian weapons complex?

Richardson: The Initiatives for Proliferation Prevention (IPP) and the Nuclear Cities Initiative (NCI) are two of several efforts supported by the United States in an interagency effort to stem a potential brain-drain and nuclear diversion from the Russian weapons complex.

IPP operates in four countries: Russia, Belarus, Ukraine and Kazakhstan, employing a highly structured three-stage approach to technology commercialization that requires 5-8 years to complete. The program works exclusively through liaison between U.S. national laboratories and former Soviet Union scientific institutes.

NCI, in contrast, operates only in Russia, and only in the ten closed cities that are responsible for its nuclear weapons design and manufacture. It is a broader program than IPP, aimed at near-term creation of alternate employment opportunities for 30- 50,000 nuclear weapons experts, employing the assistance of U.S. agencies, non-governmental organizations, financial and educational institutions and businesses, as well as the labs. Besides finding seed money for new businesses, NCI will offer training in needed business skills and assist nuclear city governments to establish conditions that will attract and foster business.

KEDO

NA: Mr. Secretary, having twice successfully negotiated with high-ranking North Korean officials for the release of American captives, you have a better understanding of the North Koreans and their current difficulties, and the threat they may pose to the region, than just about anyone in our government. As you know, the U.S. has proceeded with the implementation of agreements with the DPRK in spite of controversy over alleged activities there. What do you feel are the prospects now for success in the building of two light water reactors as provided under these agreements?

Richardson: Notwithstanding recent challenges, I believe we have made reasonable progress in moving in the direction envisioned by the Agreement signed in 1994 called the "Agreed Framework." The U.S. remains committed to the success of the Agreed Framework and the partnership with the Korean Energy Development Organization (KEDO).

> ...We have come far at DOE in fulfilling our role in the [Agreed Framework] by successfully securing virtually all the spent nuclear fuel elements in North Korea...

I believe that we have a reasonably good chance of successfully completing the construction of the two light water reactors in North Korea, assuming that the North Koreans are serious about implementing their obligations under the Agreed Framework. The recent case of the suspected underground construction demonstrates the need to remain vigilant. We continue to work closely with South Korea and Japan and the other members of KEDO to ensure that we deliver on our part of the agreement. It is important not to provide North Korea with a pretext for reneging on its commitment.

Since the inception of the 1994 Agreed Framework, we have come far at DOE in fulfilling our role in the Agreement by successfully securing virtually all the spent nuclear fuel elements in North Korea. This will effectively prevent North Korea from using that plutonium for nuclear weapons.